REVISED DRAFT

REVISED DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON
ECOLOGY FACILITY/SITE NO. 95275518

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FOR
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VOLUME I OF II

GEOENGINEERS

Revised Draft Remedial Investigation/Feasibility Study Report
Irondale Iron and Steel Plant
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Prepared for:

Washington State Department of Ecology
Toxics Cleanup Program
300 Desmond Drive
Lacey, Washington 98504

Attention: Steve Teel

Prepared by:

GeoEngineeers, Inc.
Plaza 600 Building
600 Stewart Street, Suite 1700
Seattle, Washington 98101
(206) 728-2674

CHRISTOPHER LEWIS BAILEY
STATE OF WASHINGTON
39963
REGISTERED PROFESSIONAL ENGINEER

State of Washington
346
Licensed Geologist
David A. Cook

Neil Morton

Neil F. Morton
Senior Project Manager

Chris Bailey

Chris L. Bailey
Senior Engineer

Jay Lucas

Jay C. Lucas, LG
Senior Geologist

D A Cook

David A. Cook, LG, RBP
Principal

DAC:NFM:bmw
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APPENDICES

List of Acronyms and Abbreviations

AST	Aboveground storage tank
AMSL	Above mean sea level
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	Bioaccumulation factor
CAP	Cleanup Action Plan
CLARC	Cleanup Levels and Risk Calculations database
COPC	Contaminant of potential concern
cPAHs	Carcinogenic polycyclic aromatic hydrocarbons
COC	Contaminant of concern
CSCTM	Conceptual site contaminant transport model
CSEM	Conceptual site exposure model
CSL	Cleanup Screening Level
DNR	Washington State Department of Natural Resources
DOH	Washington State Department of Health
DRO	Diesel range organics
EA	Environmental assessment
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
FS	Feasibility study
JCHHS	Jefferson County Health and Human Services
ug/kg	Micrograms per kilogram
ug/L	Micrograms per liter
mg/kg	Milligrams per kilogram
MHHW	Mean higher high water

List of Acronyms and Abbreviations (Continued)

MLLW	Mean lower low water
MTCA	Model Toxics Control Act
NOAA U.S.	National Oceanic and Atmospheric Administration
NWTPH-Dx	Northwest total petroleum hydrocarbon – diesel range extended
NWTPH-HCID	Northwest total petroleum hydrocarbon – hydrocarbon identification
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PHS	Priority Habitats and Species
QAPP	Quality assurance project plan
RI	Remedial investigation
RI/FS	Remedial investigation/Feasibility study
RRO	Residual range organics
SAIC	Science Application International Corporation
SDG	Sample data group
SHA	Site hazard assessment
SMS	Sediment Management Standards
SQS	Sediment Quality Standard
SSL	Soil screening level
SVOC	Semivolatile organic compound
TCLP	Toxicity characteristic leaching procedure
TEE	Terrestrial ecological evaluation
TEF	Toxicity equivalency factor
TEQ	Toxicity equivalent quotient
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons

List of Acronyms and Abbreviations (Continued)

UCL	Upper confidence limit on the mean
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
VOC	Volatile organic compound
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WTPH-HCID	Washington total petroleum hydrocarbon – hydrocarbon identification

EXECUTIVE SUMMARY

View of Irondale Iron and Steel Plant Site as it looks today. Former buildings and facilities were located near the shoreline and in the area now covered with trees. The road was built after industrial operations ended. The site is now a Jefferson County Park.

This Remedial Investigation/Feasibility Study (RI/FS) was completed to address contamination caused by past industrial activities at the former Irondale Iron and Steel Plant (Site) located in Jefferson County, Washington. The RI/FS is an in-depth study to characterize contamination, evaluate potential impacts on human health and the environment, and to develop and evaluate cleanup alternatives. The Site is located at 526 Moore Street in the town of Irondale, approximately 5 miles south of Port Townsend. It is located adjacent to Port Townsend Bay and encompasses about 13 acres of upland property and about 1,000 feet of shoreline. From 1881 to 1919, iron and steel were produced intermittently at the Site by various owners. Steel plant operation during this time resulted in metal and petroleum hydrocarbon contamination of soil, sediment and groundwater. The Site is owned by Jefferson County and is currently used as an undeveloped day-use park (Irondale Beach Park).

The extent and nature of contamination was investigated in the upland and sediment portions of the Site through several phases of study between 2007 and 2009. The results from these studies show that on portions of the Site soil, sediment, and groundwater contain concentrations of arsenic, copper, iron, lead, nickel, zinc, carcinogenic polycyclic aromatic hydrocarbons (cPAHs) and petroleum hydrocarbons that pose a potential risk to human health and the environment. The greatest concentrations of metals are associated with debris and industrial process waste (slag) generally concentrated in areas around the former steel production, power house, stock house, and blast furnace buildings. Petroleum hydrocarbon contamination is associated with a former 6,000-barrel (252,000 gallon) above ground fuel storage tank located on the southeastern portion of the site. A conceptual site exposure model (CSEM) that identifies sources of contamination, transport mechanisms and applicable receptors and exposure pathways was developed based on information collected during the RI. The CSEM is summarized in the table below.

Summary of Conceptual Site Model Elements	
CSEM Element	**Model Factors**
Contaminant Sources	Petroleum hydrocarbons in soil, sediment and groundwater associated with former fuel handling/storage area; smelter process waste (slag) and building debris in shallow upland soils.
Release Mechanisms and Migration	Leaching of contaminants from soil to groundwater to surface water and sediment; biota uptake of metals from soil (biota then ingested by other ecological receptors); wave erosion along shoreline exposing petroleum contaminated soils or sediments.

Summary of Conceptual Site Model Elements	
CSEM Element	**Model Factors**
Exposure Pathways	Ecological: Ingestion for terrestrial and aquatic ecological receptors, direct contact for ecological receptors and plant uptake Human: Direct contact and incidental ingestion
Potential Receptors	Ecological: Plants, soil and sediment biota, wildlife Human: Recreational users, park workers

The RI identified the following general areas and media that require remediation to comply with cleanup standards and objectives of the Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS):

1. About one acre of upland soil, groundwater and intertidal sediment in an area around and below the former above ground fuel storage tank, and
2. Shallow soil at locations of former buildings and industrial activities.

Through the feasibility study (FS) process, five remedial alternatives were identified and evaluated. The alternatives included combinations of institutional controls, excavation with off-site disposal, and capping. The remedial alternatives were evaluated and ranked based on their net environmental benefit in accordance with WAC 173-340-360. Any cleanup alternative must meet the following minimum requirements per WAC 173-340-360(2)(a): (1) protect human health and the environment, (2) comply with cleanup standards, (3) comply with state and federal laws, and (4) include provisions for long-term monitoring as outlined in WAC 173-340-410 and 173-340-720 through 173-340-760.

Based on the FS evaluation and screening process, the preferred remedial alternative includes the following combination of actions:

a) Permanent removal and offsite disposal of petroleum-contaminated near-shore upland soil and marine sediment to cleanup levels protective of human health, marine aquatic organisms and terrestrial ecological receptors;

b) Permanent removal of some shallow metal-contaminated near-shore soil located in more heavily used portions of the park in areas that will not cause significant destruction of existing vegetation, to cleanup levels protective of human health and terrestrial ecological receptors;

c) Installation of a permeable soil cap consisting of a geotextile placed on the current ground surface and covered with a 2-foot layer of clean soil in upland areas (Power House Complex and Steel Production Building), outside those areas removed by excavation, with metal contamination in shallow soil to reduce human and terrestrial ecological exposure to the contaminated soil. Installation of the cap will likely require removal of the majority of trees in these two areas; though decisions on individual trees may be decided during cap installation). The total area of the proposed cap is approximately 5,000 square yards; and

d) Post-cleanup monitoring of groundwater.

These proposed remedial actions are designed to reduce risk to receptors to acceptable levels, without adversely impacting environmental resources at the park. Complete removal of all contaminated soil exceeding one or more cleanup levels is not practical at this site because: (a) it would likely require removal of many 100+ year-old trees, (b) potentially destabilize the bluff, and (c) disrupt the existing natural quality, character and existing use of the park. Additionally, the cost for full removal of all contaminants to below all cleanup levels to protect for the pathways of concern would result in costs disproportionate to the resulting environmental and health benefits.

REVISED DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY
IRONDALE IRON AND STEEL PLANT
526 MOORE STREET
IRONDALE, WASHINGTON

1.0 INTRODUCTION

This report describes the activities and results from the remedial investigation and feasibility study (RI/FS) completed at the former Irondale Iron and Steel Plant (Site) located in Jefferson County, Washington. The Site is a 13-acre property located at 526 Moore Street in the town of Irondale, latitude 48°2' 38" N longitude 122° 45' 60" W, approximately 5 miles south of Port Townsend, Washington (see Figure 1). From 1881 to 1919, iron and steel were produced intermittently at the Site by various owners. Steel plant operations during this time resulted in contamination of soil, sediment and groundwater. The Site is owned by Jefferson County and is currently used as an undeveloped day-use park (Irondale Beach Park). It is bounded by Port Townsend Bay to the east, residential properties to the south, southwest and northwest, and parklands to the north. The Site includes both upland and aquatic land, and the boundaries of the Site are shown in Figure 2.

The Site was not completely cleaned up after the steel plant closed, and slag[1] and other debris are still present. Previous environmental investigations identified contamination in some areas, including oily residue on a portion of the beach that was formerly below a large oil storage tank. Irondale Beach Park has been identified as a high-priority cleanup area as part of Washington’s Puget Sound Initiative, which is intended to protect and restore the Puget Sound and Hood Canal ecosystem health by 2020. The RI/FS is a study intended to characterize contamination, evaluate potential impacts on human health and the environment, and develop and evaluate cleanup alternatives.

The Washington State Department of Ecology’s (Ecology’s) Toxic Cleanup Program is managing the RI/FS through its contract with Science Application International Corporation (SAIC). GeoEngineers is working in collaboration with SAIC as a teaming partner on this project under agreement between SAIC and Ecology titled “Hazardous Substances Site Investigation & Remediation for the Toxics Cleanup Program Contract # C0700034; Work Assignment # SAI017.” GeoEngineers is responsible for completing the RI/FS and draft Cleanup Action Plan (CAP) for both the upland and sediment portions of the Site, and SAIC provides technical oversight, sediment sampling and evaluation, and contract management.

1.1 PURPOSE

The purpose of the RI/FS is to collect data necessary to adequately characterize the Site for the purpose of developing and evaluating cleanup action alternatives in compliance with the Model Toxics Control Act (MTCA) (Chapter 173-340 Washington Administrative Code [WAC]) and the Washington Sediment Management Standards (Chapter 173-204 WAC). MTCA also requires that a report be prepared at the completion of the RI and FS and submitted to Ecology for review and approval.

The RI included: (1) sampling and testing to define the nature and extent of contamination in soil, sediment, surface water and groundwater, and (2) a terrestrial ecological evaluation (TEE) to determine

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[1] Slag refers to a waste material from the steel making process. It is a mixture of metal oxides, limestone and other impurities from the smelting process. It is found on the Site as loose, small to medium-sized rock-like pieces and in larger mounds or heaps.

the potential impact of contamination to ecological receptors. The FS includes identification and evaluation of cleanup alternatives and presents a preferred cleanup alternative.

1.2 REPORT ORGANIZATION

This RI report includes text, tables, figures and appendices. The report text is divided into 11 sections, as follows:

- Section 1.0 – Introduction
- Section 2.0 – Site Description – presents a summary of the Site history, environmental setting, current and planned future land uses, and previous environmental investigations.
- Section 3.0 – Remedial Investigation Activities – presents a description of the RI field program.
- Section 4.0 – Conceptual Site Model – presents the conceptual Site contaminant transport and exposure models.
- Section 5.0 – Screening Levels – describes the development of screening levels used to assess risks posed by Site contaminants of potential concern (COPCs).
- Section 6.0 – Remedial Investigation Results – summarizes the RI analytical results, including a comparison of the data to the RI screening levels.
- Section 7.0 – Terrestrial Ecological Evaluation – evaluates potential risks to terrestrial ecological receptors.
- Section 8.0 – Locations and Media Requiring Cleanup Action Evaluation in Feasibility Study
- Section 9.0 – Feasibility Study
- Section 10.0 – Limitations
- Section 11.0 – References

2.0 SITE DESCRIPTION

2.1 SITE HISTORY

The Site history described in this section was obtained from previous reports, primarily Jefferson County's 2001 Site Hazard Assessment (SHA; Jefferson County, 2001).

Industrial activities took place at the Site from 1881 through 1919. The iron and steel plant produced the first batch of iron in 1881, and the steel production plant was operational beginning in 1909. The Irondale Iron and Steel Plant consisted of a blast furnace and cast house, steel production building (including three open-hearth furnaces and a steel rolling mill), boiler plant, six charcoal kilns (also referred to as beehive kilns), miscellaneous support buildings (raw material warehouses, power house, machine shop, engine shop, and other supporting buildings), a 600-foot wharf and a 6,000-barrel aboveground storage tank (AST) for fuel oil. At its peak in 1910, the steel plant produced more than 700 tons of steel per day and employed 600 workers. The plant was closed in 1911 and was reopened between 1917 and 1919 because of the demand for steel during World War I. The estimated locations of former structures associated with the iron and steel plant are shown in Figure 2.

Since 1919, no other waste-generating industry has used the Site. From the mid-1970s until 1999, the beach area east of the former iron and steel plant was used as log storage for the Port Townsend Paper Company. A review of the history of the Site and potentially liable parties by Ecology (Ecology, 2007a) states that Cotton Engineering and Shipbuilding Corporation, later known as the Cotton Family Limited Partnership, owned the property from 1943 until December 30, 2002, when the property was sold to Jefferson County. Jefferson County bought the property to use as a recreational area and has operated the Site as Irondale Beach Park since that time.

In November 2005, a park visitor notified Ecology about an oily residue on the beach at the Site. After an initial investigation, Ecology determined that there was evidence of contamination along the beach. Ecology and Jefferson County conducted additional sampling to investigate the source of this contamination (see Section 2.4 for more information about these investigations). Ecology placed the Site on the suspected contaminated site list in March 2006. As noted above in Section 1.0, Irondale Beach Park has been identified as a high-priority cleanup area as part of the Puget Sound Initiative.

In December 2006, Irondale Beach Park was closed pending concerns about potential human health risk related to shellfish ingestion. In April 2007, Irondale Beach Park was reopened to the public. However, Jefferson County posted signs warning of possible risk to human health from consumption of intertidal shellfish harvested in the area. As of May 29, 2009, the Washington State Department of Health (DOH) Office of Shellfish and Water Protection has a marine biotoxin advisory for the Irondale Beach Park area; DOH also indicated that the Chimacum Creek Tidelands were not affected by the marine biotoxin advisory (DOH website accessed July 15, 2009). The Chimacum Creek Tidelands are immediately north of the Irondale Beach Park as shown in Figure 1. DOH obtained shellfish samples from Chimacum Creek Tidelands and the Irondale Beach Park area in June 2007. Sample results are discussed in Section 2.4.5 and in ATSDR's Health Consultation, which is included in Appendix G.

The Site is part of the Irondale National Historic District designated by the National Park Service and is also listed in the Washington State Heritage Register and the National Park Service Historic American Engineering Record.

It is our understanding from conversations with Ecology that the only environmental cleanup known to have been conducted at the Site is the removal of oily debris from the bottom of the AST by Jefferson County. The Jefferson County web page describes this action being completed January 2006 (Jefferson County, 2009)

2.2 ENVIRONMENTAL SETTING

2.2.1 General

The Site is located adjacent to Port Townsend Bay and includes upland and beach areas. Elevations at the Site range from sea level to about 100 feet above sea level. The Site includes approximately 13 acres of upland property and 1,000 feet of shoreline. The eastern near-shore portion of the Site is relatively level with an elevation of approximately 12 feet above mean sea level (AMSL). The western portion of the Site is located on sloping, uneven ground. The transition between the two areas is marked by a north-south-trending bluff with a steep break in slope. This slope is about 70 feet high in the southern portion of the Site and about 20 feet high in the northern portion of the Site. The near-shore area has a sparse grass cover and includes a gated gravel access road. The steeper upland portions of the Site is covered by

Looking north towards park entrance across near-shore flat area. Port Townsend Bay is on the right.

mature alder and maple trees with a thick understory of shrubs, vines and forest duff, and grasses.

Portions of the Site have very uneven terrain caused by mounds of building debris and remnant building foundations. In the steeper portion of the Site where these features are hard to see because of the heavy cover of vegetation, Jefferson County has posted signs explaining potential safety dangers at several locations along foot paths.

According to the geologic map published by the Washington State Division of Geology and Earth Resources (Geology & Earth Resources, 2005), the Site is underlain by unconsolidated landslide deposits and land that has been disturbed during historical uses of the Site. The beach along the Site is gently sloping, with steeper slopes on the southern quarter of the Site. The beach is composed of granular marine sediments with varying amounts of eroded fill (brick and slag) present along portions of the Site. The United States Geological Survey (USGS) characterized the beach area of the Site as a zone of substantial wave erosion where sediment is being transported along shore in two lateral directions (USGS, 1988). The only surface drainage stream located at the Site enters the Site near the northwest Site boundary and discharges through a metal culvert on the beach near the northern corner of the Site.

2.2.2 Ecological Habitat

In general, the Site can be divided into a flat, near-shore area; a steeper, upland area; and a small stream that borders the Site to the north. The near-shore area consists of grasses and other less dominant herbs. The southeastern portion of the upland area (in the vicinity of the former AST location) consists of typical upland tree and shrub species (big leaf maple, red alder, western red cedar, Douglas fir, elderberry, Indian plume, etc.). This area of the Site consists of two topographic breaks: starting at the top of the bluff, down to a flat area, before breaking into the near-shore area. Two groundwater seeps are present at the base of the bluff near the AST. The southern half of the upland area consists of mature second-growth forest, a possible priority habitat (a large, potential old-growth, Douglas fir), and a large shrub area (consisting of Indian plume and elderberry, with intermittent Himalayan blackberry). The northern half of the upland area is dominated by an immature big leaf maple overstory, but also includes a large area of shrub species. The habitat adjacent to the stream consists of Himalayan blackberry and a few small red alder trees.

Typical vegetation on western portion of the upland area.

During a June 5, 2008, habitat survey, three nighthawks were observed flying overhead in the morning. According to Priority Habitats and Species (PHS) data provided by the Washington Department of Fish and Wildlife (WDFW), a heron rookery has been documented in the northwest corner of the Site. The presence of the heron rookery was not confirmed during the habitat survey. Additional wildlife identified during the habitat survey includes crows, a black-capped chickadee, and a Douglas fir squirrel.

Additional details on the ecological habitats at the Site are presented in Section 7 (Terrestrial Ecological Evaluation).

2.2.3 Climate

The Irondale area has a maritime climate with a mean annual precipitation of about 20 inches. On average, the greatest precipitation occurs from November through January, and the least precipitation occurs in July. The Olympic Mountains to the west protect the area from the stronger Pacific winds and heavy rain that are present elsewhere on the Olympic peninsula. Mean winter temperature in the area is 44 degrees Fahrenheit (°F) and 66°F in summer.

2.3 CURRENT AND FUTURE LAND USE

The current and planned future use of the Site is as a public park. Currently the park is undeveloped and does not have formal day-use facilities such as picnic tables or restrooms.

2.4 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

Prior to this RI, there were five limited environmental investigations conducted by others, which are summarized in the sections below. The sample locations from these investigations are shown in Figure 3. The analytical results from these samples are included in Tables 1 through 15. Analytical results are compared to the RI screening levels discussed in Section 5.

The previous investigation sample locations shown in Figure 3 are approximate. GeoEngineers obtained these locations from hard copies of figures included in the referenced reports.

2.4.1 Environmental Assessment (Hart Crowser, 1996)

Hart Crowser conducted an Environmental Assessment (EA) in March 1996 that included portions of the Site. The property evaluated in the EA consisted of the Irondale Iron and Steel Plant property (parcels 001353001 and 901021002) and the property immediately north of the Site (parcel 001353004). Because it is not part of the Site, parcel 001353004 is not shown on Figure 3. In March 1996, the property north of the Site was used as a log chipping and storage facility, and logs were stored on the near-shore portion of the Site. The purpose of the EA was to assess the potential for past practices at the Site (including historical steel mill operations) to have adversely impacted subsurface conditions. Hart Crowser excavated nine test pits (TP-5, TP-6, TP-7, TP-8, TP-9, TP-10, TP-11, TP-12 and TP-19) and obtained several soil samples from the test pits, water samples from test pits TP-11 and TP-12, two sediment samples at a depth of 6 inches from near-shore sediments at low tide, a surface soil sample (SS-4) inside the 6,000-barrel AST, and two rock/slag samples (open-hearth furnace area and slag exposed on the southern beach face). EA sample locations are shown in Figure 3. Soil, sediment, water and slag samples were analyzed for one or more of the following: petroleum hydrocarbons, volatile organic compounds (VOCs) and metals.

The analytical results from soil samples obtained by Hart Crowser show that diesel- and oil-range petroleum hydrocarbons (in SS-4 only, as reported using the WTPH-HCID method), arsenic, chromium, copper, iron, lead and zinc were detected in soil and slag at concentrations greater than RI soil screening levels. Arsenic exceeded RI surface water screening levels in the two water samples obtained from test pits by Hart Crowser. These water samples were unfiltered samples obtained from the base of the test pits and were not considered “true” groundwater samples by Hart Crowser.

None of the detected concentrations of metals in sediment samples obtained by Hart Crowser exceeded their respective RI sediment screening levels.

2.4.2 Site Hazard Assessment (Jefferson County, 2001)

Jefferson County Health and Human Services (JCHHS) conducted a Site Hazard Assessment (SHA) in October 2001. Based on the results of the SHA, the Jefferson County Health Department recommended that no further action was required at the Site under MTCA; however, the Health Department did recommend that oil residue in the former AST foundation be removed to "prevent potential human exposure or release to the environment."

JCHHS obtained seven surface soil samples (SS1 through SS6 and SS8), one slag sample (SS7) and three sediment samples (BS1 through BS3). SHA sample locations are shown in Figure 3. Five soil samples and the slag and sediment samples were analyzed for metals. The other two soil samples were analyzed for TPH-diesel range organics (TPH-DRO) and TPH-residual range organics (TPH-RRO). TPH-RRO typically includes carbon ranges C_{25} to C_{36}, which is similar to oil-range petroleum hydrocarbons (also known as heavy oil) evaluated in MTCA. The total petroleum hydrocarbons (TPH) analytical method was not mentioned in the SHA report (the DRO and RRO designations were used by the Jefferson County Health Department). The slag sample was also analyzed by the toxicity characteristic leaching procedure (TCLP) for chromium, copper, lead and zinc.

TPH-RRO, arsenic, chromium, copper, lead and zinc were detected in soil or slag at concentrations greater than RI soil screening levels. Copper was detected in sediment sample BS3 at a concentration of 412 milligrams per kilogram (mg/kg), which is slightly greater than the RI sediment screening level of 390 mg/kg. Chromium, copper, lead and zinc were not detected in the TCLP analysis of the slag sample (SS7).

The location where sample SS8 was obtained is not known. This sample, which has analytical results for metals, is not shown on the sample location map associated with the 2001 SHA. Sample SS8 may be a field duplicate, based on a review of the October 22, 2001, Sampling and Analysis Plan for the SHA.

2.4.3 Initial Investigation (Ecology, 2005)

Ecology conducted an initial investigation in November 2005. The purpose of the investigation was to evaluate a report from a person who "detected petroleum odors and observed several bricks with fuel on them" at the Site. Ecology also noted petroleum odors during their investigation. As part of the investigation, Ecology obtained one soil/slag sample (003) and three sediment samples (001, 002, and 004). The soil/slag sample was analyzed for metals, and the sediment samples were analyzed for petroleum hydrocarbons using the NWTPH-HCID and NWTPH-Dx analytical methods. The 2005 Initial Investigation Field Report provides only approximate locations (on a hand-drawn map) for the four samples obtained during this investigation; therefore, the Initial Investigation sample locations are not shown in Figure 3. The soil/slag sample was obtained at the small headland formed by slag north of the former coke warehouse and the three sediment samples were obtained in the intertidal area east of the former AST.

Copper was detected in soil/slag at concentrations greater than the RI soil screening level. Oil-range petroleum hydrocarbons (identified in the Initial Investigation Field Report as severely weathered heavy fuel oil) were detected in sediment at concentrations ranging from 550 to 40,600 mg/kg. Sediment screening criteria have not been developed for oil-range petroleum hydrocarbons. However, the heavy fuel oil concentration of 40,600 mg/kg is substantially greater than the RI sediment screening levels of 136 mg/kg and 2,000 mg/kg. Ecology recommended in 2005 that the Site be listed on the Ecology database as a confirmed contaminated site and that a high-priority SHA be conducted per WAC 173-340-310(ii) based on the analytical results from their investigation.

2.4.4 Sediment and Tissue Sampling (Jefferson County, 2007)

The Jefferson County Health Department obtained sediment and tissue (clam and oyster) samples at the Site in January 2007. Three sediment samples were obtained from 12 sampling locations (Locations 1 through 12) at depths of 6, 12 and 18 inches. Each sediment sample was analyzed for TPH using the NWTPH-HCID analytical method. According to the laboratory case narrative, 18 of the 36 sediment samples contained a small to significant amount of very weathered to extremely weathered heavy fuel oil. Fifteen of the sediment samples (from six locations) were subsequently analyzed for diesel- and oil-range petroleum hydrocarbons using the NWTPH-Dx analytical method. Additionally, samples obtained at depths of 6 inches from Locations 3, 5, 7, 9 and 11 were analyzed for metals, and the samples obtained at depths of 6 inches from Locations 3, 5 and 7 were analyzed for polycyclic aromatic hydrocarbons (PAHs).

Oil-range petroleum hydrocarbons (identified by the analytical laboratory as heavy fuel oil) were detected in sediment at concentrations ranging from 39 to 2,300 mg/kg. Sediment screening criteria have not been developed for oil-range petroleum hydrocarbons. However, the heavy fuel oil concentration of 2,300 mg/kg is greater than the RI sediment screening levels of 136 mg/kg and 2,000 mg/kg. Metals and PAHs were not detected at concentrations greater than their respective sediment screening criteria.

The tissue sample was analyzed for PAHs and metals. PAHs were not detected, but arsenic, cadmium, chromium, copper, lead and zinc were detected at concentrations ranging from 0.46 to 21 mg/kg.

2.4.5 Irondale Park Shellfish Sampling (ATSDR, 2008)

According to the Agency for Toxic Substances and Disease Registry's (ATSDR's) Health Consultation (Appendix G), the analytical results from the multispecies (clam and oyster) shellfish samples obtained in January 2007 indicate that "lead may be of concern to human health especially for young children" (ATSDR, 2008). However, because the shellfish samples were not obtained following standard protocols, Washington DOH recommended additional shellfish sampling at the Site.

Shellfish samples were obtained by Washington DOH during low tide on June 14, 2007. Two little neck clam samples and two butter clam samples were obtained from the Irondale Beach Park (i.e., samples were collected from the sediment adjacent to the Site). Three little neck clam samples and one butter clam sample were also obtained from the Chimacum Creek Tidelands. The clam sample locations are shown in Appendix G (Figure 2). The tissue samples were analyzed for total arsenic, cadmium, chromium, copper, lead and zinc. Chromium, copper and zinc were detected in both clam species at concentrations less than metal-specific screening levels, which were calculated by DOH in accordance with U.S. Environmental Protection Agency (EPA) guidance. Most of the ATSDR Health Consultation evaluated the potential health effects from exposure to arsenic, cadmium and lead in shellfish at the Irondale Beach Park and Chimacum Creek Tidelands.

The ATSDR Health Consultation concluded that: (1) "Exposure to arsenic, cadmium and lead in Irondale Beach Park and Chimacum Creek Tidelands shellfish represents *no apparent public health hazard*" and (2) "Average or subsistence consumption of shellfish from Irondale Beach Park and Chimacum Creek Tidelands is not likely to result in non-cancer health effects."

2.5 SUMMARY OF PREVIOUS INVESTIGATIONS

2.5.1 Upland

The results from previous investigations indicated that portions of the upland area of the Site have concentrations of petroleum hydrocarbons, arsenic, chromium, copper, iron, lead and zinc greater than RI soil screening levels. The full nature and extent of this contamination was not defined by these investigations, and several portions of the Site had not been investigated. The preliminary conceptual model was that the source of petroleum hydrocarbons is the former AST and/or associated piping, and that the metal contamination is associated only with fill containing slag or debris from former structures.

2.5.2 Sediment

The results from previous investigations indicated that sediment in the intertidal area below the former AST was impacted by petroleum hydrocarbons in concentrations greater than RI sediment screening levels. Other than copper in one sediment sample, metal- or PAH-contamination had not been identified in sediments. The full nature and extent of this contamination in sediment was not defined by these investigations. The preliminary conceptual model was that petroleum hydrocarbons are in the sediment through a combination of erosion and redepositing of contaminated upland soil and/or migration of oil with groundwater.

2.5.3 Shellfish Tissue

The results from the 2007 Washington DOH investigation indicate that arsenic, cadmium, chromium, copper, lead and zinc are not present in shellfish tissue at concentrations that represent an apparent public health hazard.

2.5.4 Groundwater

Groundwater was not sampled during these previous investigations, except as turbid water in test pits.

3.0 REMEDIAL INVESTIGATION ACTIVITIES

3.1 GENERAL

The RI that was conducted in general accordance with the following documents that were reviewed and approved by Ecology:

- Draft Final Remedial Investigation/Feasibility Study Work Plan dated June 21, 2007 (GeoEngineers, 2007a);
- Washington Department of Fish and Wildlife Hydraulic Project Approval (Control Number 111264-1) issued November 21, 2007;
- Final Sampling and Analysis Plan Addendum dated December 7, 2007 (GeoEngineers, 2007b);
- Final RI/FS Work Plan Addendum dated May 29, 2008 (GeoEngineers, 2008); and
- Sampling Analysis Plan Addendum – Intertidal Sediment and Groundwater Sampling dated January 7, 2009 (GeoEngineers, 2009).

The RI included the collection of soil, sediment, groundwater, surface water and vegetation samples as well as an investigation of subsurface conditions and flora and fauna at the Site. The field investigation occurred in four events:

1. **June 2007:** The principal objectives of this event were to define the extent of contamination identified in earlier studies and to investigate areas of the Site and media (surface water and groundwater) that had not previously been investigated.
2. **December 2007:** The objectives of this event were: (1) to define the extent of TPH contamination in intertidal sediment and to investigate subtidal sediment; (2) to collect and test earthworms in areas of known contamination to help evaluate metals bioaccumulation and to assess potential terrestrial ecological risks; (3) to obtain an additional round of groundwater samples from the four groundwater monitoring wells installed in June 2007; and (4) to obtain additional upland soil samples to better define the extent of contamination at the AST area,

beyond the footprints of the former historical buildings, between the former steel production building and the blast furnace-power house building complex, and at the south end of the near-shore upland fill area.

3. **June 2008:** The purpose of this event were to conduct a baseline vegetation habitat survey and obtain soil samples to conduct soil biota and plant bioassays, and to collect and test plants in areas of known contamination to help evaluate metals bioaccumulation and to assess potential terrestrial ecological risks.
4. **January 2009:** The purposes of the additional field work were: (1) to confirm the June and December 2007 groundwater analytical results and groundwater flow direction; and (2) to obtain additional intertidal sediment samples with a range of petroleum hydrocarbon concentrations and to conduct bioassays to help determine sediment cleanup levels for diesel- and heavy oil-range petroleum hydrocarbons.

These investigations were designed to evaluate the nature and extent of contamination in the upland and intertidal/subtidal sediment portions of the Site, and to develop the data needed to complete the FS. The approximate locations of all explorations are shown in Figure 4. RI analytical results are summarized in Tables 1 through 13. These tables present soil results first (Tables 1 through 4), followed by groundwater and surface water (Tables 5 through 7) and sediment (Tables 8 through 13). Descriptions of the field procedures used are included in Appendix A. Appendix A also includes boring logs, well construction logs and test pit logs. Field procedures pertinent to the December 2007 subtidal and January 2009 intertidal sediment studies are described in Appendices C and D. Sediment and soil bioassay results are presented in Appendices D and E, respectively.

The Work Plans cited above provided explanations regarding the rationale for each sample location, depth and analyses. The sections below provide a summary of the RI activities. See Section 6.0 for discussion of the analytical results from this investigation.

3.2 UPLAND INVESTIGATIONS

The upland investigation focused on: (1) identifying the nature and extent of slag fill along the near-shore area; (2) investigating former buildings and work areas at the Site and defining the horizontal and vertical extent of contamination identified in previous studies; (3) evaluating areas not sampled previously and areas located away from historical sources of contamination; (4) evaluating groundwater; (5) evaluating water quality in the surface water drainage at the northern end of the Site; and (6) collecting sufficient data to understand the geology and hydrology at the Site and their relationship to contaminant transport and fate.

As can be seen in Figure 5, there are several locations with clusters of samples. These are locations where samples were co-located to provide soil for analytical tests and soil for bioassays to support the TEE.

Overview of Upland Soil Data Collection (Figure 4)

- Geophysical survey and explorations to define limits of metallic fill along near-shore area
- Explorations included 43 test pits and 7 direct-push borings
- Analyzed 111 samples
- Samples analyzed for metals (arsenic, copper, iron, lead, nickel and zinc), petroleum hydrocarbons, and PAHs.

Small headland formed by slag.

3.2.1 Near-shore Fill Area

The near-shore fill area is relatively level and open upland area adjacent to the shore. The area is about 700 feet long and 125 feet wide and is located between the existing park road and the shoreline bank. The shoreline bank includes a prominent slag deposit that formed an erosion-resistant small headland near the former coke warehouse (see Figure 2; referred to as “Slag Outcrop” in the rest of the RI). The objectives of near-shore fill area investigation were to better define the extent of slag in the subsurface and to obtain representative soil samples to evaluate the fill for the presence of site-related contamination.

Prior to investigating the near-shore fill area by test pits, a non-intrusive geophysical survey was completed by Apollo Geophysics (Apollo) on June 14, 2007. The objective of the survey was to evaluate the thickness and lateral extent of slag fill in the near-shore area. The geophysical survey was completed prior to soil sampling so the number and locations of exploratory test pits could be modified if necessary based on the geophysical findings. Apollo used a combination of electromagnetic (EM) and ground penetrating radar (GPR) geophysical methods; both of these methods have the capability of detecting metallic fill. Apollo’s geophysical survey report is included in Appendix F and is summarized below.

Apollo conducted electromagnetic (EM) traverses on approximately 5-foot spacings and conducted ten GPR traverses ranging in length from 50 to 700 feet (see Figures 1 and 2 in Appendix F for transect locations). Three of the transects paralleled the shoreline while seven transects were completed perpendicular to the parallel transects and the shoreline. Apollo interpreted the geophysical data to indicate that 1) metallic fill is most prevalent in the southern approximately 300 feet of the near-shore area, especially around the slag outcrop, 2) metallic fill content decreases northwest of the slag outcrop and there are several areas without evidence of metallic fill in the northern 360 feet of the near-shore area, 3) there is minimal evidence of metallic fill beneath the existing park access road, and 4) vertically most metallic fill is located between about 2 and 5 feet below the ground surface. Apollo also identified some areas in the upper two feet of soil they interpreted to be a mixture of sand and metallic fill.

The occurrence of metallic fill indicated by the geophysical study generally matched findings from earlier explorations and field observations of soil exposures along the shoreline, except that metallic fill did not appear present in a continuous layer as indicated by the geophysical study results and the shallow sand-metallic fill mixture was not observed. The geophysical survey results supported the need to complete test pits in all of the near-shore area as planned.

Eight tests pits (TP12 through TP19) ranging in depth from 8 to 8.5 feet below ground surface (bgs) and one monitoring well (MW04) were completed in the near-shore fill area. The test pits were completed using a mini-excavator and rubber-tired backhoe. The boring for the monitoring well (DP04) extended to a depth of 18 feet bgs and was completed using a truck-mounted, direct-push drilling rig.

Twenty-five soil samples were obtained from the test pits and boring DP04, and submitted for chemical analysis. Three soil samples were obtained from each test pit at depths ranging from 0 to 2 feet, 2 to 4 feet, and 6 to 8 feet.

Concrete structure of former steel-lined AST.

3.2.2 6,000-Barrel AST Area

A 6,000-barrel (252,000 gallon) AST was located at the southern end of the Site near the present day shoreline (Figure 2). The concrete structure of the former steel-lined AST marks where this tank was located. Oil residue was identified in 2005 on the beach below the former AST (to the east). The primary objective for investigating this area was to determine the extent of petroleum hydrocarbon contamination identified in previous studies.

Explorations included completion of 9 test pits, two direct-push borings and two hollow-stem auger borings, and installation of one monitoring well (MW02) in the upland and several test pits and borings in the intertidal area (described in Section 3.3). The presence of soft wet ground and large trees prevented access to some areas targeted for exploration and prevented over excavation of test pits to determine the lateral extent of the soil contamination.

Test pits TP06, TP07, TP09, TP11, and TP24 through TP28 were completed using an excavator. The depth of the test pits completed using an excavator generally ranged from 6 to 7 feet deep. Two borings (TP35/TP35A and TP36/TP36A) are identified as test pits; however, these soil borings were completed using a hollow-stem auger drill rig. Borings TP35/TP35A and TP36/TP36A were completed to depths of 13.5 feet.

Two test pits (TP05 and TP31) and one direct-push boring (DP06) were located within thetank footprint. The test pits were completed using hand tools, and boring DP06 was completed using a direct-push drill rig. Test pit TP-31 could be advanced only 1 foot bgs because of encountering brick rubble, and no soil sample was obtained. Test pit TP-05 was successfully advanced 4 feet below the concrete floor of thetank, and DP-06 was advanced to 8 feet bgs.

Direct-push boring DP02 was completed to a depth of 14 feet. This boring was completed at the location of TP26, which contained evidence of significant petroleum hydrocarbon contamination. A monitoring well was constructed in DP02 (MW02) to monitor for the presence of free product.

Thirty-four soil samples were obtained from the test pits and borings, and submitted for chemical analysis. Groundwater samples were obtained from MW02. Groundwater was encountered in the explorations at depths ranging from 2 feet bgs (TP07) to 8 feet bgs (TP-09). In most cases where groundwater was encountered, the walls of the test pit would cave, making it difficult to advance deeper.

3.2.3 Former Buildings and Work Areas

The Former Buildings and Work Areas are labeled in Figure 2 and include the former charcoal kilns, power house, engine house, boiler house, machine shop, boiler plant, blast furnace and cast house, steel production buildings, and slag areas around the coke warehouse. The RI sample locations are shown in Figure 4. The primary objective for investigating these areas was to characterize soil and groundwater quality in areas believed to be heavily used during historical operations. Additional objectives include evaluating the extent of metals contamination (primarily arsenic, copper and iron) in the vicinity of TP-08 and characterizing metals contamination (primarily arsenic and iron) in the vicinity of DP-01 and TP-11.

Explorations included completion of 13 test pits, four direct-push borings, three hollow-stem auger borings, three surface soil sample locations and two slag sample locations, and installation of two monitoring wells (MW-3 and MW-5). Dense vegetation and uneven terrain made access difficult

Dense vegetation and remnant foundations made access difficult in some upland areas.

in the areas where the former buildings were located. A small-sized excavator was used where possible, but difficult access required the use of hand tools (auger and shovels) to obtain samples at a few locations. At several locations, especially around the steel production buildings and the power house, it was not feasible to explore as deep as planned because of the presence of tree roots, bricks and other debris from the former buildings.

The test pits (TP01 through TP04, TP08, TP10, TP20-23, TP29, TP30 and TP40) were completed to depths from 2 to 15 feet bgs, with most explorations about 4 feet deep. Three borings (TP-32 through TP-34) are identified as test pits; however, these soil borings were completed using a hollow-stem auger drill rig. Borings TP32, TP33, and TP34 were completed to depths of 10, 5.5 and 15 feet bgs respectively.

The four borings were completed using a direct-push drill rig: one located near the former stock house (DP01), one in the slag headland area (DP03 – the boring for MW03), one in a former scrap metal area below the boiler plant (DP05 – the boring for MW05), and one near the former coke warehouse (DP-07). The direct-push borings ranged in depth from 12 to 20 feet bgs.

Surface soil samples at locations GEISS1 through GEISS3 were completed using a shovel to depths of 1 to 1.5 feet bgs. Samples of slag at locations SLAG1 and SLAG2 were obtained using hand tools.

Thirty-nine soil samples and two slag samples were obtained from the test pits, borings and surface sample locations and submitted for chemical analysis. Groundwater samples were obtained from MW03 and MW05, and one grab groundwater sample was obtained from DP07.

3.2.4 Areas without Historical Sources of Contamination

Six explorations within the Upland Area (TP37, TP38, TP39, TP41, TP42 and TP43) were located outside the footprint of known former buildings and work areas. Two of the sample locations (TP37 and TP38) represent areas that, based on historical information, were not part of the Irondale facility operations, and represent background conditions. TP37 is located at the southern end of the Site, and TP38 is located near the western boundary, about in the middle of the Site. Three of the sample locations (TP39, TP42, and TP43) are located between the former steel production building and the blast furnace-power house building complex, and sample location TP41 is located at the northern end of the Site, just west of the gravel access road. Historical documents do not indicate that buildings were located in these locations, but it is likely this area was disturbed by general industrial activities. These sample locations were also selected to provide background data for the TEE (described in Section 7).

Test pits TP37 through TP39, TP41, and TP42 were completed using a shovel to depths from 3 to 5.5 feet bgs. One boring (TP43) was identified as a test pit; however, this soil boring was completed using a hollow-stem auger drill rig to a depth of 16 feet.

Thirteen soil samples were obtained from the test pits and one boring and submitted for chemical analysis.

3.2.5 Groundwater

Overview of Upland Groundwater Data Collection (Figure 4)
• Four monitoring wells installed. • Wells were sampled three times: June and December 2007 and January 2009. • Samples analyzed for total and dissolved metals (arsenic, copper, iron, lead, nickel and zinc), petroleum hydrocarbons and PAHs.

Four monitoring wells (MW02 through MW05) were installed in June 2007 for the purposes of determining groundwater flow direction near Port Townsend Bay and to evaluate whether groundwater was contaminated. Monitoring well MW01 was planned as an upgradient background well but was not installed. Monitoring wells MW02 and MW03 are located at the southern end of the Site. MW02 was located near the former 6,000-barrel fuel oil AST, and MW03 was located downgradient of the blast furnace-power house building complex in an area with known slag fill. Monitoring well MW04 was located in the near-shore area near the northern end of the Site, downgradient of the steel production buildings and relatively close to the surface drainage. Monitoring well MW05 was located close to the boiler plant in an area that had visible debris. In addition to these monitoring wells, one-time grab groundwater samples were obtained from two direct-push borings (DP01 and DP07). DP01 is located in the southern near-shore area adjacent to the former stock house. DP07 is located below the former AST near the former coke warehouse. Groundwater sample locations are shown in Figure 4.

Groundwater samples were obtained from the four monitoring wells in June and December 2007 and January 2009. Static water levels (Table 16) were also measured during the sampling events to provide data to determine groundwater flow direction.

3.2.6 Surface Water

Overview of Surface Water Data Collection (Figure 4)
• Two samples obtained in June 2007: one upstream of Site and one at the discharge point on the Site. • Samples analyzed for total and dissolved metals (arsenic, copper, iron, lead, nickel and zinc).

Surface water samples were obtained during one field event (June 2007) from two locations in the surface water drainage (Figure 4). One sample (SW01) was obtained upstream of where the drainage enters the Site, and one sample (SW02) was obtained near the point the drainage discharges to the beach. The upstream sample location was selected to obtain water quality data representative of surface water before it enters the Site. Water quality data from the downstream sample will be compared to the upstream location to evaluate changes in water quality as the water flows across the Site.

3.3 SEDIMENT

Overview of Sediment Data Collection (Figure 4)
• Intertidal and subtidal sediment samples obtained during three field events in June and December 2007 and January 2009. • Obtained 61 samples from 36 locations. • Analyzed a total of 44 samples for petroleum hydrocarbons and SMS analytes.

Sediment samples were obtained at the Site during three field events (June and December 2007 and January 2009) (Figure 4).

3.3.1 June 2007

The objectives of the June 2007 sampling event were: (1) to characterize intertidal sediment adjacent to the Site; (2) to evaluate the horizontal extent of residual oil and contaminants of concern (COCs) in the intertidal area east of the AST area; (3) to evaluate COCs near the former coke warehouse and wharf; and (4) to obtain intertidal sediment samples from the bioactive zone (0 to 4 inches bgs) to compare resulting analytical data to Sediment Management Standards (SMS) criteria. Twenty-two samples were obtained by hand (shovel) in June 2007 from 10 locations. In general, two sediment samples were obtained at each location (at depths of 0 to 4 inches and 4 to 24 inches). At locations SED02 and SED03, the deeper samples were obtained at depths of 4 to 18 inches and 4 to 12 inches, respectively, because of the presence of buried obstructions and what appeared to be charcoal. Sediment samples at a depth of 24 to 36 inches were also obtained at locations SED05 and SED06. A sediment sample was not obtained from sample location SED-08 because of the presence of a boulder and bricks at the proposed location. The June 2007 sediment samples were analyzed for diesel- and oil-range petroleum hydrocarbons and SMS analytes (excluding polychlorinated biphenyls [PCBs]). PCBs were not analyzed for because they were not commercially manufactured until after steel mill operations ceased at the Site.

3.3.2 December 2007

The objectives of the December 2007 sampling event were: (1) to evaluate the vertical and horizontal extent of diesel- and oil-range petroleum hydrocarbons in intertidal sediment near the former coke warehouse and the former AST; and (2) to obtain subtidal sediment samples, including samples near the former coke warehouse and wharf, and to compare the sediment analytical results to SMS criteria. Eighteen intertidal samples were obtained from five hollow-stem auger borings. The intertidal sediment samples were obtained at depths ranging from 1.5 to 12.5 feet and were analyzed for diesel- and oil-range petroleum hydrocarbons and PAHs. Ten subtidal samples and one intertidal sediment sample were obtained using a stainless-steel petit ponar sampling device deployed from a small boat (the December 2007 subtidal sampling effort was conducted by SAIC and is described in detail in Appendix C). These 11 sediment samples were obtained at depth of 0 to 4 inches and were analyzed for SMS analytes (including PCBs).

3.3.3 January 2009

The objectives of the January 2009 sampling event were: (1) to obtain intertidal sediment samples near the former coke warehouse and the former AST and to compare the sediment results to SMS criteria; (2) to obtain intertidal sediment samples from 10 locations to get a representative range of TPH concentrations; and (3) to determine the relative toxicity of TPH to benthic organisms by conducting a suite of sediment toxicity tests on synoptic intertidal sediment samples. Ten intertidal sediment samples were obtained using shovels (the January 2009 sediment sampling effort was conducted by SAIC and is described in detail in Appendix D). These 10 sediment samples were obtained at depth ranging from 8 to 21 inches and were analyzed for TPH; the five sediment samples evaluated in the sediment toxicity tests were also analyzed for SMS analytes (excluding PCBs).

3.4 ECOLOGICAL

Overview of Ecological Data Collection

- Tests conducted to evaluate potential risks to terrestrial receptors (plants, soil biota and wildlife).
- Co-located soil and earthworm samples obtained to evaluate metals uptake.
- Co-located soil and plant samples obtained to evaluate metals uptake.
- Soil samples obtained to complete plant and earthworm soil bioassays for metals and earthworm soil bioassays for TPH.
- Soil samples obtained for arsenic speciation.
- Baseline habitat survey conducted by a GeoEngineers biologist.

As part of the RI, a terrestrial ecological evalution (TEE) (presented in Section 7) was conducted to evaluate whether contaminants detected in upland soil at the Site pose a threat to the terrestrial receptors (i.e., plants, birds and wildlife). After the June 2007 sampling event, Ecology and GeoEngineers compared chemical analytical results from soil samples obtained at the Site through June 2007 to MTCA "site-specific" ecological indicator soil concentrations (site-specific TEE screening values; MTCA Table 749-3). The results of this comparison indicated that metals were present in soil at concentrations greater than site-specific TEE screening values protective of plants, soil biota and wildlife, and petroleum hydrocarbons (diesel-range hydrocarbons and motor oil) were present in soil at concentrations greater than site-specific TEE screening values protective of soil biota and wildlife. Because the generic site-specific TEE screening values are intended to be protective of most sites, they are generally developed using conservative assumptions and methodologies. Therefore, Ecology recommended additional upland sampling (soil, flora and fauna) to calculate site-specific TEE screening values.

3.4.1 Soil and Earthworm Samples to Evaluate Metals Uptake by Earthworms

GeoEngineers obtained three co-located soil and earthworm samples during the December 2007 sampling event (TP30, TP40, TP41; see Figure 5). The objective of this sampling was to calculate a site-specific earthworm bioaccumulation factor, which would be used to calculate site-specific wildlife (mammalian predator and avian predator) TEE screening values. The Final Sampling and Analysis Plan Addendum (dated December 7, 2007) included three proposed sample locations: two at upland areas with known elevated metals concentrations (TP03 at the former power house/engine house and TP30 at the former steel production buildings), and one outside the steel production buildings footprint (TP40). Earthworms were not found at location TP03, and this location was abandoned.

Co-located soil and earthworm samples were successfully obtained at locations TP30 and TP40. However, because of excessive vegetation, sample location TP40 was moved closer to the steel production buildings and, based on the metals analytical results, it appears to have metals soil concentrations consistent with those detected within the footprint of the steel production buildings. The third co-located soil and earthworm samples were obtained at location TP41, which is outside the footprint of the historical buildings. The soil and earthworm samples were analyzed for arsenic, copper, iron, lead, nickel and zinc.

3.4.2 Soil and Plant Samples to Evaluate Metals Uptake by Plants

GeoEngineers obtained three co-located soil and plant samples during the June 2008 sampling event (TP03, TP32, TP40 see Figure 5). The objective of this sampling was to calculate a site-specific plant uptake coefficient, which would be used to calculate site-specific wildlife (mammalian herbivore) TEE screening values. The Final RI/FS Work Plan Addendum (dated May 29, 2008) included three proposed sample locations at areas with known elevated metals concentrations (TP03 at the former power house/engine house, TP32 northeast of the former AST and TP40 near the former steel production buildings). Co-located soil and plant samples were successfully obtained at these three locations. The soil and plant samples were analyzed for arsenic, copper, iron, lead, nickel and zinc.

Plant material obtained included the following: trialing blackberry (*Rubus ursinus*), Douglas fir seedlings (*Pseudotsuga menziesii*), snowberry (*Symphoricarpos*), thimbleberry (*Rubus parviflorus*), and Himalayan blackberry (*Rubus discolor*).

3.4.3 Soil Samples to Complete Soil Biota Bioassays (using Earthworms) for TPH Evaluation

GeoEngineers obtained four soil samples during the June 2008 sampling event for bioassay evaluations and chemical analyses (TP11, TP15, TP23, TP24 see Figure 5). The objective of this soil sampling and subsequent analyses was to derive site-specific soil biota TEE screening values for TPH. The Final RI/FS Work Plan Addendum (dated May 29, 2008) included four proposed sample locations: two at areas with known TPH contamination (TP11 and TP24, both adjacent to the AST), and two at locations not impacted by TPH (that is, TPH background locations, TP15 and TP23). The reason for obtaining two soil samples at both the TPH-impacted and TPH background areas was to help ensure that at least one soil sample would be obtained with TPH concentrations similar to levels found during the June and December 2007 sampling events and at least one soil sample would be obtained with no indications of TPH contamination. The soil samples were analyzed for diesel- and oil-range petroleum hydrocarbons. The soil samples were also submitted to Newfields Northwest, LLC (Newfields) for completion of Ecology’s Earthworm Bioassay Protocol for Soil Toxicity Screening (Publication No. 96-327).

3.4.4 Soil Samples to Complete Plant and Soil Biota Bioassays (using Butter Crunch Lettuce Plants and Earthworms) for Metals Evaluation

GeoEngineers obtained 15 soil samples during the June 2008 sampling event for bioassay evaluations and chemical analyses. The objective of this soil sampling and subsequent analyses was to derive site-specific plant and soil biota TEE screening values for metals. The Final RI/FS Work Plan Addendum (dated May 29, 2008) included 15 proposed sample locations. The intent of chosen locations was to evaluate soil samples with a range of metals concentrations. The soil samples were analyzed for arsenic, copper, iron, lead, nickel and zinc. The soil samples were also submitted to Newfields for evaluation of toxicity using the soil Microtox Bioassay^{TM} and completion of Ecology’s Earthworm Bioassay Protocol for Soil Toxicity Screening (Publication No. 96-327) and Ecology’s Early Seedling Growth Protocol for Soil Toxicity Screening (Publication No. 96-324).

3.4.5 Soil Samples for Arsenic Speciation

Arsenic was detected in soil samples obtained by GeoEngineers in June and December 2007, and by others prior to the RI, at concentrations greater than the Arsenic III and Arsenic V MTCA ecological indicator soil concentrations for wildlife (7 mg/kg and 132 mg/kg, respectively). The Arsenic III wildlife screening was exceeded in 22 samples, although the Arsenic V screening level was exceeded in only one sample. The objective of submitting soil samples for arsenic speciation was to determine the form of arsenic present at the Site.

GeoEngineers obtained four soil samples in June 2008 at areas with known arsenic contamination (TP03 at the former power house/engine house, TP08 and TP32 northeast of the former AST, and TP22 within the footprint of the steel production buildings). These soil samples were submitted to the chemical analytical laboratory for Arsenic III/V speciation.

3.4.6 Baseline Habitat Survey

GeoEngineers conducted a baseline habitat survey in June 2008 consisting of data collection and field reconnaissance tasks. The objective of the survey was to identify the types of flora and fauna using the

Site and to overlay the vegetation communities found at the Site with the areas of known soil contamination.

GeoEngineers collected and reviewed public information available from the WDFW, USGS, United States Fish and Wildlife Service (USFWS), Washington State Department of Natural Resources (DNR) and Jefferson County.

GeoEngineers also conducted a biological field reconnaissance at the Site, with emphasis on habitat type and areas of potential ecological exposure associated with the former facility. The field reconnaissance focused on the identification/confirmation of habitat types and potential species utilization of the Site. Specific information collected included: dominant vegetation, aerial coverage, vegetation height and maturity, presence of ponded or flowing water and observations of wildlife. The field reconnaissance covered the terrestrial (upland) habitat only and did not include an assessment of the aquatic habitat associated with the shoreline. Refer to Section 7.4 for additional details regarding the biological field reconnaissance.

3.5 DEVIATIONS FROM WORK PLAN AND ADDENDA

The RI activities were completed in general accordance with the RI Work Plan (GeoEngineers, 2007a) and subsequent addenda (see section 3.1). Significant deviations from these documents are summarized below.

3.5.1 June 2007 Sampling Event

There were no significant deviations from the RI Work Plan (GeoEngineers, 2007a).

3.5.2 December 2007 Sampling Event

There were no significant deviations from the Final Sampling and Analysis Plan Addendum (GeoEngineers, 2007b). Minor deviations include the following:

- Test pit TP40 was intended to be located in an area not impacted by Site activities. However, because of vegetation in the area, GeoEngineers field personnel could not get to the proposed sample location. Instead, TP40 was located adjacent to the northwest corner of the former steel production buildings.
- The Addendum included a co-located soil and earthworm sample at test pit location TP03. However, no earthworms were found at this location. Earthworms were found at location TP40, and the co-located sample location was moved to this location.
- Planned sediment borings included SED18 through SED21. Locations SED22 and SED23 were added based on field screening results from SED18, SED20, and SED21. Boring SED-19 was not completed because of the rising tide. The intent of SED19 was to provide the vertical extent of contamination near SED02.
- SED04 was to be obtained near the location of the former coke warehouse (approximately 40 feet south of SED11). However, SAIC obtained this sample at Jefferson County sediment sample location 4. This error occurred because GeoEngineers provided SAIC with the wrong sample coordinates. Based on the sediment sample results at SED11, SED17, SED21, and Jefferson County location 2, this deviation from the addendum is not expected to change the study conclusions.

3.5.3 June 2008 Sampling Event

There were no significant deviations from the Final RI/FS Work Plan Addendum (GeoEngineers, 2008).

3.5.4 January 2009 Sampling Event

There were no significant deviations from the Sampling Analysis Plan Addendum – Intertidal Sediment and Groundwater Sampling (GeoEngineers, 2009). Minor deviations include the following:

- Planned sediment locations included ID-100 through ID-109. Sediment sample ID-105 was not obtained because of refusal at a depth of 18 inches. The refusal resulted from bricks and cobbles at this location. Sediment sample ID-109 was not obtained because of the rising tide. The intent of the 10 sediment sample locations was to provide a range of combined TPH concentrations for use in subsequent sediment bioassays. An adequate range of combined TPH concentrations was obtained with the 8 sediment samples that were collected during this sampling event.

4.0 CONCEPTUAL SITE MODELS

4.1 CONCEPTUAL SITE CONTAMINANT TRANSPORT MODEL

A conceptual site contaminant transport model (CSCTM) was developed to describe historical release(s) of hazardous substances at the Site and the subsequent potential migration of those hazardous substances in environmental media. A separate conceptual model related to potential exposure pathways is discussed in Section 4.2. The potential contaminant sources and transport mechanisms are summarized below:

- While the Irondale Plant operated (1881 to 1919), there were likely spills and releases of fuel oil and lubricating oil to the soil and/or beach, especially in the vicinity of the fuel AST and associated piping. Iron ore, coke and slag were also likely spilled or dumped in the vicinity of the former wharf used to unload cargo and in the coke warehouse and charcoal kiln areas. Airborne contaminated particles emitted from the kilns and other on-site smoke sources were likely deposited on the ground surfaces. All of these releases represent potential sources of contamination to soil, water and sediment.
- Stormwater and general surface runoff while the Irondale Plant was operating transported contaminants downhill to topographic depressions and the beach. As vegetation becomes established throughout the Site, the volume of stormwater runoff would be reduced.
- Sometime after the Irondale Plant closed, the buildings were demolished and much of the debris was spread around the Site. Log storage activities resulted in regrading and filling of portions of the near-shore areas. These land disturbance activities spread slag, debris and possibly contaminants around the former buildings and near-shore area. These activities also placed clean dredge sand and wood debris over portions of the former ground surface, potentially burying contaminated soil under clean fill.
- Some contaminants in soil leach into groundwater and are transported as dissolved chemicals in groundwater. Groundwater flows toward Port Townsend Bay, where it discharges in the intertidal area.
- In the area of the former AST, petroleum hydrocarbons might have been released in sufficient quantities to accumulate as free product and migrate toward the Bay. As free product moves laterally and vertically as the groundwater table rises and falls, the free product adheres to soil, enlarging the area of soil contamination.

- Waves along the shoreline erode areas with contaminated soil and groundwater. This erosion releases contaminants to sediments and the Bay and distributes debris along the beach.

4.2 CONCEPTUAL SITE EXPOSURE MODEL

To provide a framework for interpreting the data presented in this report, a conceptual site exposure model (CSEM) was developed. In particular, the CSEM was developed to identify exposure pathways and potential receptors for the contaminants of potential concern (COPC) detected in various environmental media at the Site. Potential site-related risks were assessed by comparing the RI analytical results against published numerical criteria (screening levels; see Section 5.0) appropriate for the exposure pathways and receptors identified in the CSEM. The CSEM was developed based on Site physical features, historical activities, and field observations, and is depicted graphically in Figures 6 and 7.

A complete exposure pathway consists of: (1) an identified contaminant source, (2) a release/transport mechanism from the source to locations (exposure points) where potential receptors may come in contact with COPCs, and (3) an exposure route (for example, soil ingestion) where potential receptors may be exposed to COPCs. In Figures 6 and 7, complete potential exposure pathways for the Site are identified. Exposure pathways deemed to be incomplete (e.g. groundwater ingestion) were not considered further in this RI.

4.2.1 Potentially Complete Exposure Pathways – Humans

Current and expected future use of the Site is as a public park. People who could potentially be exposed to COPCs at the Site include site visitors. Because residential exposures and associated risks are typically greater than exposures/risks to site visitors, a hypothetical residential scenario (that is, unrestricted land use) was assumed for the purpose of conservatively assessing potential human health risks in this RI.

Soil

Potentially complete soil-based exposure pathways exist for humans throughout the upland portion of the Site, via incidental soil ingestion, dermal contact with soil and inhalation of particulates. In accordance with WAC 173-340-740, human health exposure to on-Site soil is evaluated based on the direct contact with soil exposure pathway (that is, incidental soil ingestion; unrestricted land use). Screening levels applicable to the soil ingestion exposure pathway are discussed in Section 5.1.

Groundwater

No complete pathways exist for direct exposure of human receptors to COPCs in groundwater; however, people may be exposed to groundwater COPCs south of the AST area where groundwater seeps are apparent. Additionally, people may be exposed to groundwater where it discharges to Port Townsend Bay. Groundwater screening levels are discussed in Section 5.2.

Surface Water

A complete potential pathway exists for human exposure to COPCs in surface water in Port Townsend Bay via consumption of fish. Screening levels applicable to this exposure pathway are discussed in Section 5.3.

Human exposure to surface water from occasional incidental ingestion of water in the drainage at the northern end of the Site (while wading in the water, for example) was considered as a possible exposure pathway during development of the CSEM. However, potential exposures from occasional incidental ingestion are unlikely to exceed the hypothetical human exposures from fish consumption (bioaccumulation pathway) that form the basis for numerical criteria used in this RI to derive surface water screening levels.

Sediment
Potentially complete exposure pathways exist for human exposure to COPCs in intertidal sediments via incidental ingestion and dermal contact with sediment and ingestion of shellfish. Screening levels applicable to the direct contact exposure pathways (that is, ingestion and dermal contact) are discussed in Section 5.3. The shellfish ingestion exposure pathway was evaluated separately by the ATSDR (ATSDR, 2008) and is discussed in Section 6.3.

4.2.2 Potentially Complete Exposure Pathways – Ecological Receptors

Several complete potential exposure pathways exist for ecological receptors under current and likely future Site use conditions. Ecological receptors that may be exposed to COPCs include plants, soil biota and wildlife (mammals and birds) in the terrestrial environment, and benthic invertebrates and fish in the aquatic environment.

Soil
Potentially complete exposure pathways exist for exposure of terrestrial ecological receptors to COPCs throughout the upland area via direct contact (plants and soil biota), incidental ingestion (wildlife), and consumption of plants or soil biota (wildlife – bioaccumulation pathway). Numerical criteria applicable to these exposure pathways that were used to derive soil screening levels are discussed in Section 5.1.

Groundwater
Potentially complete exposure pathways exist for exposure of terrestrial ecological receptors to COPCs in groundwater via direct contact (plants and soil biota). However, because the depth to groundwater throughout most of the Site is greater than typical rooting or burrowing depths, these exposure pathways are assumed to be insignificant. Ecological receptors may be exposed to COPCs in groundwater indirectly at locations where groundwater discharges to surface water in Port Townsend Bay. Therefore, ecological exposure to groundwater is evaluated via potential surface water exposure.

Surface Water
A complete potential pathway exists for benthic invertebrate and fish exposure to COPCs in surface water. Numerical criteria applicable to this exposure pathway that were used to derive surface water screening levels are discussed in Section 5.2.

Sediment
Complete potential pathways exist for exposure of aquatic ecological receptors to COPCs in Port Townsend Bay intertidal sediment via direct contact (benthic invertebrates, fish and shellfish) and consumption of benthic invertebrates and/or fish (wildlife – bioaccumulation pathway). Numerical criteria applicable to these exposure pathways that were used to derive sediment screening levels are discussed in Section 6.4.

5.0 SCREENING LEVELS

Regulatory screening criteria were identified to evaluate analytical results and determine the extent of contamination. The purpose of the screening criteria is to identify chemical concentrations that, if exceeded, could pose a risk to human health or the environment. The screening levels are not the final cleanup levels. This section discusses the numerical criteria used to derive the RI screening levels. Consistent with the MTCA Cleanup Regulation (Chapter 173-340 WAC; Ecology, 2007b), the development of screening levels also included identifying potential exposure pathways for human and environmental impacts based on the current and planned future land use of the Site. Potential exposure pathways are discussed in Section 4.

5.1 SOIL

Tables 1 through 4 show the soil analytical data evaluated in the RI. Tables 1, 3, and 4 show the soil screening levels used to evaluate the RI soil analytical data, and the numerical criteria from which the screening levels were derived. In general, the most conservative (lowest) published numerical values were selected from among the following criteria:

- **MTCA Method A Soil Cleanup Level for Unrestricted Land Uses.** MTCA Method A was used only to evaluate petroleum hydrocarbons in soil—specifically, to evaluate the potential of free product accumulating on Site groundwater. MTCA Method A was also used for arsenic (based on natural background levels in soil) and lead (based on preventing unacceptable blood lead levels).
- **MTCA Method B Soil Cleanup Levels**. MTCA Method B values for human health protection, which are based on a residential (incidental soil ingestion) exposure scenario, were obtained from Ecology's Cleanup Levels and Risk Calculations (CLARC) online database in February 2009. Where values were available for both carcinogenic and noncarcinogenic toxic effects, the lower value (typically the carcinogenic value) was used. In addition, extractable petroleum hydrocarbon (EPH) analytical results were used to calculate a site-specific MTCA Method B soil cleanup level for TPH.
- **MTCA Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals.** Section 2.2.2 of this report describes the ecological setting of the Site, including vegetation and wildlife species observed or expected to be present in the Site vicinity. A site-specific TEE was determined to be appropriate for the Site because: (1) the Site does not qualify for an exclusion from a TEE under WAC 173-340-7491(1); and (2) as defined in WAC 173-340-7491(2), the Site "is located on, or directly adjacent to, an area where management or land use plans will maintain or restore native or semi-native vegetation."

  A site-specific TEE was performed and is presented in Section 7. The TEE evaluated plants, soil biota and wildlife and identified appropriate screening levels for each receptor. These screening levels are presented in Tables 3 and 4. The lowest applicable screening levels for plants, soil biota and wildlife were used.

- **Petroleum Hydrocarbons.** When comparing an analytical result to the screening level, the combined TPH concentration (sum of diesel-range and heavy oil-range petroleum hydrocarbons) was used. In addition, a bioassay sediment screening level of 136 mg/kg, which was derived from sediment bioassays conducted on intertidal sediment samples (see Appendix D for details), was used to evaluate combined TPH concentrations in soil.

- **cPAHs.** The MTCA Method B formula value for benzo(a)pyrene protective of human health was used as the soil screening level for total cPAHs, calculated using the toxicity equivalent (TEQ) approach in accordance with WAC 173-340-708(8)(e). In this RI, cPAH TEQs were calculated using 2005 California Environmental Protection Agency toxicity equivalency factors (TEFs) for humans (WAC 173-340-900, Table 708-2).
- **Natural Background.** Natural background concentrations for metals were considered when deriving soil screening levels, in accordance with WAC 173-340-705(6). For any given COPC, if the lowest published numerical criterion was less than the natural background concentration, the

background concentration was used as the screening level. Background concentrations were obtained from the following source: *Natural Background Soil Metals Concentrations in Washington State* (Ecology, 1994).

5.2 GROUNDWATER AND SURFACE WATER

Tables 5 through 7 show the RI groundwater/surface water analytical data, the screening levels used to evaluate the RI groundwater and surface water analytical data, and the numerical criteria from which the screening levels were derived. Groundwater at, or potentially affected by, the Site is not used for drinking water at this time and is not a reasonable future source of drinking water because of its proximity to marine surface water (as described in WAC 173-340-720(2)(d)). In addition, Site groundwater discharges into Port Townsend Bay (marine water), making it improbable that there is, or could be, any interconnection between contaminated groundwater and any potential future source of groundwater.

Preliminary groundwater/surface water cleanup levels were, therefore, selected from available state and federal surface water criteria as outlined in WAC 173-340-730(3). Unless otherwise noted, the criteria below are applicable to groundwater and surface water. In general, the most conservative (lowest) published numerical values were selected from among the following criteria:

- **Water Quality Standards for Surface Waters of the State of Washington.** These marine surface water criteria for protection of aquatic life (chronic exposures) are published in Chapter 173-201A WAC.
- **Federal National Recommended Water Quality Criteria.** These marine surface water criteria for protection of aquatic life (chronic exposures) and human health (fish consumption) are established under Section 304 of the Clean Water Act.
- **National Toxics Rule Federal Water Quality Criteria.** These marine surface water criteria for protection of aquatic life (chronic exposures) and human health (fish consumption) are published in 40 C.F.R. 131.36.
- **MTCA Method B Formula Values.** MTCA Method B standard formula values for human health protection, which are based on human consumption of fish, were obtained from Ecology's CLARC online database in February 2009. Where values were available for both carcinogenic and noncarcinogenic toxic effects, the lower value (typically the carcinogenic value) was used.
- **Petroleum Hydrocarbons.** Numerical surface water criteria have not been established for petroleum hydrocarbons; therefore, as allowed by WAC 173-340-730(3)(b)(iii)(C), the Method A groundwater value of 500 micrograms per liter (µg/L) was used as the petroleum hydrocarbons screening level. When comparing an analytical result to the screening level, the combined TPH concentration (sum of diesel-range and heavy oil-range petroleum hydrocarbons) was used.
- **MTCA Method A Cleanup Level for Groundwater.** MTCA Method A was used only to evaluate arsenic in groundwater. The MTCA Method A arsenic groundwater cleanup level is based on background concentrations for the State of Washingto and is not applicable to surface water samples collected at the Site.
- **Additional Considerations.** MTCA states that a cleanup level cannot result in the presence of nonaqueous phase liquid in or on the surface water. Physical observations of groundwater and surface water were used as the screening criteria for this cleanup level. MTCA describes physical observations as including lack of a film, sheen, discoloration, sludge or emulsion in surface water or adjoining shoreline (WAC 173-340-730(5)).

5.3 SEDIMENT

Tables 8 through 16 show the RI sediment analytical data. Tables 8, 9, 10, 12, 15 and 16 show the sediment screening levels used to evaluate the RI sediment analytical data, and the numerical criteria from which the screening levels were derived. Published numerical values were selected from among the following criteria:

- **Sediment Management Standards.** The Sediment Quality Standard (SQS) and Cleanup Screening Level (CSL) criteria established under the SMS (Chapter 173-204 WAC; Ecology, 1986) were used as the sediment screening levels for the Site. The SQS criteria (WAC 173-204-320 through 340) are established sediment quality goals that will result in no adverse effects on biological resources and no significant threat to human health. The CSL criteria (WAC 173-204-520 through 540) represent the threshold for minor adverse effects and potential threat to human health.
- **Petroleum Hydrocarbons.** SMS criteria have not been established for petroleum hydrocarbons; therefore, the MTCA Method A soil screening level of 2,000 mg/kg was used as a screening level for TPH in sediment. Additionally, sediment bioassays were conducted on intertidal sediment samples at the Site. A bioassay sediment screening level of 136 mg/kg was derived from the bioassays conducted on intertidal sediment samples (see Appendix D for details).

6.0 REMEDIAL INVESTIGATION RESULTS

6.1 PHYSICAL CHARACTERISTICS OF THE SITE

Physical characterization of the Site is based on field observations and logging of soil from the explorations as well as previously published information.

6.1.1 Soil

The Site is underlain by a combination of fill and native soil. The fill varies in thickness from zero to approximately 15 feet and is present along all of the near-shore area and beneath former building areas (details of the composition of the fill are outlined below). Most of the upper foot or more of the Site has been disturbed by the prior industrial activities. Native soils underlie the fill and consist of unconsolidated landslide deposits (Geology & Earth Resources, 2005). Native soil encountered in explorations consisted of loose gray to brown sand with varying amounts of silt, shell fragments and gravel. Native sediments exposed in the steeper portion of the Site consist of loose sand and silt. A thin layer of topsoil and/or forest duff covers most of the upland portion of the Site.

The fill material encountered beneath the Site is described below; although not all types are present everywhere. Listed in general order from ground surface to deeper, they are:

- Bricks and brick fragments from the former structures. These materials are found around most of the former buildings and the area where the charcoal kilns were located. Brick fragments are also common along the beach below the former kilns and on several of the paths through the park. A layer of charcoal is present near the surface in the former kiln area.
- Loose grey sand with gravel and shell fragments with occasional chips of wood and coke fragments. Along the near-shore area where logs were formerly stored, there is a layer of woody material at the surface of the ground or/and mixed in with the granular material. This appears to be the same material identified in explorations at the adjacent Chimacum Creek site as part of a cultural resource investigation (Eastern Washington University, 2005). That study identified

approximately 2 to 8 feet of fill in the near-shore area and characterized the fill as a mixture of timber and dredged granular marine sediments.

- Loose sand with slag and building debris, including some areas that are entirely slag. This fill layer was identified in most of the Site seaward of the steel production buildings and boiler house complex. It was not observed in the test pit (TP-01) at the blacksmith/machine shop buildings. This fill material is suspected to be associated with metal contamination at the Site. This fill type is thickest (5 to 15 feet thick) near the former coke warehouse. Along the shoreline near the former coke warehouse and wharf, there are areas that are composed entirely of slag and clinker[2] material. Slag was not identified in the explorations adjacent to and beneath the AST area. The near-shore area from the northern Site boundary southward to the vicinity of TP-12 does not contain significant slag.

6.1.2 Hydrogeology

Groundwater Occurrence

Static groundwater measurements were obtained in the four monitoring wells in December 2007 and January 8 and 9, 2009. Based on these measurements, shallow groundwater occurs about 4 to 6 feet bgs in the near-shore area. These measurements were obtained during both falling and rising tidal cycles but do not represent conditions during extreme high or low tides. Groundwater levels near Port Townsend Bay may be higher and lower during these tides. Groundwater elevations based on these monitoring events are summarized in Table 17. This table also shows the estimated tide elevation at the time of each measurement and the phase (rising or falling) of the tidal cycle. Groundwater occurs in both fill material and native sediments.

As expected based on the Site topography and confirmed through the groundwater monitoring results, groundwater flows from the upland to the east toward Port Townsend Bay, discharging in the intertidal area. It should be noted that the monitoring well data are not representative of steeper portions of the upland because monitoring wells were not installed in these areas. However, it is reasonable to assume that groundwater flows from these higher elevation areas toward the Bay.

Precipitation is the main source of recharge to groundwater at the Site. Other sources of recharge may include septic drainage fields and stormwater/irrigation runoff related to residences located upgradient of the Site. The water budget for the Port Townsend area, which includes the Site, indicates that groundwater is recharged November through March, but there is a deficit (no or limited recharge) during the remaining months of the year because of evapotranspiration (Ecology, 1981). Overall, the annual water budget presented in the Ecology publication shows a small (0.6- to 4-inch) annual recharge to groundwater. The actual groundwater budget at the Site may vary as a result of different geology and Site conditions than assumed in the Ecology study.

Groundwater Use

There are no groundwater supply wells located on the Site, and groundwater is not a current source of drinking water. Based on our review of the Washington State Well Log Viewer (Ecology, 2007c) and the Ecology publication “Geology and Ground-Water Resources of Eastern Jefferson County, Washington,” dated April 1981 (Ecology, 1981), the closest water supply well is located about ½ mile southwest of the Site and about ½ mile inland from Port Townsend Bay. This is considered too far a distance to be pertinent to this investigation.

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[2] Clinker refers to loose, medium-sized, rock-like pieces of slag, coke and other waste material from the steel-making process.

Groundwater beneath the Site satisfies the criteria in MTCA (WAC 173-340-720) for classification as nonpotable groundwater. MTCA provides for this classification at sites where there is an extremely low probability that the groundwater will be used as a potable water supply. For groundwater to be considered as nonpotable, MTCA requires that certain conditions be satisfied. These conditions (*in italics*), along with an accompanying explanation of why they are satisfied at this Site, are listed below.

1. *Not a current source of drinking water*: There are no water supply wells located on the Site.
2. *Contaminants unlikely to be transported to groundwater that is a current or potential future source of drinking water:* With the exception of TPH in one well, concentrations of chemicals greater than drinking water standards have not been identified in groundwater at the Site. There are no potable groundwater resources downgradient of the Site. It is extremely unlikely that groundwater beneath the Site will be a future source of drinking water because: (a) the Site will remain a county park with no water supply well, (b) it is sufficiently connected (hydraulically) to Port Townsend Bay to be impracticable to use as a drinking water source, and (c) it is probably too shallow to be considered "the highest quality source feasible" as required under WAC 246-290-130.
3. *There are known or projected points of entry of the groundwater into the surface water*: Groundwater discharges to the adjacent Bay.
4. *The surface water is not classified as a suitable domestic water supply source under Chapter 173-201A WAC:* Marine waters, including Port Townsend Bay, are not classified as a suitable domestic water supply source.
5. *The groundwater is sufficiently hydraulically connected to the surface water that the ground water is not practicable to use as a drinking water source:* Groundwater is in direct contact with surface water along the shoreline of the Site.

6.1.3 Aquatic Habitat and Sediment Characteristics

The Site is located on the southwestern shore of Port Townsend Bay and includes intertidal and subtidal areas, along with a small stream that enters the bay. The beach along the Site is gently sloping, with steeper slopes on the southern quarter of the Site. The beach is composed of granular marine sediments (sand, gravel and shell debris), with varying amounts of anthropogenic debris (brick and slag). The adjacent subtidal environment consists mainly of silt and fine sand (see sediment descriptions below).

Surface Water

The drainage stream exists along the northern boundary of the Site (Figure 2). This stream enters the Site near the northwestern Site boundary and discharges through a metal culvert on the beach near the northern corner of the Site. The length of the portion of the drainage that is located on the Site is about 500 feet. The stream is about 10 to 20 feet wide and has a dense cover of vegetation, including Himalayan blackberry bushes. The sources of water contributing to this drainage are not known, although one property owner stated it was "spring fed." The drainage originates in the housing area above the Site. Freshwater drainages provide nutrient loading, terrestrial and aquatic prey, chemical buffering, salinity buffering, and habitat structure (e.g., large woody debris) to the nearshore environment.

Tides

Information regarding tides affecting the Site is available from the Port Townsend National Oceanographic and Atmospheric Administration (NOAA) tide station (station ID 9444900), located about 5 miles from the Site. Information from this station describes a mean tidal range of 5.34 feet and a diurnal tidal range of 8.52 feet. The mean range represents the average difference in height between mean high water and mean low water. The diurnal range represents the difference in height between mean higher high water (MHHW) and mean lower low water (MLLW). The minimum water level is 4.22 feet below MLLW, and the maximum water level is 3.21 feet above MHHW.

Biota/Habitat

The Site has a number of large native littleneck clams in the intertidal areas of sand, gravel and broken brick (WDFW, 2009). Gastropods, tube worms, and hermit crabs were observed at the intertidal sediment sampling sites along with a high prevalence of shell debris. Immediately north of the Site, an estuary was created where Chimacum Creek flows into Puget Sound. The creek was historically known for good trout fishing, and a variety of shellfish were reported such as clams, geoduck, scallop, oysters, sea urchins, barnacles, and mussels from the tidelands (Eastern Washington University, 2005; WDFW, 2009). Chimacum Creek is native habitat for chum, coho, steelhead and cutthroat. The shallow waters of the Chimacum tidelands contain eelgrass beds (Zostera spp., a seagrass), which provide nearshore rearing and migrating refuge habitat for Hood Canal Summer Run chum salmon (listed as threatened under the Endangered Species Act), other salmonids, and nearshore marine fishes (i.e., threespine stickleback and sculpins).

The intertidal areas offshore and parallel to the Site contain both *Ulva* spp., a green macroalgae, and eelgrass. *Ulva* was prevalent, found at 7 of 11 sediment sampling sites in the intertidal zone. Eelgrass was found in only 2 of the 11 sampling sites. Eelgrass beds are designated critical habitat for certain protected salmon runs. *Ulva* has a high nutrient value (Kirby, 2001) and provides an important source of marine nitrogen, as detritus, that supports eelgrass growth. Gastropods and clams use *Ulva* to anchor themselves and are consumed by various bird species. The proximity of the Chimacum Creek tidelands and similar habitat characteristics indicate that the Site would similarly be utilized by migrating salmonids and other nearshore fishes.

Intertidal Sediment

(Information from SAIC’s Data Report dated April 14, 2009; see Appendix D and GeoEngineers June and December 2007 sample events; see Appendix A for test pit logs): In the areas east of the former AST and south of the Slag Outcrop, the near-shore surface sediments are generally medium to coarse sand with shell fragments, bricks and occasional slag. Surface sediments farther into the water generally consist of silty fine to medium sand with occasional shells and bricks. The surface sediment at locations SED02 and SED11, which are closer to the Slag Outcrop, consist of coarse slag with sand and shell fragments. Sediment at locations SED09 and SED22, which are the southernmost RI sediment sample locations, consists of brick and slag cobbles with medium to coarse sand and shells. Surface sediments north of the former wharf generally consist of fine to medium sand with silt, shell fragments, and slag. Intertidal surface sediments sampled in January 2009 were primarily medium sand and gravel.

Looking north from south end of site at brick and cobble on intertidal beach.

Hollow-stem auger borings were completed at five locations in this area. Native sediments were identified throughout the boring completed at SED20, and fill was identified in borings SED18 and SED21 through 23 at depths ranging from 4 to 7 feet bgs.

Subtidal Sediment

(Information from SAIC's Data Report dated April 21, 2008; see Appendix C): Subtidal surface sediments consist primarily of fine sand with silt with some shell debris, organic matter, and a slight to moderate sulfide odor. Sand generally constituted 52 to 72 percent of the subtidal sediment samples. One station, ID-59-SD, was the only subtidal sample location composed primarily of silt (72 percent).

6.2 ANALYTICAL DATA QUALITY

EcoChem, Inc. is the Data Validation Contractor for this project and is responsible for quality assurance oversight of analytical data quality and data validation. Appendix B of this RI/FS report contains the laboratory analytical reports for this RI. The quality of analytical data generated during the RI was reviewed in detail by EcoChem, Inc., as presented in the Data Validation Reports included in Appendix B. Analytical data were assessed against the data quality objectives established in the Quality Assurance Project Plan (GeoEngineers, 2007a). In general, the analytical data obtained during this study are usable in defining the nature and extent of contamination, and in conducting human health and ecological risk assessments, feasibility studies and other decision-making processes.

The usability of specific analytical data is indicated by a data quality "flag" in the analytical summary tables. These flags are explained in the explanation for the analytical data summary tables. Not all data reported by the analytical laboratories were considered usable. These rejected data are not included in the tables or data summaries. The most significant data quality issues identified during the data validation include the following:

- **Sample Data Group LF99:** The matrix spike/matrix spike duplicate analyses for this SDG were performed using sample SED06-070628-0-4. Spiking compounds benzyl alcohol and benzoic acid were not recovered. These two compounds were not detected in SED06-070628-0-4; therefore, the reporting limits were rejected.
- **Sample Data Group ME43:** The analytical laboratory archived sediment samples SED18-071210-5, SED20-071212-1.5 and SED21-071210-5 three days past the 14-day holding time for semivolatile organic compound (SVOC) analyses by EPA Method 8270D and 8270D-SIM. Associated results and reporting limits were qualified as estimated (J/UJ).

Aside from the two rejected non-detected compounds in SDG LF99, the data, as qualified, are acceptable for use in the RI/FS.

6.3 NATURE AND EXTENT OF CONTAMINATION

The soil, groundwater, surface water and sediment data discussed in this section are compared to the draft cleanup levels presented in Section 5.0.

The RI analytical data were evaluated, and potential risks to human and ecological receptors were assessed, by comparing the analytical data to screening levels developed from published numerical criteria. The screening levels used in this RI are presented in Tables 1, 3 through 10, 12, 15 and 16. An exceedance of a screening level does not indicate that a cleanup action will be required. Rather, screening levels are used in conjunction with the CSEM presented in Section 4.2 to assess relative risks associated with COPCs at the Site. The potential risks posed by on-Site COPCs may be further evaluated as necessary during the FS to develop appropriate cleanup action alternatives.

6.3.1 Upland

6.3.1.1 Soil

Soil conditions at the Site were characterized by physical observations and field screening during exploration and chemical analytical tests on selected samples. Soil samples were analyzed for one or more of the following constituents: arsenic, copper, iron, lead, nickel, zinc, petroleum hydrocarbons or PAHs. The results of these tests were compared to the screening levels to identify areas with exceedances. Soil samples were also obtained for bioassay tests to support the TEE (see Section 7.0).

Overview of Upland Soil RI Results (Tables 1, 2, 3, 4)

- Heavy oil concentrations exceeded MTCA Method A levels near south end of AST, extending into intertidal sediments.
- Metal COCs exceeded human health and TEE screening levels at 15 sample locations. Maximum depth of exceedance was 6 feet.
- PAH exceedances associated with heavy oil exceedances and in area near TP02.
- There were no exceedances in the near-shore fill area. See Section 3.2.1 for a description of the near-shore fill area.

Petroleum Hydrocarbons

Sixty-four soil samples were analyzed for petroleum hydrocarbons. The concentrations ranged from not-detected to 33,000 mg/kg (total of diesel- and heavy oil-range hydrocarbons) as shown in Table 1. EPH results are shown in Table 2. The oil identified in these samples was characterized by the analytical laboratory as “extremely” and “very” weathered oil, as would be expected if the source is the 90-year-old 6,000-barrel AST. Ecology’s chemist also reviewed the chromatographs from the analytical tests and identified the oil as heavy oil-range petroleum hydrocarbons. The soil petroleum hydrocarbon results were compared to the MTCA Method A TPH soil screening level of 2,000 mg/kg throughout the Site and the sediment bioassay screening level of 136 mg/kg for soil samples collected near the former AST. The sediment bioassay screening level was used to address concerns regarding erosion of upland soils south of the slag headland and adjacent to the former AST.

Exceedances of the MTCA Method A TPH screening level of 2,000 mg/kg were limited to the area near the former AST in the upland and extending into the intertidal area. As noted, petroleum hydrocarbon data from soil samples obtained in the vicinity of the former AST were also compared to the sediment bioassay screening level of 136 mg/kg. TPH-contaminated soil appears to be located in an approximately 3- to 12-foot-thick interval that extends from near the south side of the former AST to approximately 60 feet seaward of the shoreline bank. This is illustrated in Figure 8, which is a cross section through this area, and Figure 14, which shows the lateral boundary of the exceedances. TPH exceedances in the sediment samples obtained from the intertidal area are discussed in Section 6.3.2.

Field screening tests identified moderate and heavy oil sheens on samples from several test pits (see Table 1) near the former AST. In most cases, the sheens were first encountered at the same depth where groundwater was first encountered in the test pit, which indicates that the sheens are the result of oil transport in groundwater rather than leakage from the ground surface. The exception to this was in test pits TP11 and TP24, which are located on the south side of the AST. No groundwater was encountered in either of these test pits, but heavy and moderate sheen was observed starting at 2 feet bgs and extending to the total depth of the test pits (8 and 4 feet, respectively). The shallowest and highest concentrations of TPH were also identified in samples from these two test pits.

Direct-push boring DP02 (MW02) was at the location of TP26. At this location, combined TPH was detected at concentrations ranging from 9,400 to 18,800 mg/kg at depths ranging from 6.5 to 11 feet bgs. Combined TPH was not detected in samples obtained at 2 and 4 feet bgs and was detected at a concentration of 23 mg/kg in the sample obtained at a depth of 13 feet bgs. This is the only sample location that identified the vertical extent of TPH contamination in soil.

In TP24, a 2-inch-diameter pipe was observed at a depth of 4 feet bgs. The pipe appeared to extend from the former AST in a southeast direction. A hole was observed in the pipe, and what appeared to be oil or an oil/water mixture leaked from this hole a few minutes after it was exposed. Test pit TP24 was abandoned and TP25 was excavated adjacent to it. However, at 1.5 feet bgs in TP25, a flat milled wood surface was encountered, and the test pit was backfilled. The purpose and extent of the wood surface was not determined. In TP11 at a depth of approximately 2 feet bgs, free product was observed when soil was disturbed on the side of the test pit closest to the AST. These field observations and analytical results suggest that an oil release occurred near the south side of the former AST, possibly associated with piping in this area.

Hollow-stem auger borings TP35/35A and TP36/36A were completed to delineate the horizontal extent of TPH contamination. Field screening results for TPH were negative, and TPH was not detected in samples obtained at these two locations.

The intertidal area below the AST was visually inspected for oil seeps several times during the RI. We did not observe any oil seeps.

Metals

The laboratory analyzed 126 soil samples for metals (primarily arsenic, copper, iron, lead, nickel and zinc). In addition, six slag samples were analyzed for metals. Arsenic, copper, iron, nickel, lead and zinc were detected at concentrations greater than human health or TEE soil screening levels in at least one soil sample. Soil metals results are presented in Table 3. Metals exceedances are located in four general areas of the Site: the steel production building; the power, engine and boiler house complex; the vicinity of test pit TP08 (TP08 is located immediately seaward of the 6,000-barrel AST), and the slag outcrop area. These three areas are described in detail below.

- **Steel Production Building** – Metals were detected at concentrations greater than human health or TEE soil screening levels at soil sample locations TP-6 (obtained by Hart Crowser), TP22/TP30 and TP40. Soil concentrations of arsenic and iron exceeded human health screening levels, and concentrations of arsenic, copper and nickel exceeded TEE screening levels. At sample location TP-6, an initial sample was obtained in 1996 by Hart Crowser at a depth of 0.5 to 2 feet, and a follow-up sample was obtained at approximately the same location in 2008 by GeoEngineers at a depth of 1 foot bgs; deeper samples were not obtained at this location. At sample locations TP22 and TP30, which were obtained adjacent to each other, and TP40, the exceedances of soil screening levels were in shallow soil samples obtained between 0.5 and 2 feet bgs. Metals concentrations in soil samples obtained from depths of 3 to 5 feet bgs at these locations were less the soil screening levels, indicating that metals contamination at the steel production building may be limited to the top few feet of fill material. The metals exceedances at sample locations TP22/TP30 and TP40 (arsenic, copper, iron and nickel) ranged from 2 to almost 25 times the soil screening levels, but the exceedances at sample location TP-6 (copper and iron) ranged from only 1 to 2 times the screening levels. Lastly, elevated concentrations of metals (chromium, copper, lead and zinc) were detected in at least one of the two slag samples (SS-3 and SS7) that were obtained within or near the steel production building. Because the metals in the slag are not expected to be readily bioavailable (that is, the slag is in a rock-like form that will limit ingestion and dermal contact with metals in the slag), these elevated metals concentrations do not indicate an immediate concern to human health and the environment. Slag samples SS-3 and SS7 were submitted for TCLP analysis of arsenic and lead; neither metal was detected (see Table 3). However, erosion and weathering of the slag may be a future source of metals contamination in this area.

- **Power, Engine and Boiler House Complex:** Metals were detected at concentrations greater than human health or TEE soil screening levels at soil sample locations SS3, SS4, TP02, and TP03. As shown in Figures 9 and 10, samples from locations SS3 and TP02 were obtained at, or very close to, the same location. Soil concentrations of arsenic, iron and lead exceeded human health screening levels, and concentrations of arsenic, copper, lead, nickel and zinc exceeded TEE screening levels. At sample location SS4, a surface soil sample (exact depth is not known) was obtained in 2001 by Jefferson County; deeper samples were not obtained at this location. Zinc was detected at SS4 at a concentration of 268 mg/kg, which exceeds that plant soil screening level of 160 mg/kg. No other screening levels were exceeded at this location. At sample locations TP02/SS3, three soil samples were obtained during two RI sampling events at depths ranging from 2 to 3 feet bgs, and one surface soil sample (SS3; exact depth is not known) was obtained in 2001. Metals exceedances at TP02/SS3 occurred in only one of the three RI samples and the 2001 surface soil sample. In addition, the maximum metals exceedance (versus human health or TEE soil screening levels) was less than 2.5 times the soil screening levels. These results indicate that the metals concentrations at or near TP02/SS3 are only somewhat elevated and are also sporadic. The metals concentrations at TP03, however, are much more elevated, with exceedances ranging up to 11 times the soil screening levels. Arsenic, iron and lead were detected at concentrations greater than human health screening levels, and arsenic, copper, lead, nickel and zinc were detected at concentrations greater than TEE screening levels. Four soil samples (plus a sample obtained for arsenic speciation) were obtained at TP03 at depths ranging from 1 to 4 feet bgs. However, the sample obtained at 4 feet bgs was not submitted for chemical analysis. The metals results from these three locations indicate significantly elevated metals concentrations at TP03, with slightly elevated metals concentrations at TP02/SS3 and SS4.
- **TP08 (seaward of AST) Vicinity:** Metals were detected at concentrations greater than human health or TEE soil screening levels at soil sample locations DP01, GEISS1, TP08, TP-11 (obtained by Hart Crowser), TP32, TP33 and TP34. As shown in Figures 9 and 10, samples from locations TP-11 and GEISS1 were obtained at, or very close to, the same location. Slightly elevated metals concentrations were also detected at sample location TP28. Soil concentrations of arsenic, copper (at one location only) and iron exceeded human health screening levels, and concentrations of arsenic, copper, lead and zinc exceeded TEE screening levels. As shown in Figure 9, human health exceedances in this area are generally limited to samples obtained from deeper than 2 to 3 feet bgs. The exception is sample location TP32, where elevated concentrations of arsenic, copper, iron and zinc were detected in samples obtained between 0 and 3 feet bgs (there were no human health exceedances in the soil sample obtained at a depth of 5 feet bgs at this location). At sample location TP28, copper and nickel were detected at concentrations slightly greater than their respective plant soil screening levels in a soil sample obtained at a depth of 5 feet bgs. As shown in Figure 10, elevated concentrations of metals were not detected in other soil samples obtained in the immediate vicinity of TP28. The metals results from the TP08 vicinity indicate that exceedances of human health screening levels are generally limited to subsurface soil (with TP32 being the exception). Metals were also detected at TP32 in surface soil samples at concentrations greater than TEE soil screening levels.

- **Slag Outcrop Area:** Metals were detected at concentrations greater than human health or TEE soil screening levels at slag sample location SLAG1. Slag concentrations of arsenic, copper, and iron exceeded human health screening levels, and concentrations of arsenic, copper, and nickel exceeded TEE screening levels. GeoEngineers also obtained slag sample SLAG2 from the slag out crop area; no metals were detected at concentrations greater than human health or TEE soil screening levels in sample SLAG2. Because the metals in the slag are not expected to be readily bioavailable (that is, the slag is in a rock-like form that will limit ingestion and dermal contact with metals in the slag), the elevated metals concentrations in SLAG1 do not indicate an immediate concern to human health and the environment. In addition, metals were not detected in intertidal sediment samples at concentrations greater than sediment screening levels. Therefore, this area was not identified in the FS as an area requiring remedial action; however, the slag outcrop area is evaluated in the FS as a slag removal area associated with shoreline restoration activities common to FS Alternatives 2 through 5 (see Section 9 for additional details on incorporation of slag removal into shoreline restoration activities).

Polycyclic aromatic hydrocarbons (PAHs)

The cPAH TEQ[3] concentrations in soil at sample locations TP02, TP11, TP24 and TP26 are greater than the soil screening level for cPAHs (Table 4). The exceedances at TP11, TP24 and TP26 are likely associated with heavy oil that was also identified in these samples. cPAH concentrations at these three locations ranged from 54 to 590 micrograms per kilogram (µg/kg).

6.3.1.2 Groundwater

Groundwater samples obtained from monitoring wells MW02 through MW05 were analyzed for total and dissolved metals (arsenic, copper, iron, lead, nickel and zinc), petroleum hydrocarbons and PAHs. The two grab groundwater samples obtained from direct-push borings DP01 and DP07 were analyzed for total metals and petroleum hydrocarbons.

Overview of Groundwater RI Results (Tables 5, 6, 7)
• Copper and nickel exceeded in MW-2 located near former AST and MW-3 located in area with slag fill. • TPH exceeded in MW-2 located adjacent to former AST.

Groundwater samples obtained from monitoring wells are considered more representative of groundwater quality than groundwater samples obtained from direct-push borings. Although groundwater samples obtained from the direct-push borings are useful to determine an order of magnitude characterization of potential contamination, the analytical results are typically biased high. There are three main reasons for the high bias of direct-push boring samples and the greater representative nature of monitoring well samples: (1) samples obtained from direct-push borings are one-time grab samples and the analytical results cannot be verified; (2) the short collection time for the grab groundwater samples is often insufficient for equilibration with surrounding water; and (3) grab groundwater samples are often turbid because it is difficult to properly develop the temporary sample screen.

Petroleum Hydrocarbons

Petroleum hydrocarbon concentrations exceeding the MTCA Method A groundwater screening level were identified only in samples from monitoring well MW02 (Table 5). This well is located near the former AST and in the area where high concentrations of petroleum hydrocarbons were identified in soil. Groundwater in MW-02 also contained evidence of free product in the form of blebs of oil and heavy sheen on the purge water extracted during sampling. Combined TPH concentrations in samples obtained from MW02 ranged from 1.1 to 3.5 milligrams per liter (mg/L)[4]. The MTCA Method A screening criterion is 0.5 mg/L. The hydrocarbon identification analyses of the samples from MW-02 indicate that the TPH consists of diesel-range and motor oil-range organic compounds. The analytical results indicate that these two ranges are present in similar concentrations in the samples obtained from MW02. TPH was not detected in samples from the other monitoring wells or from the direct-push borings.

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[3] Regulatory evaluation of cPAHs is completed using Ecology's TEQ methodology. This methodology is completed by multiplying the detected concentrations of specific analytes by their respective TEFs. The results of the calculations are then added to produce a TEQ concentration.

[4] Duplicate samples from this well had non-detectable (<0.50 mg/L) TPH.

Metals

In general, dissolved metal concentrations were 70 to 100 percent of total metal concentrations except for iron. Dissolved iron concentrations were 50 percent or less of the total iron concentrations. Total metal concentrations were compared to MTCA Method A groundwater cleanup levels (arsenic only), human health marine surface water screening levels (based on organism ingestion only) and MTCA Method B surface water cleanup levels, and dissolved metal concentrations were compared to MTCA Method A groundwater cleanup levels (arsenic only) and the aquatic life marine chronic surface water screening levels, which are based on dissolved rather than total concentrations (Table 6). There were no exceedances for zinc or lead. Arsenic, copper and nickel exceedances are discussed below.

Total and dissolved arsenic were detected at concentrations less than the MTCA Method A groundwater screening level of 5 µg/L in the four monitoring wells. However, total arsenic was detected at concentrations of 16.4 and 105 µg/L in the direct-push grab groundwater samples.

Dissolved copper and nickel exceeded the aquatic life marine chronic surface water screening level (2.4 and 8.2 µg/L) in samples obtained from monitoring wells MW02 and MW03. Copper and nickel were not detected or were detected at concentrations less than surface water screening levels in samples obtained from monitoring wells MW04 and MW05. Total and dissolved copper concentrations ranged from less than 2 to 12 µg/L in the monitoring wells, and total copper concentrations ranged from 282 and 329 µg/L in the direct-push samples. Total nickel concentrations ranged from 3.4 to 48.2 µg/L in the monitoring wells, and 40 and 100 µg/L in the direct-push samples. Dissolved nickel concentrations ranged from 3 to 53.4 µg/L in the monitoring wells.

Summary of Groundwater Metal Exceedances in Samples from Monitoring Wells

SWSL[1]	Arsenic	Copper	Nickel
Aquatic Life Marine Chronic (dissolved metals)	None	MW02; MW03	MW02; MW03
Human Health Marine (total metals)	None	None	None
MTCA Method B Surface Water (total metals)	None	None	None

[1] SWSL = surface water screening level (see Table 6)

Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)

The cPAH TEQ[5] concentration in one groundwater sample obtained in June 2007 from MW-2 is greater than the cPAH surface water screening level (Table 7). This exceedance is primarily the result of elevated method reporting limits (chrysene was the only cPAH detected in the groundwater sample). In addition, no individual cPAHs were detected in the duplicate groundwater sample obtained from MW-2 in June 2007. The cPAH TEQ concentration detected in groundwater samples obtained from MW-2 in December 2007 and January 2009 were less than the cPAH surface water screening level. However, the duplicate groundwater sample obtained from MW-2 in January 2009 is greater than the cPAH surface water screening level (Table 7). The lowest surface water screening level for cPAHs is 0.018 µg/L (human health marine).

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[5] Regulatory evaluation of cPAHs is completed using Ecology's TEQ methodology. This methodology is completed by multiplying the detected concentrations of specific analytes by their respective TEFs. The results of the calculations are then added to produce a TEQ concentration.

6.3.1.3 Surface Water

Overview of Surface Water RI Results (Tables 5, 6, 7)

- Only exceedances are for arsenic and for copper.
- Upstream and downstream analytical results are similar, indicating that contamination at the Site is not impacting water in the surface drainage.

Two surface water samples, one upstream (SW01) and one downstream (SW02) from within the surface water drainage ditch along the north Site boundary, were analyzed for total and dissolved metals. The only exceedances of surface water screening levels were for arsenic in both samples and copper in SW02 (copper was not detected in the duplicate SW02 sample; Table 6). Arsenic concentrations ranged from 0.92 µg/L (dissolved) to 1.4 µg/L (total). The arsenic concentrations were about the same in the two samples (difference of 0.01 µg/L for dissolved arsenic and 0.1 µg/L for total arsenic).

The dissolved metal concentrations were similar in the downstream sample and the upstream sample. This indicates that contamination at the Site is not impacting water in the surface drainage. With the exception of iron, the concentrations of metals identified in the surface water samples are similar to the concentrations identified in the groundwater sample obtained from the closest monitoring well (MW04). The concentration of iron was lower in the groundwater sample: 190 µg/L versus 1,360 µg/L in surface water sample SW02. Groundwater elevation data (Section 6.1.2) suggest that groundwater and surface water in the drainage are hydrologically connected in the vicinity of MW04.

6.3.2 Sediment-Marine

Sediment conditions at the Site were characterized by physical observations and field screening during exploration and chemical analytical tests on selected samples. Sediment samples were analyzed for SMS analytes and petroleum hydrocarbons. The results from these tests were compared to the sediment screening levels to identify areas with exceedances.

Overview of Sediment RI Results (Figure 11)

- No exceedances of SMS criteria in bioactive zone of 0 to 4 inches bgs.
- MTCA Method A soil screening level exceeded at six intertidal sediment sample locations at depths below the bioactive zone of 0 to 4 inches bgs.
- Sediment bioassay screening level exceeded in thirteen intertidal sediment sample locations.
- No exceedances of SMS or sediment bioassay screening level in subtidal sediment samples.

6.3.2.1 SMS Analytes

As shown in Tables 9 through 13, there were no SMS analytes were detected at concentrations greater than the SMS criteria in the bioactive zone of 0 to 4 inches bgs (see discussion of sediment sample BS3 below). Benzo(a)pyrene and chrysene were detected at intertidal sediment location SED02, at a depth of 4 to 18 inches. The exceedances for these two cPAHs were based on a comparison of dry weight sediment concentrations versus dry weight sediment screening levels. The dry weight comparison was necessary due to the elevated total organic carbon (TOC) concentration of 10.4 percent in sample SED02-070628-4-18. This dry weight comparison was also performed for the remaining sediment samples (see Table 9b, 10b, and 12b). 2,4-dimethylphenol was detected at concentrations greater than SMS criteria at locations SED18 and SED20 (at depths of 5 and 1.5 feet, respectively). 2,4-dimethylphenol was not detected in other sediment samples collected at the Site.

Copper was detected in sediment sample BS3 at a concentration of 412 mg/kg, which is slightly greater than the SMS criteria of 390 mg/kg. The approximate location of sample BS3 is shown on Figure 3. The Jefferson County sample location figure included in the 2001 SHA report shows this sample as a subtidal sample, however, the text describes sample BS3 as a beach sample. Because the actual sample location is highly uncertain, the sample depth is not known, the copper concentration only slightly exceeds the SMS criteria, and copper concentrations in sediment samples obtained as part of this RI were less than the SMS criteria, therefore this sample is not discussed further in this report.

6.3.2.2 Petroleum Hydrocarbons

Thirty-four sediment samples were obtained during the RI and analyzed for TPH (Table 8). The concentrations ranged from not-detected to 15,700 mg/kg (total of diesel- and heavy oil-range petroleum hydrocarbons). The oil identified in these samples was characterized by the analytical laboratory as “extremely” and “very” weathered oil, similar to that detected in soil. Based on chromatographs from the analytical tests, Ecology’s chemist identified the oil as heavy oil-range petroleum hydrocarbons. This description of the oil is consistent with oil identified in the upland and consistent with the historic uses at the Site. In addition, Hart Crowser obtained two sediment samples in 1996, Ecology obtained three sediment samples in 2005, and Jefferson County obtained 36 sediment samples (from 12 locations) in 2007. Note that the locations of the 2005 sediment samples appear to be in the area of TPH contamination identified in the Jefferson County and RI sediment samples; however, the exact location of these samples is not known. The TPH concentrations in the 2005 sediment samples range from 550 to 40,600 mg/kg.

Exceedances of the bioassay sediment screening level of 136 mg/kg are shown in Figure 11 (see Appendix D). TPH-contaminated sediment appears to be located in an approximately 5- to 12-foot-thick interval that extends from the shoreline east of the former AST to approximately 50 feet seaward of the shoreline bank. This location of the contamination is illustrated in Figure 8, which is a cross section through this area, and Figure 14, which shows the lateral boundary of the sediment exceedances.

7.0 TERRESTRIAL ECOLOGICAL EVALUATION

GeoEngineers conducted a TEE to evaluate whether contaminants detected in upland soil at the Site pose a threat to the terrestrial receptors (that is, plants, soil biota and wildlife). After the June 2007 sampling event, GeoEngineers compared chemical analytical results from soil samples obtained at the Site through June 2007 (including applicable historical data) to MTCA site-specific ecological indicator soil concentrations (Site-specific TEE screening values; MTCA Table 749-3). The results of this comparison indicated that metals were present in soil at concentrations greater than site-specific TEE screening values protective of plants, soil biota and wildlife, and that petroleum hydrocarbons (diesel-range petroleum hydrocarbons and motor oil) were present in soil at concentrations greater than site-specific TEE screening values protective of soil biota and wildlife. Based on this initial evaluation, Ecology recommended additional upland sampling (soil, flora and fauna) and soil bioassays to calculate site-specific TEE screening values (Figure 5).

7.1 PLANTS

Arsenic, copper, lead, nickel and zinc were detected in historical soil samples (samples obtained by others prior to this RI) and/or soil samples obtained by GeoEngineers in June 2007 at concentrations greater than the soil plant TEE screening values (MTCA Table 749-3). In order to calculate site-specific plant TEE screening levels for metals, GeoEngineers obtained soil samples, and Newfields conducted plant bioassays.

7.1.1 Plant Bioassay for Metals Evaluation

The objective of the plant bioassay was to establish site-specific plant TEE screening concentrations for metals. The plant bioassay consists of germinating and growing lettuce seeds in Site soils. GeoEngineers obtained 15 soil samples during the June 2008 sampling event for inclusion in the metals soil biota bioassays, as shown in Figure 4. Soil samples obtained from locations TP10, TP12 and TP42 were not retained for use in the plant bioassays. These samples were excluded because the chemical analytical results for the 15 soil samples showed a sufficient number of samples with low-level metal concentrations without retaining these three samples. The chemical analytical results are presented in Table 3.

Newfields followed Ecology's "Early Seedling Growth Protocol for Soil Toxicity Screening" (Publication No. 96-324) when completing the plant bioassay using the 12 selected soil samples. Two 14-day early seedling bioassays were performed on soils from the Site. The initial test was initiated on June 23, 2008. Because of low germination of the artificial soil control, the second test was initiated on August 8, 2008. According to Newfields (see Appendix E), statistical analyses of the plant responses during the second test and associated metals concentrations did not result in any definitive relationships. Therefore, because the plant bioassay results were inconclusive, Ecology recommended that EPA Soil Screening Levels be used as plant screening levels in this RI.

7.1.2 Plant TEE Evaluation

Soil sample locations where metals were detected at concentrations greater than the plant soil screening levels are shown in Figure 10. Nickel was detected at concentrations slightly greater than the plant screening level of 48 mg/kg at three additional sample locations (TP26, TP37 and TP38); however, these sample locations are not shown in Figure 11 because the exceedances are slight and are from samples obtained at depths ranging from 5 to 6.5 feet, which is the conditional point of compliance (6 feet) for ecological receptors, and because nickel concentrations in shallower soil samples at each location are less than the plant screening criteria. The nickel, plant soil, screening level is based on Puget Sound background soil concentration because the EPA soil screening level of 38 mg/kg is less than background nickel concentrations. These three sample locations (and copper at TP43) are discussed further in the following sections.

- **TP26.** Nickel was detected in soil at TP26 at a concentration of 49 mg/kg at a sample depth of 6.5 feet, which is below the conditional point of compliance of 6 feet for terrestrial receptors. Nickel was also detected at TP26 at a concentration of 35 mg/kg at a depth of 2 feet.
- **TP37.** Nickel was detected in soil at TP37 at a concentration of 52 mg/kg at a sample depth of 5.5 feet. Nickel was also detected at TP37 at a concentration of 32 mg/kg at a depth of 1.5 feet.
- **TP38.** Nickel was detected in soil at TP38 at a concentration of 51 mg/kg at a sample depth of 5 feet. Nickel was also detected at TP38 at concentrations of 33 and 36 mg/kg at depths of 1 and 2 feet, respectively.
- **TP43.** Copper was detected in soil at TP43 at concentrations of 71.8 and 250 mg/kg at depths of 5.5 and 10 feet, respectively. The EPA soil screening level for copper is 70 mg/kg, although the MTCA default plant soil screening level is 100 mg/kg (from MTCA Table 749-3). We do not consider copper to be an exceedance at TP43 within the biologically active zone/conditional point of compliance because the copper concentration of 71.8 mg/kg: (1) was detected in a soil sample obtained at a depth of 5.5 feet, which is close to the conditional point of compliance for terrestrial receptors; (2) only slightly exceeds the EPA soil screening level; and (3) is less than the MTCA default plant soil screening level. However, copper is identified as an exceedance at TP43 below the biologically active zone/conditional point of compliance because of the copper detection of 250 mg/kg at a depth of 10 feet.

7.2 SOIL BIOTA

Arsenic, copper, lead, zinc and diesel-range petroleum hydrocarbons were detected in historical soil samples and/or soil samples obtained by GeoEngineers in June 2007 at concentrations greater than the soil biota TEE screening values (MTCA Table 749-3). In order to calculate site-specific soil biota TEE screening levels for metals and TPH, GeoEngineers obtained soil samples and Newfields conducted soil biota bioassays.

7.2.1 Soil Biota Bioassay for TPH Evaluation

The objective of the soil biota bioassay was to establish site-specific soil concentrations that are protective of soil biota at the Site. The soil biota (earthworm) bioassay consists of adding earthworms to field collected Site soils; the primary test endpoint is mortality after 14 days exposure. GeoEngineers obtained four soil samples in June 2008 for potential inclusion in the TPH soil biota bioassays, as shown in Figure 4. Two samples were obtained from areas with known TPH contamination (TP11 and TP24, both adjacent to the AST) and two at locations not impacted by TPH (that is, TPH background locations; TP15-CS-080606-2 and TP23-BA-080606-2). These four soil samples were submitted for chemical analysis of diesel- and oil-range petroleum hydrocarbons following Ecology's NWTPH-Dx method. Combined TPH was detected in samples TP11-BA-080606-3 and TP24-BA-080606-3 at concentrations of 9,300 mg/kg and 9,400 mg/kg, respectively. As for the background locations, Combined TPH was detected in samples TP15-CS-080606-2 and TP23-BA-080606-2 at concentrations of 150 mg/kg and 12 mg/kg, respectively. GeoEngineers, in consultation with Ecology, selected samples TP11-BA-080606-3 and TP23-BA-080606-2 for inclusion in the soil biota bioassays because they are a similar soil type. Additionally, sample TP24-BA-080606-3 was wet (depth to groundwater was approximately 2.5 feet at this location) and sample TP15-CS-080606-2 contained organic compounds and shells.

After the soil samples to be used in the bioassay were identified, Newfields prepared five additional soil samples by serially diluting the source sample (TP11-BA-080606-3) with the background sample (TP23-BA-080606-2) using a 0.5x dilution series (that is, 0.5, 0.25, 0.12, 0.06 and 0.03). The source sample is also referred to as the 100 percent treatment; the 0.5 dilutions are referred to as the 50 percent, 25 percent, 12 percent, 6 percent, and 3 percent treatments. These additional samples were then submitted to the analytical laboratory for chemical analysis following Ecology's NWTPH-Dx method. TP-11-BA-080606-3 was resubmitted at the same time to avoid any potential holding time issues. The chemical analytical results from this serial dilution series are presented in Table 2 of Newfield's "Biological Testing of Soils from the Irondale Iron and Steel Plant Site, Irondale, WA," dated February 2009 (see Appendix E).

Newfields then completed the soil bioassay following Ecology's "Earthworm Bioassay Protocol for Soil Toxicity Screening" (Publication No. 96-327). Reduced survival was noted in the 50 percent and 100 percent treatments; however, there was variability in the three replicates conducted at each treatment level, with 100 percent survival in two of the three replicates at the 50 percent and 100 percent treatments. Based on this variability, Newfields determined that the reduced survival was not statistically significant. Therefore, the Combined TPH soil screening level for soil biota is 5,200 mg/kg. Because this value is greater than the MTCA Method A soil cleanup level for diesel- and heavy oil-range petroleum hydrocarbons of 2,000 mg/kg, it was not used to evaluate the extent of petroleum contamination.

7.2.2 Soil Biota Bioassay for Metals Evaluation

The objective of the soil biota bioassay was to establish site-specific soil biota TEE screening concentrations for metals. The soil samples obtained for this bioassay and rationale for including/excluding samples to use in the bioassay are described in Section 7.1.1.

Newfields then completed the soil bioassay following Ecology's "Earthworm Bioassay Protocol for Soil Toxicity Screening" (Publication No. 96-327). Survival in the control sample was 100 percent, although survival in the test treatments ranged from 97 to 100 percent. Site-specific soil screening levels for metals protective of soil biota (earthworms) were not calculated because the earthworms were not adversely affected by the metals in soil and because a number of the June 2008 soil samples were obtained from areas with the highest known metals concentrations.

7.2.3 Soil Biota TEE Evaluation

Soil sample locations where petroleum hydrocarbons were detected at concentrations greater than the soil biota soil screening level are shown in Figure 11 (sample locations TP11, TP24, and TP26/DP02).

7.3 WILDLIFE

Arsenic, copper, lead, zinc and diesel-range petroleum hydrocarbons were detected in historical soil samples and/or soil samples obtained by GeoEngineers in June 2007 at concentrations greater than the wildlife TEE screening values (MTCA Table 749-3). In order to calculate site-specific wildlife TEE screening levels for metals and TPH, GeoEngineers obtained collocated soil and earthworm samples (that is, soil and earthworm samples were obtained at the same location) in December 2007 and co-located soil and plant samples in June 2008. Plant material obtained included the following: trialing blackberry (*Rubus ursinus*), Douglas fir seedlings (*Pseudotsuga menziesii*), snowberry (*Symphoricarpos*), thimbleberry (*Rubus parviflorus*), and Himalayan blackberry (*Rubus discolor*).

The chemical analytical results from the co-located samples were used to calculate site-specific earthworm bioaccumulation factors (BAF) and site-specific plant uptake coefficients, which were then used to calculate site-specific wildlife (mammalian predator, avian predator and mammalian herbivore) TEE screening values. This analysis assumes that the earthworms and plant species are ingested by certain indicator wildlife (mammalian predator and herbivore and avian) species.

7.3.1 Soil Samples for Arsenic Speciation

GeoEngineers obtained four soil samples in June 2008 at areas with known arsenic contamination (TP03 at the former power house/engine house, TP08 and TP32 northeast of the former AST, and TP22 within the footprint of the steel production building). The objective of submitting soil samples for arsenic speciation was to determine the form of arsenic (III or V) present at the Site. The chemical analytical results, which are presented in Table 3, indicate that 99 to 100 percent of the arsenic in soil at the Site is arsenic V. Therefore, wildlife screening levels for arsenic are based on arsenic V.

7.3.2 Soil and Earthworm Samples to Evaluate Metals Uptake by Earthworms

The chemical analytical results for the soil and earthworm samples are presented in Table 18. The analytical laboratory reported the earthworm results as wet weight concentrations. GeoEngineers converted the wet weight concentrations to dry weight using an assumed earthworm percent moisture of 84 percent (EPA, 1993). Site-specific bioaccumulation factors (BAFs) were then calculated by dividing the earthworm dry weight concentrations by the co-located soil dry weight concentrations. Table 18 presents the maximum and average site-specific BAFs and the MTCA default BAFs (Table 749-4) for arsenic, copper, iron, lead, nickel and zinc. The average site-specific BAFs were used to calculate site-specific wildlife screening levels (for avian and mammalian predators) based on discussions with Ecology (GeoEngineers, 2008).

Table 20 presents the site-specific wildlife screening level calculations using the MTCA default BAFs and the average site-specific BAFs. As shown in Table 20, the site-specific wildlife screening level for zinc of 110 mg/kg is less than the MTCA default wildlife screening level for zinc of 360 mg/kg. Both values are based on the avian predator (robin) equation provided in MTCA Table 749-4. However, because the MTCA default wildlife screening levels (referred to as “Ecological Indicator Soil Concentrations” in MTCA Table 749-3) are “expected to be protective at any MTCA site,” Ecology recommended using the MTCA default wildlife screening level for zinc (Ecology, 2009). The values that were selected as wildlife soil screening levels are highlighted in Table 20.

7.3.3 Soil and Plant Samples to Evaluate Metals Uptake by Plants

The chemical analytical results for the soil and plant samples are presented in Table 19. The analytical laboratory reported the plant results as wet weight concentrations. GeoEngineers converted the wet weight concentrations to dry weight using sample-specific percent moisture values, which range from 77 to 84 percent. Site-specific plant uptake coefficients were then calculated by dividing the plant dry weight concentrations by the co-located soil dry weight concentrations. Table 19 presents the maximum and average site-specific plant uptake coefficients and the MTCA default plant uptake coefficients (Table 749-4) for arsenic, copper, iron, lead, nickel and zinc. The average site-specific plant uptake coefficients were used to calculate site-specific wildlife screening levels (for mammalian herbivores) based on discussions with Ecology (GeoEngineers, 2008).

Table 20 presents the site-specific wildlife screening level calculations using the MTCA default plant uptake coefficients and the average site-specific plant uptake coefficients. As shown in Table 20, the site-specific mammalian herbivore wildlife screening levels for lead, nickel and zinc are less than the MTCA default mammalian herbivore wildlife screening levels for these metals. The MTCA default values are based on the mammalian herbivore (vole) equation provided in MTCA Table 749-4. However, because the predator-based wildlife screening levels are less than either the MTCA default or the site-specific herbivore-based wildlife screening levels for lead, nickel and zinc, herbivore-based screening levels were not selected as wildlife screening levels for the RI.

7.3.4 Wildlife TEE Evaluation

Soil sample locations where metals and petroleum hydrocarbons were detected at concentrations greater than the wildlife soil screening levels are shown in Figures 10 and 11, respectively. A single metal was detected at concentrations greater than wildlife screening levels at two additional sample locations (TP-11 [obtained by Hart Crowser] and TP22). However, statistical analyses of metals concentration in soil surrounding these sample locations, but within the expected home range of the potentially affected receptors (robins and shrews), indicate that the average metals concentrations are less than the wildlife screening values. Therefore, these sample locations are not shown in Figure 10. These two sample locations are discussed further in the following sections.

TP-11

Zinc was detected in soil at TP-11 at a concentration of 670 mg/kg at a sample depth of 2.5 to 4.5 feet, which is greater than the wildlife soil screening level of 360 mg/kg (based on the avian predator [robin]). The zinc concentration of 670 mg/kg is, however, less than the mammalian predator and mammalian herbivore soil screening levels of 970 and 14,200 mg/kg, respectively.

According to MTCA Table 749-3, the home range for the Amercian Robin (*Turdus migratorius*) is 0.6 acre (or approximately 26,100 square feet). Soil sample locations within a robin home range centered at TP-11 include DP03, GEISS1, GEISS2, GEISS3, SS1 (Jefferson County), TP08, TP-11 (Hart Crowser), TP32, TP33 and TP34. Zinc was not detected in the soil sample obtained from DP03 at a depth of 7 feet, which is below the 6-foot conditional point of compliance for terrestrial receptors. To conservatively evaluate zinc concentrations in the biologically active zone (that is, the top 6 feet of soil), sample location DP03 was not retained in the statistical evaluation of zinc concentrations. Sample SS1 was not analyzed for zinc and was also not retained. The 95 percent upper confidence limit on the mean (95 percent UCL) zinc concentration in soil based on the soil samples obtained in the vicinity of TP-11 is 206 mg/kg for a lognormal distribution and 250 mg/kg for a gamma distribution. Because the 95 percent UCL zinc concentration is less than the wildlife soil screening level of 360 mg/kg, sample location TP-11 is not identified as a wildlife exceedance in Figure 10.

TP22

Copper was detected in soil at TP22 at a concentration of 1,630 mg/kg at a sample depth of 2 feet, which is greater than the wildlife soil screening level of 1,340 mg/kg (based on the mammalian predator [shrew]). The copper concentration of 1,630 mg/kg is, however, less than the avian predator and mammalian herbivore soil screening levels of 1,760 and 2,790 mg/kg, respectively.

According to MTCA Table 749-3, the home range for the Shrew (*Sorex*) is 0.1 acre (or approximately 4,360 square feet). Soil sample locations within a shrew home range centered at TP22 include TP22 and the adjacent TP30. Four soil samples were obtained at these two locations at depths ranging from 0.5 to 3.5 feet. Because of the limited number of samples, a 95 percent UCL could not be calculated. The mean copper concentrations, based on the four soils samples obtained in the vicinity of TP22, is 606 mg/kg. Because the mean copper concentration is significantly lower than the wildlife soil screening level of 1,340 mg/kg and the maximum detected concentration of 1,630 only slightly exceeds the screening level, sample location TP22 is not identified as a wildlife exceedance in Figure 10.

7.4 BASELINE HABITAT SURVEY

The project area contains a small diversity of groundwater seeps, stream and terrestrial habitats that support several small mammal and bird populations. High-value terrestrial habitats similar to those within the project area – primarily the large tract of mixed second-growth and old-growth forest within the Site – typically support numerous bird species, including raptors, woodpeckers, herons and songbirds, as well as mammals such as blacktail deer (*Odocoileus hemionus*), raccoon (*Procyon lotor)* and Douglas squirrel (*Tamiasciurus douglasii*) (USDA, 1985). The project area habitat types are described in greater detail below.

7.4.1 Terrestrial Habitats

This section provides a narrative summary of existing habitat characteristics. We have divided the Site into the following six defined habitat areas as shown in Figure 12:

- Second-growth forest with old-growth forest,
- Immature forest,
- Shrub,
- Herbaceous plants,
- Groundwater seeps, and
- Open water (stream).

7.4.1.1 Second-growth with Old-growth Forest

Most of the Site contains mix stands of coniferous and deciduous second-growth forest, consisting of bigleaf maple (*Acer macrophyllum*) and red alder (*Alnus rubra*) as the dominant tree species in the overstory. Western Hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*) and Douglas fir (*Pseudotsuga menziesii*) are also common tree species found throughout second-growth portion of the Site (Figure 12). A potential stand of old-growth trees was identified in the southwest corner of the Site, consisting of both bigleaf maple and Douglas fir. Snags were also observed throughout the second-growth habitat area ("Definition and Inventory of Old Growth Forest on DNR State Managed Lands"; WDNR, 2005).

The second-growth forest habitat is interspersed with small shrub and herbaceous ground cover, dominated by red elderberry (*Sambucus racemosa*) and Indian plum (*Oemleria cerasiformis*), with lesser amounts of snowberry (*Symphoricarpos albus*). The herbaceous understory is dominated by western swordfern (*Polystichum munitum*) with lesser amounts of stinging nettle (*Urtica dioica*) and Himalayan blackberry (*Rubus discolor*). Three American crows (*Corvus brachyrhynchos*) were observed within the tree canopy, along with one black-capped chickadee (*Poecile atricapillus*) and Rufous Hummingbird (*Selasphorus rufus*) in the understory.

7.4.1.2 Immature Forest

The north-central portion of the Site near the former steel production buildings (Figure 12) is dominated by an immature forest that stretches to the northwestern boundary of the Site. The immature forest is dominated by a dense cover of bigleaf maple. Most of the area lacks an understory because of the dense canopy cover. However, small patches of Scouler’s willow (*Salix scouleriana*), red alder, Pacific ninebark (*Physocarpus capitatus*), Oregon grape (*Berberis nervosa*), Indian plum, red elderberry and Himalayan blackberry were observed. A great blue heron rookery was identified by Washington State Department of Fish and Wildlife (WDFW, 2008); however, the rookery was not observed during the habitat survey.

7.4.1.3 Shrub

The shrub-dominated communities were located near and around the edges of the Site where disturbance in the soil allowed early succession species to thrive in the open areas. The areas included, but were not limited to, the western edge of the access road and at the northern end of the steel production buildings (Figure 12). The dominate shrubs in these areas consisted of Himalayan blackberry and red alder samplings.

7.4.1.4 Herbaceous

The eastern limits of herbaceous-dominated community are defined by the shoreline and extend west to the gravel access road. Orchard grass (*Dactylis glomerata*) dominates the area, along with colonial bentgrass (*Agrostis capillaris*). Lesser amounts of purple clover (*Trifolium purpureum*), common plantain (*Plantago major*), bird’s-foot-trefoil (*Lotus corniculatus*) and vetch (*Vicia*) were observed throughout the area. Aerial coverage was observed to be zero percent. Two nighthawks (*Chordeiles minor*) were observed flying overhead of the herbaceous-dominated community during the habitat survey.

7.4.1.5 Groundwater Seeps

Groundwater seeps were observed at the base of the bluff, southeast of the former 6,000-barrel AST. The water from the seeps accumulated into small pockets, which drained to a small channel less than 1 foot wide. The channel dissipated into smaller pockets of water with no obvious outlet to the bay. The soil within the area was saturated to the surface with areas of standing water less than 1 inch deep. Vegetation within the seeps consisted of stinging nettle, salmonberry (*Rubus spectabilis*) and red alder.

7.4.1.6 Stream/Open Water

The unnamed stream is a seasonal type “N” stream as documented by Washington State Department of Natural Resources (WDNR, 2007). It is a lowland stream that collects runoff from surrounding development and upper elevations. The stream extends along the northern boundary of the Site, before discharging via a 10-inch culvert into the bay. One barn swallow (*Hirundo rustica*) was observed flying overhead of the stream channel/open water feature on-Site.

7.4.2 Environmental Impacts on Habitats

Vegetation was observed to be thriving throughout the Site, with diverse plant communities and aerial coverage averaging 60 percent within the forest areas. Plant growth was hindered within the immediate vicinity of the 6,000-barrel AST. However, this may be the result of insufficient substrate for plants to grow. Additionally, the AST may have also blocked sunlight from reaching surrounding vegetation. In areas that are identified as having high metal concentrations, plant life was not observed to have been stressed. The overall conditions of the habitats on-Site are favorable, except for the abundance of invasive plant species.

8.0 LOCATIONS AND MEDIA REQUIRING CLEANUP ACTION EVALUATION IN FEASIBILITY STUDY

This section identifies the locations and environmental media (soil, groundwater and sediment) at the Site that require cleanup action evaluation in the FS. These locations are shown in Figures 13 and 14. The areas shown in these figures are accurate for the purpose of the FS, but the actual extent of areas with exceedances may vary because of uncertainty of the exact location of former buildings and the nature of limited sampling density.

8.1 UPLAND SOIL

Based on the information evaluated in this RI, shallow soil at the former steel production building, shallow soil at discrete areas at the former power house/engine house buildings and deeper soil in the vicinity of the AST and TP08 require evaluation of cleanup action alternatives based on the presence of some constituents at concentrations exceeding preliminary cleanup levels protective of human health and terrestrial ecological receptors.

The areas shown in Figure 13 are based on interpolation of data between sample locations, knowledge of Site conditions and professional judgment. The TP08 area is defined by “clean” samples, the shoreline and the topographic bluff on the west side. The power house/engine house buildings area is defined by “clean” sample locations and the footprint of the former facility. The former steel production building area is not well defined by clean samples or topographic features. Samples from this area showed high variance in concentrations, which makes estimates of extent of contamination more uncertain than other areas. Because of this uncertainty, the area requiring evaluation in the FS was expanded to include the footprint of the former building and the area around TP22 (which exceeded screening levels), rather than just around samples with exceedances. The AST area includes sample locations with TPH concentrations of 136 mg/kg or greater.

8.2 GROUNDWATER

Based on the information evaluated in this RI, groundwater in the vicinity of the AST requires evaluation of cleanup action alternatives because of the presence of free product and TPH exceeding preliminary cleanup levels protective of human health and terrestrial ecological receptors. This area is within the AST area shown in Figure 14. Cleanup actions for groundwater should be coordinated with soil cleanup actions in this area to avoid recontamination of groundwater by contaminated soil.

8.3 SEDIMENT

Based on the information evaluated in this RI, shallow sediment located downslope of the upland AST requires evaluation of cleanup action alternatives because of the presence of TPH and PAHs exceeding preliminary cleanup levels protective of human health and terrestrial ecological receptors. Cleanup actions in this area should be coordinated with cleanup actions of the adjacent upland soils and groundwater to prevent recontamination of sediment by these media.

9.0 FEASIBILITY STUDY

This section presents the feasibility study (FS) conducted for upland properties and aquatic lands at the Site. The FS was completed to develop and evaluate cleanup action alternatives for addressing contamination identified at the Site, and to select a preferred alternative for cleanup. The FS utilizes information about the history and environmental conditions of the Site gathered during prior investigations. The results of these investigations and history of the Site are summarized in Sections 1 through 8 of this RI/FS.

The RI and FS were completed in accordance with the requirements of the Model Toxics Control Act (MTCA) Cleanup Regulation, Chapter 173-340 Washington Administrative Code (WAC), and the Sediment Management Standards (SMS), Chapter 173-204 WAC.

9.1 CLEANUP STANDARDS

Cleanup standards consist of: 1) cleanup levels that are protective of human health and the environment, and 2) the point of compliance at which the cleanup levels must be met. Preliminary Site-specific cleanup standards were developed in the RI (section 5.0). These preliminary cleanup standards are adopted in this FS for the purpose of developing cleanup action objectives (CAOs) for the Site. CAOs are presented in Section 9.3. The proposed media-specific cleanup levels and points of compliance are summarized below. The listed constituents for the three environmental media are those remaining from the RI screening process (Sections 5 through 7).

Overview of Cleanup Standards

	Cleanup Level and Media		
Constituent	**Soil (mg/kg)**	**Groundwater (ug/l)**	**Sediment (mg/kg)**
Arsenic	18	Not required	Not required
Copper	70	2.4	Not required
Iron	58,700	Not required	Not required
Lead	120	Not required	Not required
Nickel	48	8.2	Not required
Zinc	160	Not required	Not required
cPAHs	0.137	0.018	Not required
TPH	136	500	136
Point of Compliance based on MTCA	Upper 15 feet	Point of entry to Port Townsend Bay	Biologic active zone and vertical extent of TPH to 136 mg/kg

9.1.1 Cleanup Levels

9.1.1.1 Soil

Site-specific cleanup levels for soil that are protective of human health and terrestrial ecological receptors, and cleanup levels for groundwater that are protective of marine surface water, were developed in accordance with MTCA requirements. Based on existing and future land use as a Jefferson County Park the Site is considered to be “unrestricted” (a.k.a. residential) with regard to MTCA exposure evaluations. Accordingly, Method B cleanup levels apply to soil beneath the upland portion of the Site. The TPH cleanup level is adopted directly from the site-specific sediment standard (136 mg/kg) described below because soil contamination could potentially migrate directly to sediment by erosion. For example, waves may erode soil along the beach bluff and transport contaminated soil particles to beach sediments.

9.1.1.2 Groundwater

The highest beneficial use of groundwater beneath the Site is based on the protection of surface water resources (Port Townsend Bay), as specified in WAC 173-340-720. Accordingly, groundwater beneath the Site is subject to the surface water standards. In general, the most conservative (lowest) published numerical values selected from available state and federal surface water criteria as outlined in WAC 173-340-730(3) were selected as the cleanup level.

9.1.1.3 Sediment

Sediment cleanup levels were developed according to MTCA and SMS requirements and direction provided by Ecology. Two SMS criteria are promulgated by Ecology (WAC 173-204-320). These include the Sediment Quality Standard (SQS), the concentration below which effects to benthos are unlikely, and the cleanup screening level (CSL), the concentration above which more than minor adverse biological effects may be expected. The SQS and CSL values have been developed for a suite of chemicals that includes metals, PAHs and other semivolatile organic compounds (SVOCs), PCBs, and ionizable organic compounds. The SQS are the most stringent SMS criteria and are used in this FS as sediment cleanup levels for the SMS constituents detected in sediment at the Site.

There is no promulgated SMS criterion for petroleum hydrocarbons in sediment. Therefore, SAIC developed a site-specific cleanup level of 136 mg/kg for total petroleum hydrocarbons based on sediment bioassays (see Appendix D for details).

9.1.2 Points of Compliance

Under MTCA, the point of compliance is the point or location on a site where the cleanup levels must be attained. The points of compliance for affected media will be approved by Ecology and presented in the site-wide CAP. However, it is necessary to identify proposed points of compliance in order to develop and evaluate cleanup action alternatives in the FS. This section describes the proposed points of compliance for soil, groundwater, and sediment.

9.1.2.1 Soil

The standard point of compliance (upper 15 feet) is considered applicable to prevent exposure by direct contact to Site soil, as defined in WAC 173-340-740(6)(d).

For potential terrestrial ecological exposures, MTCA regulations allow a conditional point of compliance to be established from the ground surface to 6 feet below ground surface (bgs) (the biologically active zone according to MTCA default assumptions), provided institutional controls are used to prevent excavation of deeper soil [WAC 173-340-7490(4)(a)]. Accordingly, in areas of the Site where potential ecological exposures are a concern, and where appropriate institutional controls can be implemented, a conditional point of compliance for soil concentrations protective of terrestrial ecological receptors may be proposed throughout the soil column from the ground surface to 6 feet bgs. Considering the future use of the Site as a park, this is an appropriate proposal.

9.1.2.2 Groundwater

Because the groundwater cleanup levels are based on protection of marine surface water and not protection of groundwater as drinking water and as provided for in WAC 173-340-720(8)(i), the proposed conditional point of compliance for the groundwater cleanup levels is the point or points where groundwater flows into Port Townsend Bay.

9.1.2.3 Sediment

For marine sediments potentially affected by Site-related hazardous substances, the point of compliance for protection of the environment is surface sediments within the biologically active aquatic zone, represented by samples collected across the top 10 centimeters (cm) (i.e., 0 to 4 inches) below the mudline. Since erosion may remove shallow sediment over time, effectively moving the bottom of the biologically active zone deeper compared to current conditions, Ecology determined that the vertical point of compliance in areas with petroleum hydrocarbons should be the vertical extent of sediment with combined TPH concentrations greater than the cleanup level of 136 mg/kg.

9.2 LOCATIONS AND MEDIA REQUIRING CLEANUP ACTION EVALUATION

This section identifies the locations and environmental media (soil, groundwater, sediment) at the Site that require cleanup action evaluation. These areas are shown on Figures 13 and 14 and are summarized in section 8.0 of the RI.

9.2.1 Soil

Based on the information evaluated in the RI, shallow soil at the former steel production building, shallow soil at discrete areas at the former power house/engine house buildings (referred to in Figure 13 as the Power House Complex) and deeper soil in the vicinity of the former AST and TP08 require evaluation of cleanup action alternatives based on the presence of some constituents at concentrations exceeding preliminary cleanup levels protective of human health and terrestrial ecological receptors.

9.2.2 Groundwater

Based on the information evaluated in the RI, groundwater in the vicinity of the former AST requires evaluation of cleanup action alternatives because of the presence of free petroleum product and TPH exceeding preliminary cleanup levels protective of human health and the environment and dissolved copper and nickel exceeding preliminary cleanup levels protective of the environment. This area is within the Former AST area shown in Figure 14. Dissolved copper and nickel also slightly exceeded preliminary cleanup levels protective of the environment in a groundwater monitoring well in the vicinity of the TP08 location (TP08 Vicinity is shown in Figure 13). Cleanup actions for groundwater should be coordinated with soil cleanup actions in this area to avoid recontamination of groundwater by contaminated soil.

9.2.3 Sediment

Based on the information evaluated in this RI, shallow sediment located downslope of the upland former AST requires evaluation of cleanup action alternatives because of the presence of TPH and PAHs exceeding preliminary cleanup levels protective of human health and aquatic ecological receptors. Cleanup actions in this area should be coordinated with cleanup actions of the adjacent upland soils and groundwater to prevent recontamination of sediment by these media.

9.3 CLEANUP ACTION OBJECTIVES

This section presents cleanup action objectives (CAOs), applicable regulatory requirements for the cleanup action, and a screening evaluation of general response actions and remediation technologies that are potentially applicable to the Site.

CAOs consist of chemical- and medium-specific goals for protecting human health and the environment. The CAOs specify the media and contaminants of interest, potential exposure routes and receptors, and proposed cleanup goals. Because of the substantial differences between the uplands and marine area physical environments, resources/uses, and cleanup standards, as well as anticipated differences in cleanup-related construction logistics, separate cleanup action alternatives are developed in this FS for the uplands and marine areas. The CAOs for these areas are presented below.

9.3.1 Soil and Groundwater (Uplands)

The objective of the proposed uplands cleanup action is to eliminate, reduce, or otherwise control to the extent feasible and practicable, unacceptable risks to human health and the environment posed by hazardous substances in soil and groundwater in accordance with the MTCA Cleanup Regulation (WAC 173-340) and other applicable regulatory requirements. Specifically, the objective of the uplands cleanup is to mitigate risks associated with the following potential exposure routes and receptors:

- Contact (dermal, incidental ingestion, or inhalation) by visitors, workers (including excavation workers), and other Site users with hazardous substances in soil;
- Contact (dermal, incidental ingestion, or inhalation) by terrestrial wildlife with hazardous substances in soil;
- Contact by terrestrial plants and soil biota and/or food-web exposure to hazardous substances in soil; and
- Exposure by aquatic organisms to hazardous substances in soil that erodes, or groundwater that migrates, to the marine environment.

The cleanup goal for the uplands areas is to mitigate these risks by meeting the soil and groundwater cleanup standards identified in Section 9.1.

9.3.2 Sediment (Marine Area)

The objective of the proposed marine area cleanup action is to eliminate, reduce, or otherwise control to the extent feasible and practicable, unacceptable risks to human health and the environment posed by Site-related hazardous substances in marine sediment in accordance with the MTCA Cleanup Regulation (WAC 173-340), SMS regulations (WAC 173-204) and other applicable regulatory requirements. Specifically, the objective of the Marine Area cleanup is to mitigate risks associated with the following potential exposure routes and receptors:

- Exposure of benthic organisms to Site-related hazardous substances in the biologically active zone of sediment (the upper 10 centimeters (cm) below the mudline);
- Ingestion by aquatic organisms of benthic organisms contaminated by Site-related hazardous substances in sediment; and
- Ingestion by Site visitors of marine organisms contaminated by Site-related hazardous substances in sediment.

The cleanup goal for the marine area is to mitigate these risks by meeting the sediment groundwater cleanup standards identified in Section 9.1.

9.4 APPLICABLE REGULATORY REQUIREMENTS

In addition to the cleanup standards developed through the MTCA process and presented in Section 9.1, other regulatory requirements must be considered in the selection and implementation of the cleanup action. MTCA requires the cleanup standards to be “at least as stringent as all applicable state and federal laws" [WAC 173-340-700(6)(a)]. Besides establishing minimum requirements for cleanup standards, applicable state and federal laws may also impose certain technical and procedural requirements for performing cleanup actions. These requirements are described in WAC 173-340-710. Table 22 presents the ARARs identified as being applicable at this Site.

Additional activities that need to take place prior to implementing the cleanup actions:

- The anticipated cleanup action qualifies for a U.S. Army Corps of Engineers (Corps) Nationwide Permit 38 (NWP 38). Nevertheless, federal consultation under the Endangered Species Act, Section 401 Water Quality Certification, and other substantive requirements must still be met by the cleanup action. Ecology will be responsible for issuing the final approval for the cleanup action, following consultation with other state and local regulators. The Corps will separately be responsible for issuing approval of the project under NWP 38, following Endangered Species Act consultation with the federal Natural Resource Trustees, and also incorporating Ecology's 401 Water Quality Certification.
- Because the proposed project area is part of the Irondale Historic District identified on the National Register of Historic Places, a Cultural Resources Assessment will need to be performed and a Monitoring and Treatment Plan will need to be prepared prior to implementing cleanup actions that cause disturbance to the land. Additionally, a permit from the Washington State Department of Archaeology and Historic Preservation (DAHP) will be needed for the field work portions of the Cultural Resources Assessment. Input will also be requested from local Tribes regarding both the cultural resources assessment and cultural resources monitoring during remedial activities, with cultural resource protocols being developed considering Tribal input.

9.5 SCREENING OF GENERAL RESPONSE ACTIONS AND REMEDIATION TECHNOLOGIES

This section presents the results of a screening evaluation of potentially applicable remediation technologies for the cleanup action. The screening evaluation is carried out for each of the environmental media (soil and sediment) requiring cleanup action evaluation. Based on the screening evaluation, selected response actions and technologies are carried forward for use in the development of cleanup action alternatives for the uplands and marine areas.

The response actions considered in the screening evaluation include no action, institutional controls, soil containment, soil removal, off-site management, and ex situ treatment. These potential response actions and remediation technologies for soil were screened on the basis of effectiveness, implementability, and relative cost. A summary of the screening evaluation is presented in Table 23. The screening process determined the most appropriate technologies and process options that warrant development into remedial alternatives for further evaluation. Some response actions and technologies were screened out from further evaluation due to low effectiveness or implementability, or due to another technology being similarly effective and implementable and having a significantly lower cost. Potentially effective and implementable response actions and remediation technologies are evaluated further below.

Summary of Technology Screening
(see Table 23)

Technologies Retained for Further Evaluation

1. Institutional Controls
2. Soil and Sediment Cap
3. Soil and Sediment Removal/Disposal
4. Natural Attenuation for Groundwater

9.5.1 Institutional Controls

A restrictive covenant (e.g., deed restrictions, posted notification of Site conditions) would not be an acceptable site-wide cleanup action alternative on its own because it would not achieve the CAOs for the

Site areas. However, restrictive covenants can in certain instances be effective and implementable in combination with engineered and other institutional controls where the covenant requires maintenance of the protective barriers that keep humans and ecological receptors from contacting contaminated soil.

If contaminated soil is to be left in place at a depth less than 15 feet bgs, then a restrictive covenant could be employed to require special procedures for future subgrade work (e.g., worker protection and soil management plans).

Access controls such as fencing would not be compatible with the public use of the property as park space. However, notification methods such as signage can effectively alert Site visitors to the presence of contamination in subsurface soil.

Institutional controls would require long-term monitoring to ensure that the Site conditions remain as required to achieve CAOs.

9.5.2 Engineered Controls

Applicable engineered controls that could be employed include establishing and maintaining a barrier layer between contaminated soil and potential human and ecological receptors. One type of barrier layer that could be used is a reinforced (to prevent animal burrowing) geotextile liner installed over areas of contaminated soil that are currently unpaved and not covered by building foundations. Clean fill and/or a lawn would be placed over the top of the geotextile to keep it anchored in place and protected from degradation by sunlight and would allow use of the Site as park space. The geotextile would not need to be an impermeable liner because leaching of soil contaminants to groundwater is not an exposure pathway of concern at the Site. Using a permeable geotextile reduces the need to add drainage features or be overly concerned about establishing proper grading for drainage. The geotextile will be designed to the strength required to withstand settling forces of the overlying soil as well as forces associated with maintenance vehicles and equipment that may drive across the overlying landscaped area. Surface pavement using asphalt and/or concrete would also provide an effective barrier that would prevent human or ecological exposure and also limit erosion of contaminated soil. However, this approach would not be compatible on a large scale with the current and future use of the Site.

Although a geotextile liner may provide an effective barrier to exposure, it would require long-term monitoring to identify any areas where the liner becomes exposed or damaged, and maintenance to repair the liner. Monitoring would consist of periodically inspecting the capped area for areas of eroded soil and exposed liner material. Use of engineering controls would not result in a permanent reduction in contaminant mass, mobility, or toxicity.

9.5.3 Excavation, Off-Site Disposal and / or Reuse

9.5.3.1 Soil

Soil removal by excavation is considered to be an effective technology to permanently eliminate the risk of exposure to contaminants at the Site. Excavation adjacent to or underneath existing buildings or other structures or utilities may require protective measures such as shoring or temporary removal of structures. Excavation activities performed near the shoreline or at depths near or below the water table may require dewatering. Dewatering can be achieved through extraction of water from within the excavated area during excavation activities or can be initiated prior to excavation through installation of extraction wells that create a dry environment to work in. In addition, installation of sheet-pile surrounding the expected excavation area will reduce the volume of water that enters the excavation, particularly in situations where excavation is performed adjacent to surface water. Extracted water will require storage, treatment to remove particulates and contaminants, and proper disposal.

It is anticipated that the majority of excavated soil could be disposed of at a permitted solid waste landfill (for example, a Resource Conservation and Recovery Act [RCRA] Subtitle D facility) rather than requiring disposal at a hazardous/dangerous waste disposal facility (such as a RCRA Subtitle C facility). Due to elevated levels of metals detected in some soil, it will be necessary to perform dangerous waste characterization of excavated soil. However, based on previous TCLP results that have indicated low metals leachability it is unlikely that a significant volume of soil will require treatment prior to disposal or disposal at a Subtitle C facility. Treatment of metals-contaminated soil by stabilization is discussed below.

9.5.3.2 Sediments

Marine area sediments at the Site are situated such that complete removal may require both land-based and water-based equipment and methods. Water-based removal would be performed from a barge-mounted clamshell dredge, while land-based removal would be performed from the shore at low tide using traditional land-based earthwork equipment. Because of the shallow nature of the work area, water-based equipment would need to be relatively small with limited draft, or would need to work partial shifts during high tide to prevent grounding out. Due to these considerations, an upland-based operation performed during periods of low tide may be a more cost-effective method for removal, particularly within intertidal areas. Land-based removal may be more effective if performed in conjunction with shoring/dewatering components such as a sheet-pile wall bounding the outside of the excavation area. This would allow excavation to be performed from the land side, with less consideration for tidal periods. However, dewatering would require treatment and disposal of significant volumes of hydrocarbon-impacted water.

Upland disposal at a permitted municipal or private landfill (Subtitle D) would likely be necessary for excavated sediments. Sediments excavated using land-based equipment would be loaded onto trucks (and potentially subsequently onto a rail car) for shipment to a regional Northwest landfill. Sediments excavated using water-based equipment would be loaded on a barge, and would be shipped directly to a barge-truck-rail transloading facilitaty for shipment to an upland landfill with rail access.

9.5.4 Soil Stabilization

Stabilization of contaminated soil typically involves chemically binding and immobilizing the contaminants on a molecular level. Treatment of soil by stabilization is most commonly employed by mixing contaminated soil with Portland cement or another pozzolanic material. A pozzolanic material exhibits cementitious properties when combined with calcium hydroxide. With contaminants such as heavy metals, stabilization has been reliably demonstrated. Stabilization of metals-contaminated soil is retained for treatment of any soil that fails TCLP for metals. However, although metals concentrations are relatively high in some locations of the Site, data suggests that the volume of soil that would fail TCLP is minimal. Therefore it may be more cost-effective to remove any soil exceeding TCLP criteria and perform the stabilization at the waste facility rather than on Site.

9.5.5 Engineered Containment

Engineered containment is a commonly used technology to manage marine area sediments that require action. Containment for sediments involves placing an engineered aggregate cap to isolate material that could otherwise not be effectively removed through excavation or dredging. In the aquatic environment, the cap must be designed to withstand erosive forces generated by wave action, and must be thick enough to provide the required isolation of the material contained by the cap.

A sediment cap would be designed to effectively contain and isolate contaminated sediments from the biologically active surface zone. The cap would be designed to be thick enough and of sufficient grain size to maintain its integrity under reasonable worst-case conditions. Due to the objective of zero net loss of aquatic habitat, capping is only considered appropriate in combination with removal so that the cap does not decrease the amount of aquatic habitat (i.e., removal of 2 feet of sediment to accommodate a 2-foot-thick cap).

Where used, sediment caps would be designed using methodology developed by the EPA and the Corps (Palermo et al., 1998), also promoting tidal mixing and associated oxidation of sediment porewater at the sediment/water interface. Cap material would either be placed from the water, using a clamshell derrick and a supply barge of cap material, or from the shore at low tide using land-based earthwork equipment.

9.6 DEVELOPMENT OF CLEANUP ALTERNATIVES

In this section, the technologies and process options for remedial cleanup retained through the screening evaluation described in Table 23 are used to develop alternatives to address the CAOs for contaminated areas and media within the uplands areas and marine sediments of the Site. This section also provides comparative analysis of the five cleanup action alternatives developed for evaluation to address contamination at the Site. Each alternative addresses contaminated media with a combination of treatment technologies appropriate for Site conditions. The five alternatives represent a reasonable number and range of potentially applicable cleanup components to provide a basis for evaluation. Most of the alternatives include removal of TPH contaminated sediment and nearby TPH contaminated upland soil because of the common source of petroleum (Former AST and piping) and continuity of contamination. The difference between several of the alternatives is how the areas of upland contaminated soil located away from the shoreline are addressed, including the former Steel Production Building and the Power House Complex.

Summary of Six Cleanup Alternatives Evaluated (see Table 24)

1. Institutional Controls.
2. Capping contaminated soil and sediment.
3. Excavate contaminated sediment and upland TPH contaminated area and TP08 area, institutional controls for power house complex and steel production building.
4. Excavate contaminated sediment and upland TPH contaminated area and TP08 area, cap power house complex and steel production building.
5. Excavate all contaminated sediment and soil.

The development of a “no-action” alternative was not included with this feasibility study. The use of no action for addressing contaminants present in the sub-areas of the Site would not be expected to achieve remedial action objectives and meet the minimum requirements of a remedial alternative under the MTCA guidance. Therefore, the no action option is screened out from consideration during the remedial technology screening process outlined in Table 23.

The design parameters used to develop the alternatives are based on engineering judgment and current knowledge of Site conditions. The final design for the selected alternative may require additional characterization and analysis to better define the scope and costs associated with the cleanup action.

The six remedial alternatives were developed to be consistent with the current and future land uses at the Site. Each of the alternatives is compatible with maintaining the existing use of the Site as a public park.

9.6.1 Remedial Alternative 1 (Institutional Controls)

Remedial Alternative 1 is a limited action alternative, utilizing institutional controls as the primary mechanism for protection of human health and the environment. Under this remedial alternative, current monitoring activities would be continued and additional measures would be implemented to restrict exposure to contaminants at the Site. Deed restrictions would be implemented to prevent redevelopment of the Site for different usage and would set requirements for treatment and disposal of soil generated during Site work. Notification methods such as signage would be implemented to prevent Site users from being exposed to contaminated soil on Site through digging or harvesting of plants.

9.6.2 Remedial Alternative 2 (Capping – All Sub-Areas)

Remedial Alternative 2 involves leaving COCs in place in both soil and sediment media and using a combination of capping methods and institutional controls to limit exposure to COCs. Figure 15 shows the proposed extent of upland and shoreline capping associated with Alternative 2. Upland soil in all impacted areas (Power House Complex and Steel Production Building) will be capped with a permeable geotextile and an approximately 2-foot thick layer of clean soil to create a physical barrier between the contaminated soil and Site users. The upland capping will require removal and replacement of plants, but placement of the soil layer above the geotextile will allow replanting with shallow-rooted native plants. The impacted soil left in place will require institutional controls such as deed restrictions to ensure future development at the Site properly addresses the contaminated soil left in place.

The contaminated sediment in the area adjacent to the location of the former AST will be addressed through capping as well. The marine cap will be constructed to eliminate the erosion of impacted sediment and soil. In order to install an appropriate marine cap without resulting in a net filling of the marine environment, an upper layer of sediment of the same thickness as the proposed cap material will require removal by excavation or dredging prior to placement of the cap material. For cost estimating purposes, a cap thickness of 2 feet was assumed. Marine capping would require modeling of wave strength and shoreline stability during remedial design to determine final cap thickness and cap material grain size. In conjunction with the marine capping component of this alternative, the slag outcrop area on the shoreline will be restored by removing slag material on the shoreline surface to the extent required to place a proper thickness of beach habitat substrate while preserving the existing grade. Removal of the slag outcrop material is considered a Site restoration component consistent for each of Alternatives 2 through 5 and therefore the costs associated with that component is not represented in the cost estimates for the Alternatives.

Contaminants will be left in place in the upland and marine environment and will require monitoring to ensure that the proposed Remedial Alternative does not result in an increase of contaminant concentrations in groundwater. In addition, periodic sediment sampling will be used to evaluate the potential for recontamination of surface sediments. Groundwater monitoring would be conducted quarterly for one year followed by annual monitoring for a minimum of five years. A network of monitoring wells would be installed at downgradient compliance locations and groundwater would be monitored for contaminant concentrations as well as indicators of natural attenuation in groundwater to evaluate potential for natural attenuation of contaminant concentrations. Sediment monitoring would be conducted annually for five years to evaluate the effectiveness of the marine cap at containing subsurface contamination.

9.6.3 Remedial Alternative 3 (Excavation and Institutional Controls)

Remedial Alternative 3 utilizes removal actions in specific, more accessible, locations across the Site to achieve cleanup action objectives (Figure 16). Soil that exceeds cleanup levels in the vicinity of the former AST and TP-08 Area would be excavated to the extent practicable. The contaminated soil in the upland areas away from the shoreline, the Power House Complex and the Steel Production Building, will be addressed through institutional controls such as deed restrictions, signage and notification measures as described for Alternative 1. The contaminated sediment will be addressed by excavating or dredging the contaminated sediment in conjunction with the excavation activities at the former AST area. Specifically, Remedial Alternative 3 includes the following components:

- Excavate approximately 5,500 cubic yards of soil from various upland areas across the Site. The areas of proposed soil excavation include:
    - Excavate to the extent feasible, soil down to approximately 11 feet bgs in the former AST area with TPH concentrations above cleanup levels. TPH was not detected in two subsurface samples obtained below the existing AST structure (sample locations DP06 and TP05, see Figure 4). However, if, during excavation, elevated TPH (i.e., greater than cleanup levels) appears to be below the concrete AST structure, part or all of the structure may need to be removed to facilitate removal of the contaminated soil. Potential removal of the concrete AST structure will be coordinated with Washington State DAHP.Excavate to the extent feasible, soil down to approximately 6 feet bgs in the vicinity of TP-08 Area with metals concentrations above cleanup levels.
- Excavate or dredge approximately 1,600 cubic yards of sediment from the impacted shoreline area adjacent to the former AST area. The sediment impacted with TPH above the ecological-based cleanup level will be removed to the extent practicable.
- Develop institutional controls in the form of restrictive covenants, signage controls, and other notification measures to address remaining contaminated soil left in place in the Power House Complex and Steel Production Area.
- Transport stockpiled soil and sediment to appropriate disposal facility.
- Backfill upland excavations with clean imported fill and restore original Site topography, features, and surfaces.
- Backfill shoreline removal areas with clean imported fill of grain size appropriate for the marine environment, using a habitat substrate surface material.
- Install a monitoring well network and monitor groundwater quarterly for at least one year.

The following sections provide further description of the components of Remedial Alternative 3.

9.6.3.1 Soil and Sediment Removal

Soil exceeding the final cleanup levels for TPH, cPAHs, and metals would be removed to varying depths, as described above and shown in Figure 16. The upland soil removal associated with Remedial Alternative 3 is expected to be performed using commonly available land-based excavation techniques. The construction methods would be specified during the design of the cleanup action or by the selected cleanup contractor. The shoreline excavation of contaminated sediment could be performed as an extension of the upland excavations, using land-based machinery. However, this would likely require shoring the outer edge of the removal area using sheet-pile wall or similar methods to allow the excavation to be performed to the depth required and to allow for dewatering of the excavation. For the purpose of estimating costs associated with the soil removal component of this alternative, the following assumptions were made:

- Excavation of soil as shown in Figure 16 results in approximately 5,500 cubic yards of contaminated soil excavated.
- Excavation or dredging of TPH-impacted sediment adjacent to the former AST location to the extent practicable. The shoreline sediment removal would likely be performed as an extension of the upland soil removal at the former AST location, using land-based equipment. The outer edge of the sediment removal would likely require installation of a sheet-pile wall to meet shoring needs and to serve as a cut-off wall to allow removal in a dryer environment. The sediment

removal would result in generating approximately 1,600 cubic yards of contaminated sediment requiring disposal.

- Excavations extending below 10 feet bgs would be completed using commonly available dewatering techniques to allow the driest excavation possible.

In conjunction with the sediment/shoreline soil removal component of this alternative, the slag outcrop area on the shoreline will be restored by removing slag material on the shoreline surface to the extent required to place a proper thickness of beach habitat substrate without adjusting the grade. Removal of the slag outcrop material is considered a Site restoration component consistent for each of Alternatives 2 through 5 and therefore the costs associated with that component is not represented in the cost estimates for the Alternatives.

9.6.3.2 Soil Disposal

Excavated soil would be characterized for disposal as required by MTCA and Washington State Dangerous Waste regulations and the selected disposal facility. The contaminated soil is expected to fall into two categories: non-dangerous waste suitable for disposal at a Subtitle D landfill, or dangerous waste requiring either disposal at a Subtitle C (hazardous/dangerous waste) facility or treatment prior to disposal at a Subtitle D facility.

For soil to be categorized as non-dangerous waste and suitable for disposal at a Subtitle D landfill, it would be necessary to demonstrate that Site contaminants are not present at concentrations greater than ten times the Universal Treatment Standards (UTS), as defined in 40 CFR 268.48. This requirement includes the results of toxicity characteristic leaching procedure (TCLP) testing for metals. Based on the results of previous TCLP analyses performed on soil with high total metals concentrations, it is expected that the volume of soil that fails TCLP will be minimal and costs associated with potential treatment are not considered in the estimated cost of this Alternative.

9.6.3.3 Groundwater Monitoring

The soil removal proposed in this alternative is expected to result in a reduction of contaminant concentrations in groundwater (TPH and metals [copper and nickel]), thereby obviating the need for active groundwater remediation. To verify that the soil removal is protective of groundwater, a network of new monitoring wells would be installed along the shoreline of the Site following completion of the soil removal activities. The monitoring wells would be sampled and analyzed for contaminant concentrations as well as indicators of natural attenuation during at least four quarterly events to demonstrate that groundwater impacts have been addressed. Long-term groundwater monitoring may be necessary if initial groundwater monitoring indicates the potential for contaminant transfer from remaining contaminated soil to groundwater over time.

9.6.3.4 Institutional Controls

Restrictive covenants would be required for the portions of the Site where complete soil removal was not achieved. The covenants would attach future development restrictions and requirements to property deeds for the lifetime of the remaining contamination. Soil management plans would be required that instruct property owners on Ecology’s requirements for performing invasive work in areas of remaining contaminated soil. Future management of contaminated material could result in higher future development project costs. The restrictive covenants would require maintenance in the form of periodic reviews and updating of soil management plans.

9.6.4 Remedial Alternative 4 (Excavation and Capping)

Remedial Alternative 4 utilizes the same general actions that are proposed for Remedial Alternative 3, while capping the upland areas away from the shoreline, the Power House Complex and the Steel Production Building (Figure 17). The soil removal actions proposed under Remedial Alternative 4 include areas associated with the former AST and the TP-08 Area. Soil that exceeds cleanup levels in the vicinity of these areas would be excavated to the extent practicable. Similar to Remedial Alternative 2, the contaminated soil in the vicinity of the Power House Complex and Steel Production Building would be addressed by construction of a cap to prevent direct exposure to the contaminated soil. The contaminated sediment will be addressed by excavating or dredging to the extent required to achieve cleanup goals in conjunction with the excavation activities at the former AST area. Specifically, Remedial Alternative 4 includes the following components:

- Excavate approximately 5,500 cubic yards of soil from various areas across the Site. The areas of proposed soil excavation include:
    - Excavate to the extent feasible, soil down to approximately 11 feet bgs in the former AST area with TPH concentrations above cleanup levels. TPH was not detected in two subsurface samples obtained below the existing AST structure (sample locations DP06 and TP05, see Figure 4). However, if, during excavation, elevated TPH (i.e., greater than cleanup levels) appears to be below the concrete AST structure, part or all of the structure may need to be removed to facilitate removal of the contaminated soil. Potential removal of the concrete AST structure will be coordinated with Washington State DAHP.
    - Excavate to the extent feasible, soil down to approximately 10 feet bgs in the vicinity of TP-08 Area with metals concentrations above cleanup levels.
- Excavate or dredge approximately 1,600 cubic yards of sediment from the impacted shoreline area adjacent to the former AST area. The sediment impacted with TPH above the ecological-based cleanup level will be removed to the extent practicable.
- Cap contaminated soil in the Power House Complex and the Steel Production Building with a multi-component cap consisting of a permeable geotextile covered with clean soil, as described for Alternative 2.
- Transport stockpiled soil to appropriate disposal facility.
- Backfill upland excavations with clean imported fill and restore original Site topography, features, and surfaces.
- Backfill shoreline removal areas with clean imported fill of grain size appropriate for the marine environment, using a habitat substrate surface material.
- Install a monitoring well network and monitor groundwater quarterly for at least one year.

The following sections provide further description of the components of Remedial Alternative 4.

9.6.4.1 Soil and Sediment Removal

Soil exceeding the final cleanup levels for TPH, cPAHs, and metals would be removed to varying depths, as described above and shown in Figure 17. The scope of the sediment and near-shore soil removal component of Remedial Alternative 4 would be the same as proposed for Alternative 3. The assumptions for developing the cost estimate for the soil and sediment removal component of Alternative 4 are the same as described above for Alternative 3 in Section 9.6.3.1.

In conjunction with the sediment/shoreline soil removal component of this alternative, the slag outcrop area on the shoreline will be restored by removing slag material on the shoreline surface to the extent required to place a proper thickness of beach habitat substrate without adjusting the grade. Removal of the slag outcrop material is considered a Site restoration component consistent for each of Alternatives 2 through 5 and therefore the costs associated with that component is not represented in the cost estimates for the Alternatives.

9.6.4.2 Soil Disposal

The soil disposal activities proposed for Remedial Alternative 4 are expected to be the same as described in Section 9.6.3 for Alternative 3.

9.6.4.3 Soil Capping

Soil capping under Remedial Alternative 4 would be limited to the upper areas of the Site; the Steel Production Building Area and the Power House Complex. The capping methods used for these areas are the same as described above for Alternative 2.

9.6.4.4 Groundwater Monitoring

The groundwater monitoring activities proposed for Remedial Alternative 4 are expected to be the same as described in Section 9.6.3 for Remedial Alternative 3. Long-term groundwater monitoring may be necessary if initial groundwater monitoring indicates the potential for contaminant transfer from remaining contaminated soil to groundwater over time.

9.6.4.5 Institutional Controls

Restrictive covenants would be required for the portions of the Site where complete soil removal was not achieved, such as the areas where soil contamination is addressed by capping. The covenants would attach future development restrictions and requirements to property deeds for the lifetime of the remaining contamination. Soil management plans would be required that instruct property owners on Ecology’s requirements for performing invasive work in areas of remaining contaminated soil. Future management of contaminated material could result in higher future development project costs. The restrictive covenants would require maintenance in the form of periodic reviews and updating of soil management plans.

9.6.5 Remedial Alternative 5 (Excavation – All Sub-Areas)

Similar to Remedial Alternative 4, Alternative 5 achieves complete removal of contaminated soil in the vicinity of the former AST area and TP-08 Area (Figure 18). However, Remedial Alternative 5 also includes removal of soil exceeding human health cleanup levels in the vicinity of both the Power House Complex Steel Production Building. Soil that exceeds respective cleanup levels in the vicinity of these areas would be excavated to the extent practicable. Similar to Remedial Alternative 4, contaminated sediment will be addressed by excavating or dredging to the extent required to achieve cleanup goals in conjunction with the excavation activities at the former AST area. Specifically, Remedial Alternative 5 includes the following components:

- Excavate approximately 12,000 cubic yards of soil from various areas across the Site. The areas of proposed soil excavation include:
    - Excavate to the extent feasible, soil down to approximately 11 feet BGS in the former AST area with TPH concentrations above cleanup levels. TPH was not detected in two subsurface samples obtained below the existing AST structure (sample locations DP06 and TP05, see Figure 4). However, if, during excavation, elevated TPH (i.e., greater than cleanup levels) appears to be below the concrete AST structure, part or all of the structure

may need to be removed to facilitate removal of the contaminated soil. Potential removal of the concrete AST structure will be coordinated with Washington State DAHP.

  - Excavate to the extent feasible, soil down to approximately 10 feet BGS in the TP-08 Area with metals concentrations above cleanup levels.
  - Excavate to the extent feasible, soil down to approximately 10 feet BGS in the vicinity of the Power House Complex with metals concentrations cleanup levels.
  - Excavate to the extent feasible, soil down to approximately 6 feet BGS in the vicinity of the Steel Production Building with metals concentrations above cleanup levels.

- Excavate or dredge approximately 1,600 cubic yards of sediment from the impacted shoreline area adjacent to the former AST area. The sediment impacted with TPH above the ecological-based cleanup level will be removed to the extent practicable.
- Develop institutional controls in the form of restrictive covenants, signage controls, and other notification measures to address remaining contaminated soil left in place in areas of the Site inaccessible to excavation activities.
- Transport stockpiled soil to appropriate disposal facility.
- Backfill upland excavations with clean imported fill and restore original Site topography, features, and surfaces.
- Backfill shoreline removal areas with clean imported fill of grain size appropriate for the marine environment, using a habitat substrate surface material.
- Install a monitoring well network and monitor groundwater quarterly for at least one year.

The following sections provide further description of the components of Remedial Alternative 5.

9.6.5.1 Soil and Sediment Removal

Soil exceeding the final cleanup levels for TPH, cPAHs, and metals would be removed to varying depths, as described above and shown in Figure 18. The soil removal component of Remedial Alternative 5 would be similar to Alternative 4, with the addition of excavation of contaminated soil in the upland areas away from the shoreline, at the Power House Building area and the Steel Production Building area. The additional excavation would require a significant level of clearing of plants and other obstructions to achieve complete removal of soil exceeding cleanup levels. However, the general methods would be expected to be similar to those used for upland excavation in other areas of the Site. The scope of the shoreline excavation of contaminated sediment is the same as proposed for Alternative 4. For the purpose of estimating costs associated with the soil removal component of this alternative, the following assumptions were made:

- Excavation of soil as shown in Figure 18 results in approximately 12,000 cubic yards excavated.
- The sediment removal along the shoreline adjacent to the former AST will be addressed as described for Remedial Alternative 3. The sediment removal would result in generating approximately 1,600 cubic yards of contaminated sediment requiring disposal.
- Excavations extending below 10 feet BGS would be completed using commonly available dewatering techniques to allow the driest excavation possible.

In conjunction with the sediment/shoreline soil removal component of this alternative, the slag outcrop area on the shoreline will be restored by removing slag material on the shoreline surface to the extent required to place a proper thickness of beach habitat substrate without adjusting the grade. Removal of the slag outcrop material is considered a Site restoration component consistent for each of Alternatives 2 through 5 and therefore the costs associated with that component is not represented in the cost estimates for the Alternatives.

9.6.5.2 Soil Disposal

The soil disposal activities proposed for Remedial Alternative 5 are expected to be the same as described in Section 9.6.3 for Alternative 3.

9.6.5.3 Groundwater Monitoring

The groundwater monitoring activities proposed for Remedial Alternative 5 are expected to be the same as described in Section 9.6.3 for Remedial Alternative 3. Long-term groundwater monitoring may be necessary if initial groundwater monitoring indicates the potential for contaminant transfer from remaining contaminated soil to groundwater over time.

9.6.5.4 Institutional Controls

The intent of Alternative 5 is to remove contaminated soil to the greatest extent practicable. However, restrictive covenants would be required for the portions of the Site where complete soil removal was not achieved due to obstructions or inaccessibility. The covenants would attach future development restrictions and requirements to property deeds for the lifetime of the remaining contamination. Soil management plans would be required that instruct property owners on Ecology's requirements for performing invasive work in areas of remaining contaminated soil. Future management of contaminated material could result in higher future development project costs. The restrictive covenants would require maintenance in the form of periodic reviews and updating of soil management plans.

9.7 EVALUATION CRITERIA

This section presents a description of the threshold requirements for cleanup actions under MTCA and the additional criteria used in this FS to evaluate the cleanup action alternatives.

9.7.1 THRESHOLD REQUIREMENTS

Cleanup actions performed under MTCA must comply with several basic requirements. Cleanup action alternatives that do not comply with these criteria are not considered suitable cleanup actions under MTCA. As provided in WAC 173-340-360(2)(a), the four threshold requirements for cleanup actions are that they must:

- Protect human health and the environment;
- Comply with cleanup standards;
- Comply with applicable state and federal laws; and
- Provide for compliance monitoring.

9.7.1.1 Protection of Human Health and the Environment

The results of cleanup actions performed under MTCA must ensure that both human health and the environment are protected.

9.7.1.2 Compliance with Cleanup Standards

Compliance with cleanup standards requires, in part, that cleanup levels are met at the applicable points of compliance. If a remedial action does not comply with cleanup standards, the remedial action is an interim action, not a cleanup action. Where a cleanup action involves containment of soils with hazardous substance concentrations exceeding cleanup levels at the point of compliance, the cleanup action may be determined to comply with cleanup standards, provided the requirements specified in WAC 173-340-740(6)(f) are met.

9.7.1.3 Compliance with Applicable State and Federal Laws

Cleanup actions conducted under MTCA must comply with applicable state and federal laws. The term "applicable state and federal laws" includes legally applicable requirements and those requirements that Ecology determines to be relevant and appropriate as described in WAC 173-340-710.

9.7.1.4 Provision for Compliance Monitoring

The cleanup action must allow for compliance monitoring in accordance with WAC 173-340-410. Compliance monitoring consists of protection monitoring, performance monitoring, and confirmational monitoring. Protection monitoring is conducted to confirm that human health and the environment are adequately protected during construction and the operation and maintenance period of a cleanup action. Performance monitoring is conducted to confirm that the cleanup action has attained cleanup standards and, if appropriate, remediation levels or other performance standards. Confirmational monitoring (groundwater, soil and/or sediment) is conducted to confirm the long-term effectiveness of the cleanup action once cleanup standards and, if appropriate, remediation levels or other performance standards have been attained.

9.7.2 Other MTCA Requirements

Under MTCA, when selecting from the alternatives that meet the minimum requirements described above, the alternatives shall be further evaluated against the following additional criteria:

- **Use permanent solutions to the maximum extent practicable [WAC 173-340-360(2)(b)(i)].** MTCA requires that when selecting from cleanup action alternatives that fulfill the threshold requirements, the selected action shall use permanent solutions to the maximum extent practicable [WAC 173-340-360(2)(b)(i)]. MTCA specifies that the permanence of these qualifying alternatives shall be evaluated by balancing the costs and benefits of each of the alternatives using a “disproportionate cost analysis” in accordance with WAC 173-340-360(3)(e). The criteria for conducting this analysis are described in Section 9.7.2.1 below.
- **Provide a reasonable restoration time frame [WAC 173-340-360(2)(b)(ii)].** In accordance with WAC 173-340-360(2)(b)(ii), MTCA places a preference on those cleanup action alternatives that, while equivalent in other respects, can be implemented in a shorter period of time. MTCA includes a summary of factors to be considered in evaluating whether a cleanup action provides for a reasonable restoration time frame [WAC 173-340-360(4)(b)].
- **Consideration of Public Concerns [WAC 173-340-360(2)(b)(iii)].** Ecology will consider public comments submitted during the RI/FS process in making its preliminary selection of an appropriate cleanup action alternative. This preliminary selection is subject to further public review and comment when the proposed remedy is published in the draft CAP.

9.7.2.1 MTCA Disproportionate Cost Analysis

The MTCA disproportionate cost analysis (DCA) is used to evaluate which of the alternatives that meet the threshold requirements are permanent to the maximum extent practicable. This analysis involves comparing the costs and benefits of alternatives and selecting the alternative whose incremental costs are not disproportionate to the incremental benefits. The evaluation criteria for the disproportionate cost analysis are specified in WAC 173-340-360(2) and (3), and include protectiveness, permanence, cost, long-term effectiveness, management of short-term risks, implementability, and consideration of public concerns.

As outlined in WAC 173-340-360(3)(e), MTCA provides a methodology that uses the criteria below to determine whether the costs associated with each cleanup alternative are disproportionate relative to the incremental benefit of the alternative above the next lowest-cost alternative. The comparison of benefits relative to costs may be quantitative, but will often be qualitative. When possible for this FS, quantitative factors such as mass of contaminant removed or percentage of area of impacts remaining were compared to costs for the alternatives evaluated, but many of the benefits associated with the criteria described below were necessarily evaluated qualitatively. Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental degree of benefits achieved by the other lower-cost alternative [WAC 173-340-360(e)(i)]. Where two or more alternatives are equal in benefits, Ecology selects the less costly alternative [WAC 173-340-360(e)(ii)(c)].

Each of the MTCA criteria used in the DCA is described below.

Protectiveness

The overall protectiveness of a cleanup action alternative is evaluated based on several factors. First, the extent to which human health and the environment are protected and the degree to which overall risk at a Site is reduced are considered. Both on-site and off-site reduction in risk resulting from implementing the alternative are considered.

Permanence

MTCA specifies that when selecting a cleanup action alternative, preference shall be given to actions that are “permanent solutions to the maximum extent practicable.” Evaluation criteria include the degree to which the alternative permanently reduces the toxicity, mobility or mass of hazardous substances, including the effectiveness of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment processes, and the characteristics and quantity of treatment residuals generated.

Cost

The analysis of cleanup action alternative costs under MTCA includes all costs associated with implementing an alternative, including design, construction, long-term monitoring, and institutional controls. Costs are intended to be comparable among different alternatives to assist in the overall analysis of relative costs and benefits of the alternatives. The costs to implement an alternative include the cost of construction, the net present value of any long-term costs, and agency oversight costs. Long-term costs include operation and maintenance costs, monitoring costs, equipment replacement costs, and the cost of maintaining institutional controls. Unit costs used to develop overall remediation costs for this FS were derived using a combination of published engineering reference manuals (i.e., R.S. Means); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment.

Long-Term Effectiveness

Long-term effectiveness is a parameter that expresses the degree of certainty that the alternative will be successful in maintaining compliance with cleanup standards over the long-term performance of the cleanup action. The MTCA regulations contain a specific preference ranking for different types of technologies that is to be considered as part of the comparative analysis. The ranking places the highest preference on technologies such as reuse/recycling, treatment, immobilization/solidification, and disposal in an engineered, lined, and monitored facility. Lower preference rankings are applied for technologies such as on-site isolation/containment with attendant engineered controls, and institutional controls and monitoring.

Management of Short-term Risks

Evaluation of this criterion considers the relative magnitude and complexity of actions required to maintain protection of human health and the environment during implementation of the cleanup action. Cleanup actions carry short-term risks, such as potential mobilization of contaminants during construction, or safety risks typical of large construction projects. In-water dredging activities carry a risk of temporary water quality degradation and potential sediment recontamination. Some short-term risks can be managed through the use of best practices during project design and construction, while other risks are inherent to project alternatives and can offset the long-term benefits of an alternative.

Implementability

Implementability is an overall metric expressing the relative difficulty and uncertainty of implementing the cleanup action. Evaluation of implementability includes consideration of technical factors such as the availability of mature technologies and experienced contractors to accomplish the cleanup work. It also includes administrative factors associated with permitting and completing the cleanup.

Consideration of Public Concerns

The public involvement process under MTCA is used to identify potential public concerns regarding cleanup action alternatives. The extent to which an alternative addresses those concerns is considered as part of the evaluation process. This includes concerns raised by individuals, community groups, local governments, tribes, federal and state agencies, and other organizations that may have an interest in or knowledge of the Site. In particular, the public concerns for this Site would generally be associated with environmental concerns and performance of the cleanup action, which are addressed under other criteria such as protectiveness and permanence.

9.8 EVALUATION AND COMPARISON OF CLEANUP ALTERNATIVES

This section provides an evaluation and comparative analysis of the cleanup action alternatives developed for the Site. The alternatives are evaluated with respect to the MTCA evaluation criteria described in Section 9.7, and then compared to each other relative to their expected performance under each criterion. The components of the six remedial alternatives are described above in Sections 9.6.1 through 9.6.6 and are summarized in Table 24. The detailed evaluation of the alternatives is presented in Table 25, and the results of the evaluation are summarized in Table 26.

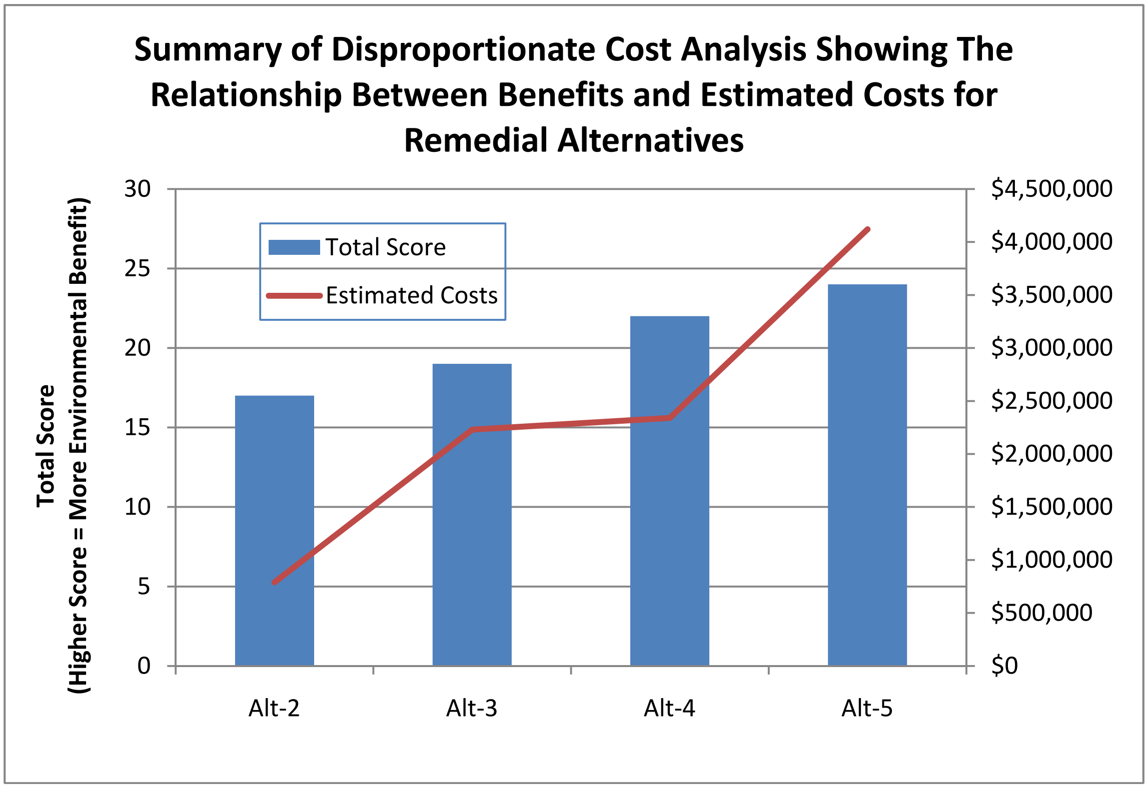
9.8.1 Threshold Requirements

All of the alternatives developed in this FS except for Alternative 1 meet each of the four MTCA threshold requirements described for cleanup actions: protection of human health and the environment, compliance with cleanup standards, compliance with applicable state and federal regulations, and provision for compliance monitoring. Alternative 1(“Institutional Controls”) does not meet MTCA threshold requirements, because this alternative would leave contaminated soil, sediment and groundwater in place that presents a threat to human health and the environment. Consequently, Alternative 1 is not evaluated further in this FS.

The five remaining alternatives differ in the manner in which the MTCA threshold requirements would be met. Alternative 5 utilizes soil removal to the greatest extent, resulting in complete removal, to the extent feasible, of soil and sediment exceeding cleanup levels throughout the Site. Alternative 5 is thus the most practicable permanent solution and forms the baseline cleanup action alternative [WAC 173-340-350(8)(c)(ii)(A) and 173-340-360(3)(e)(ii)(B)]. Alternative 2 does not involve removal of contaminated soil or sediment (with the exception of the upper layer of sediment removed to accommodate the marine cap), but addresses the requirements through elimination of the respective exposure pathways. Alternatives 3 and 4 meet the threshold requirements through the use of removal actions that focus on the areas with the highest concentrations of Site contaminants, while varying the methods used to address contaminants in the more remote areas of the Site (Steel Production Building and the Power House Complex).

9.8.2 MTCA Disproportionate Cost Analysis

As discussed in Section 9.7.2.1, the MTCA analysis of disproportionate costs is used to determine which cleanup alternative that otherwise meets threshold requirements is permanent to the maximum extent practicable. Remedial Alternatives 2 through 5 meet MTCA threshold requirements, and thus were evaluated based on the relative benefits ranking factors of the DCA. The evaluation of the level of achievement for how each individual criterion applies to each alternative, using a numeric scoring scale of 1 (lowest) to 5 (highest) and the methodology described above in Section 9.7.2.1, is presented in Table 25. Table 26 presents the analysis of these results, including the summation of the resulting scores for each alternative and the determination of disproportionate cost. The conclusions of this evaluation are summarized in the following sections and the graph below.



9.8.2.1 Protectiveness

Remedial Alternative 5 achieves the highest level of protectiveness of the remaining alternatives as a result of achieving the maximum feasible removal of soil and sediment exceeding cleanup levels. Alternatives 3 and 4 achieve progressively lower levels of protectiveness relative to Alternative 5 based on the method selected to address soil in upland areas away from the shoreline (Power House Complex and Steel Production Building). These three Alternatives share the same proposed remediation scope for the areas with the exposure pathways of greatest risk to human health and the environment; soil and sediment at the Former AST Area, sediment adjacent to the Former AST Area, and the TP-08 Area. Alternative 2 has a lower level of protectiveness as a result of relying on capping of contamination in place rather than removal from the Site.

9.8.2.2 Permanence

Remedial Alternatives 3 through 5 all achieve a high level of permanence by achieving complete removal of the mass of contamination that poses the greatest risk to human health and the environment; TPH and metals impacted soil and sediment in the Former AST Area, the TP-08 Area, and the intertidal area adjacent to the Former AST Area. The permanence of Remedial Alternatives 3 and 4 are lower than Alternative 5 as a result of maintaining upland contaminant mass on Site associated with the Power House Complex and Steel Production Building and relying on institutional controls or capping methods to prevent exposure. However, Alternative 2 would be expected to have the lowest level of permanence as it utilizes capping methods for contaminated marine sediments, which would have a higher possibility of failure due to erosion and other natural processes that could expose contaminants in the future.

9.8.2.3 Long-Term Effectiveness

The long-term effectiveness of the four alternatives that meet the threshold requirements have relative rankings similar to those described above for the Permanence category. The long-term effectiveness relies heavily on using proven technologies to remove contaminant mass. Alternatives that rely primarily (Alternative 2) or partially (Alternatives 3 and 4) on capping and/or institutional controls to protect human health and the environment, while leaving contaminants in place have lower long-term effectiveness as a result of the need to monitor and the potential for the need to revisit the cleanup action in the event of failure. Alternative 5 relies on removal of contaminant mass from the Site to the greatest extent practicable and therefore achieves the highest level of long-term effectiveness.

9.8.2.4 Management of Short-Term Risks

Remedial Alternatives 3 through 5 involve extensive soil removal, including excavation near and within the shoreline and across large areas of open park space currently used by the public. However, the relative difference between the short-term risks associated with these four alternatives is low. The short-term risk associated with Remedial Alternative 2 is lower than the other three Alternatives as a result of the reduced scope of the intrusive earthwork. However, Alternative 2 involves a significant amount of earthwork associated with upland and marine capping, reducing the difference between the Alternatives.

9.8.2.5 Technical and Administrative Implementability

All of the four Remedial Alternatives that meet the threshold requirements are generally implementable using commonly available methods. Alternative 2 rates a higher level of technical implementability due to the limited nature of the associated earthwork but has a reduced level of administrative implementability associated with the development and maintenance of extensive institutional controls. Remedial Alternative 5 has a lower level of technical implementability as a result of including removal of contaminated soil in the Power House Complex and Steel Production Building Area. Including these difficult to access areas of the Site significantly increases the difficulty of Alternative 5. Alternatives 3 and 4 have moderate implementability, with the capping element of Alternative 4 reducing the relative implementability slightly. All of these alternatives have significant earthwork components, particularly the shoreline excavations associated with the former AST area.

9.8.2.6 Cost

The cost estimates for Remedial Alternatives 2 through 5 were developed as described in section 9.7.2.1 and are presented in Tables 26 through 29.

- **Remedial Alternative 2** (Capping all Sub-Areas) has an estimated cost of approximately $789,000. This alternative includes the removal of approximately 930 tons of contaminated soil.
- **Remedial Alternative 3** (Excavation/Removal at the Sediment Remediation Area, Former AST Areas and TP08 Vicinityand Institutional Controls at the Power House Complex and Steel

Production Building) has an estimated cost of approximately $2.23 million. This alternative includes the removal of approximately 11,200 tons of contaminated soil.

- **Remedial Alternative 4** (Excavation/Removal at the Sediment Remediation Area, Former AST Areas and TP08 Vicinity and Capping at Power House Complex and Steel Production Building) has an estimated cost of approximately $2.34 million. This alternative includes the removal of approximately 11,200 tons of contaminated soil.
- **Remedial Alternative 5** (Excavation/Removal all Sub-Areas) has an estimated cost of approximately $4.12 million. This alternative includes the removal of approximately 21,500 tons of contaminated soil.

9.8.3 Reasonable Restoration Time Frame

The restoration time frame for all of the proposed Remedial Alternatives that meet the threshold requirements is expected to be on the order of two to three years. This time frame includes project design, permitting, contracting, construction, and Site closure activities. Management of institutional controls in the form of restrictive covenants would be required for the contaminated soil left in place under Alternatives 2, 3, and 4. Long-term monitoring may be necessary to ensure compliance with the covenants. These requirements would extend the duration of the associated alternatives and are described in Table 25.

9.8.4 Consideration of Public Concerns

The remedial alternatives proposed for the Site are generally expected to be acceptable to the public. The alternatives that achieve the greatest level of protection and certainty rely on the greatest level of soil removal and result in the most intrusive Site activities. Each of the alternatives that involve significant removal of contaminated soil scored a 4 for this criterion (i.e., low to moderate public concern). Alternative 2, which relies predominantly on capping, would be expected to have a lower level of acceptance by the public and therefore, was scored lower than the other alternatives, with a score of 3.

9.9 PREFERRED CLEANUP ALTERNATIVE

Based on the comparative analysis presented in Section 9.8.2, the preferred Remedial Alternative for the Site is Alternative 4. This alternative reduces immediate risk to potential human and ecological receptors through:

1. Complete removal of contaminated sediment below the MHHW;
2. Complete removal of TPH and metals contaminated soil at the former AST area and the area in the vicinity of sample location TP-08;
3. Installation of a permeable geotextile and soil cap to prevent direct exposure to contaminated soil in the Power House Complex and Steel Production Building areas; and
4. Perform site restoration tasks including restoring excavation areas to original conditions; planting soil cap areas for use as public park space; and remove slag material in the slag outcrop area along the shoreline to allow restoration of the shoreline.

As summarized in Table 30, Alternative 5 ranks the highest of the four alternatives that meet threshold requirements. However, the estimated costs associated with Alternative 5 ($4.12 million) is nearly double the cost of the next highest ranking alternative, Alternative 4 ($2.34 million), and therefore the cost of Alternative 5 is considered substantial and disproportionately higher than the estimated cost of Alternative 4 relative to the incremental environmental benefit. The cost of Alternative 4 is not significantly higher than the estimated cost of the next highest ranking alternative, Alternative 3 ($2.23 million) and therefore the increased cost of Alternative 4 is not disproportionate to the increase of the environmental benefit associated with capping of the Power House Complex and Steel Production Building (Alternative 4) versus the use of only institutional controls (Alternative 3). Consequently, Alternative 4 is preferred over the other alternatives.

10.0 LIMITATIONS

We have prepared this report for the exclusive use by SAIC (GeoEngineers is subcontracted to SAIC for Ecology Contract #C0700034), it's authorized agents and the Washington State Department of Ecology. The information contained herein is not intended for use by others and it is not applicable to other sites. No other (third) party may rely on the product of our services unless we agree in advance and in writing to such reliance. This plan can be provided to contractors, maintenance and utility personnel or other third parties for informational purposes only. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. The conclusions and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty or other conditions, express or implied, should be understood.

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Please refer to Appendix H titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

11.0 REFERENCES

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TABLE 1
SUMMARY CHEMICAL ANALYTICAL DATA
PETROLEUM IN SOIL
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

				Field Screening Results[2]		Laboratory Analytical Results			
Location ID[1]	**Sample ID**	**Collection Date**	**Sample Depth (feet bgs)**	**Headspace Vapors (ppm)**	**Sheen**	**HCID**	**Diesel-range Hydrocarbons (mg/kg)**	**Heavy Oil-range Hydrocarbons (mg/kg)**	**Combined Total Petroleum Hydrocarbons[3]**
Hart Crowser (1996)									
SS-3 (slag)	SS-3	March-07	0.2 - 0.25	--	--	0.1 U	--	--	--
SS-4	SS-4	March-07	surface	--	--	134,000	--	--	--
TP-5, S-4	TP-5, S-4	3/7/2007	7.0 - 8.0	--	--	1,085	--	--	--
TP-8, S-1	TP-8, S-1	3/8/2007	0.0 - 1.0	--	--	220	--	--	--
TP-9, S-1	TP-9, S-1	3/8/2007	0.0 - 2.0	--	--	700	--	--	--
TP-10, S-1	TP-10, S-1	3/8/2007	1.0 - 2.0	--	--	0.1 U	--	--	--
TP-11, S-1	TP-11, S-1	3/9/2007	0.0 - 2.0	--	--	0.1 U	--	--	--
TP-12, S-3	TP-12, S-3	3/9/2007	4.5 - 6.0	--	--	0.1 U	--	--	--
Jefferson County (2001)									
SS1	SS1	10/25/2001	unknown	--	--	--	230	950	1180
SS2	SS2	10/25/2001	unknown	--	--	--	2,000	16,000	18,000
GeoEngineers (2007 and 2008)									
DP01	DP01-070626-5	6/26/2007	5	0	hs	--	6.1 U	12 U	--
	DP01-080626-11	6/26/2007	11	15.9	ns	--	8 U	15 U	--
DP02	DP02-070625-11	6/25/2007	11	14.6	hs	DRO/Motor Oil	4,700	4,500	9,200
	DP02-070625-13	6/25/2007	13	238	ss	DRO/RRO	12 U	27	27
DP03	DP03-070626-7	6/25/2007	7	390	ns	Motor Oil	<5.5	13	13
DP04	DP04-070625-7.5	6/25/2007	7.5	49.7	ms	--	<5.6	<11	--
	DP04-070625-12	6/25/2007	12	234	ms	--	<6.9	<14	--
DP05	DP05-070626-7	6/25/2007	7		ns	--	<6.2	<12	--
DP06	DP06-070625-7	6/25/2007	7	18.9	ss	--	6.0 UJ	12 UJ	--
TP01	TP01-070625-2.5	6/25/2007	2.5	0	ns	--	5.4 U	11 U	--
TP02	TP02-070625-2	6/25/2007	2	0	ns	DRO/Motor Oil	17	70	87
TP04	TP04-070627-2	6/27/2007	2	--	--	DRO/Motor Oil	42	250	292
TP05	TP05-070627-2	6/27/2007	2	--	--	--	<5.8	<12	--
	TP05-070627-4	6/27/2007	4	--	--	--	<6.3	<13	--
TP06	TP06-070621-2	6/21/2007	2	0	ns	--	<5.1	<10	--
	TP06-070621-4	6/21/2007	4	0	ns	--	<5.5	<11	--
	TP06-070621-6.5	6/21/2007	6.5	0	ns	--	<6.2	<12	--
TP07	TP07-070621-2	6/21/2007	2	0	ns	Motor Oil	<5.4	17	17
	TP07-070621-4	6/21/2007	4	0	vss	--	<5.4	<11	--
	TP07-070621-6.5	6/21/2007	6.5	0	ns	--	<6.1	<12	--
TP08	TP08-070621-1.5	6/21/2007	1.5	0	vss	DRO/Motor Oil	16	62	78
	TP08-070621-4	6/21/2007	4	0	ns	Motor Oil	<6.5	21	21
	TP08-070621-6	6/21/2007	6	0	ns	--	<6.1	<12	--
TP09	TP09-070622-2	06/22/07	2	0	ns	--	<5.5	<11	--
	TP09-070622-4	06/22/07	4	0	ns	--	<5.6	<11	--
	TP09-070622-8	6/22/2007	8	0	ns	--	<6.1	<12	--
TP11	TP11-070621-2	6/21/2007	2	0.5	hs	DRO/Motor Oil	9,200	12,000	21,200
	TP11-070621-4	6/21/2007	4	0.5	hs	DRO/Motor Oil	5,000	5,000	10,000
	TP11-070621-6.5	6/21/2007	6.5	1.5	ms	DRO/Motor Oil	4,500	4,100	8,600
	TP11-070621-2seep	6/21/2007	2seep	0	ms	DRO/Motor Oil	3,200	5,200	8,400
	TP11-BA-080606-3	6/6/2008	3	--	--	DRO/RRO	3,900	5,400	9,300
TP12	TP12-070622-7	6/22/2007	7	0	ns	--	<6.2	<12	--
TP13	TP13-070625-8	6/25/2007	8	0	ns	--	<5.8	<12	--
TP14	TP14-070626-8	6/26/2007	8	0	ns	--	<5.9	<12	--
TP15	TP15-070621-6.5	6/21/2007	6.5	0	ns	--	<9.9	<20	--
	TP15-BA-080606-2	6/6/2008	2	--	--	DRO/RRO	30	120	150
TP16	TP16-070622-7	6/22/2007	7	0	ns	--	<6.0	<12	--
TP17	TP17-070626-2	6/26/2007	2	0	ss	--	<5.1	<10	--
TP18	TP18-070626-8	6/26/2007	8	0	ns	--	<6.5	<13	--
TP19	TP19-070621-7	6/21/2007	7	0	ns	--	<6.7	<13	--
TP20	TP20-070625-2	6/25/2007	2	0	ss	--	<5.4	<11	--
	TP20-070625-6	6/25/2007	6	0	ss	--	<5.2	<10	--
TP22	TP22-070626-2	6/26/2007	2	0	ss	DRO/Motor Oil	5.5	23	28.5
TP23	TP23-070622-7	6/22/2007	7	0	ns	--	<5.8	<12	--
	TP23-BA-080606-2	6/6/2008	2	--	--	RRO	<5.5	12	12
TP24	TP24-070622-2	6/22/2007	2	0.5	hs	DRO/Motor Oil	17,000	16,000	33,000
	TP24-BA-080606-3	6/6/2008	3	--	--	DRO/RRO	4,300	5,100	9,400
TP26	TP26-070622-2	6/22/2007	2	0	ns	--	<5.3	<11	--
	TP26-070622-4	6/22/2007	4	0	ns	--	<5.4	<11	--
	TP26-070622-6.5	6/22/2007	6.5	0	ms	DRO/Motor Oil	4,900	4,800	9,700
	TP26-070622-7	6/22/2007	7	0.5	hs	DRO/Motor Oil	10,000	8,800	18,800
TP27	TP27-070625-5	6/25/2007	5	0	ns	DRO/Motor Oil	7.6	22	29.6

TABLE 1
SUMMARY CHEMICAL ANALYTICAL DATA
PETROLEUM IN SOIL
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

				Field Screening Results[2]		Laboratory Analytical Results			
Location ID[1]	**Sample ID**	**Collection Date**	**Sample Depth (feet bgs)**	**Headspace Vapors (ppm)**	**Sheen**	**HCID**	**Diesel-range Hydrocarbons (mg/kg)**	**Heavy Oil-range Hydrocarbons (mg/kg)**	**Combined Total Petroleum Hydrocarbons[3]**
TP28	TP28-070625-3	6/25/2007	3	0	ns	--	<6.1	<12	--
	TP28-070625-5	6/25/2007	5	0	ss	DRO/Motor Oil	150	200	350
	TP28-070625-6.5	6/25/2007	6.5	0	ns	--	<5.7	<12	--
TP29	TP29-070625-3	6/25/2007	3	0	ns	DRO/Motor Oil	43	140	183
	TP29-070625-6	6/25/2007	6	0	ns	DRO/Motor Oil	12	43	55
	TP29-070625-7	6/25/2007	7	0	ns	DRO/Motor Oil	<5.8	15	15
TP30	TP30-070626-3.5	6/26/2007	3.5	0	ss	--	<5.5	<11	--
TP32	TP32-071210-7.5	12/10/2007	7.5	--	--	RRO	5.8 U	14	14
TP35	TP35-071212-1.5	12/10/2007	1.5	--	--	--	5.5 U	11 U	--
	TP35-07210-5	12/10/2007	5	--	--	--	5.9 U	12 U	--
	TP35-071210-7.5	12/10/2007	7.5	--	--	--	6.3 U	12 U	--
TP36A	TP36A-071211-9.5	12/11/2007	9.5	--	--	--	6.3 U	13 U	--
Applicable Screening Levels									
MTCA Method A[4]									2,000
Sediment Bioassay[5]									136

Notes:

[1] Approximate locations of soil samples are shown in Figures 3 and 4.

[2] Field screening methods are described in Appendix A. NS=No sheen; SS=slight sheen; MS=moderate sheen; HS=heavy sheen.

[3] Total Petroleum Hydrocarbons equals sum of diesel-range and heavy-oil range concentrations.

[4] MTCA Method A soil cleanup levels for unrestricted land use (Table 740-1;Chapter 173-340WAC). This value is applicable to soil above the bluff (i.e., Power House Complex and Steel Production Building) and in the nearshore fill area.

[5] This value is a sediment screening level derived from bioassays conducted on intertidal sediments obtained at the Irondale Site (See Appendix D). This value is applicable to soil near the former 6,000 barrel above ground storage tank.

HCID = Hydrocarbon identification

MTCA = Model Toxics Control Act

DRO = Diesel Range Organics

RRO = Residual Range Organics

mg/kg=milligrams per kilogram

ppm=parts per million

Shading indicates that the analyte was detected at a concentration exceeding the MTCA Method A or Sediment Bioassay screening level, whichever is applicable.

"U" indicates analyte not detected. The number reported is the method reporting limit.

"J" value estimated by analytical laboratory

TABLE 2
SUMMARY CHEMICAL ANALYTICAL DATA
EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) IN SOIL
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Sample ID	**TP11-070621-2**	**TP26-070622-7**
Collection Date	**6/21/2007**	**6/22/2007**
Location ID[1]	**(mg/kg)**	**(mg/kg)**
GeoEngineers (2007 and 2008)		
Aliphatics, C8-C10	27 U	27 J
Aliphatics, C10-C12	67	260
Aliphatics, C12-C16	1,200	2,200
Aliphatics, C16-C21	4,300	3,800
Aliphatics, C21-C34	7,400	5,200
Aromatics, C8-C10	27 U	24 U
Aromatics, C10-C12	27 U	52
Aromatics, C12-C16	200	580
Aromatics, C16-C21	3,700	3,800
Aromatics, C21-C34	6,500	5,000

Notes:

[1] Approximate locations of soil samples are shown in Figure 4.

"U" indicates analyte not detected. The number reported is the method reporting limit.

"J" value estimated by analytical laboratory

mg/kg=milligrams per kilogram

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TABLE 3
SUMMARY OF CHEMICAL ANALYTICAL DATA
METALS IN SOIL AND SLAG
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

				Metals														TCLP	
Location ID[1]	Sample ID	Collection Date	Sample Depth (feet bgs)	Antimony (mg/kg)	Arsenic (III/V) (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	Arsenic (mg/L)	Lead (mg/L)
Hart Crowser (1996); GeoEngineers (2008, TP-6 only)																			
TP-5	TP-5, S-3	3/7/1996	5.0 - 6.0	--	6	--	0.5 U	9.5	67	23,000	56	0.13 U	24	--	--	--	130	0.05 U	0.03 U
TP-5	TP-5, S-4	3/7/1996	7.0 - 8.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TP-6	TP-6, S-1	3/8/1996	0.5 - 2.0	--	11	--	--	27	180	66,000	120	0.13 U	16	--	--	--	61	0.05 U	0.03 U
	DP06-BA-080605-1	6/5/2008	1	--	6.2	--	--	--	127	24,800	91	--	31 J	--	--	--	106 J	--	--
TP-7	TP-7, S-2	3/8/1996	2.0 - 4.0	--	1.7	--	0.5 U	12	17	13,000	27	0.13 U	25	--	--	--	29	--	--
TP-8	TP-8, S-1	3/8/1996	0.0 - 1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TP-9	TP-9, S-1	3/8/1996	0.0 - 2.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TP-9	TP-9, S-2	3/8/1996	3.0 - 5.0	--	2.3	--	0.5 U	15	15	14,000	5 U	0.13 U	35	--	--	--	20	--	--
TP-10	TP-10, S-1	3/8/1996	1.0 - 2.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TP-10	TP-10, S-3	3/8/1996	6.5 - 8.0	--	1.2	--	0.5 U	8.9	6.2	7,800	5 U	0.13 U	16	--	--	--	13	--	--
TP-11	TP-11, S-1	3/9/1996	0.0 - 2.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TP-11	TP-11, S-2	3/9/1996	2.5 - 4.5	--	68	--	0.71	8.2	270	110,000	220	0.13 U	33	--	--	--	670	0.05 U	0.03 U
TP-12	TP-12, S-3	3/9/1996	4.5 - 6.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TP-19	TP-19, S-2	3/9/1996	6.0 - 8.0	--	18	--	0.5 U	10	51	44,000	5 U	0.13 U	11	--	--	--	160	0.05 U	--
SS-3 (slag)	SS-3	March-96	0.2 - 0.25	--	2.8 U	--	0.5 U	83	420	320,000	2,200	0.13 U	12	--	--	--	81	0.05 U	0.03 U
SS-4	SS-4	March-96	surface	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SS-5 (slag)	SS-5	March-96	0.25	--	4.8	--	0.5 U	8.3	62	25,000	11	0.13 U	14	--	--	--	50	--	--
Jefferson County (2001)																			
SS1	SS1	10/25/2001	unknown	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SS2	SS2	10/25/2001	unknown	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SS3	SS3	10/25/2001	unknown	nd	15.3	nd	nd	23.6	108	--	87.1	0.1	37	nd	nd	nd	409	--	--
SS4	SS4	10/25/2001	unknown	nd	8.9	nd	nd	20.5	42.3	--	61.1	0.0	32.4	nd	nd	nd	268	--	--
SS5	SS5	10/25/2001	unknown	nd	6.1	nd	nd	22.7	79.4	--	nd	0.1	29.4	nd	nd	nd	65.9	--	--
SS6	SS6	10/25/2001	unknown	nd	5.4	nd	nd	32.6	48.7	--	24.7	0.1	45.9	nd	nd	nd	72.9	--	--
SS7 (slag)	SS7	10/25/2001	unknown	nd	10.7	nd	nd	111	318	--	1,910	nd	15.8	nd	nd	nd	144	nd	nd
SS8	SS8	10/25/2001	unknown	nd	4.3	nd	nd	34.2	47.6	--	nd	0.1	45.4	nd	nd	nd	73.3	--	--
Ecology (2005)																			
(soil/slag)	05444012; Location 003	11/3/2005	0.5	0.21	9.06	1.04	0.20	17.3	466	--	5.41	0.005 U	22.3	0.50 UJ	0.20	0.10 U	33	--	--
GeoEngineers (2007 and 2008)																			
DP01	DP01-070626-5	6/26/2007	5	--	32 J	--	--	--	497	93,800	10 U	--	22	--	--	--	61	--	--
	DP01-BA-080605-4	6/5/2008	4	--	4.8	--	--	--	97.1	31,700	8	--	33 J	--	--	--	86 J	--	--
DP03	DP03-070626-7	6/26/2007	7	--	0.3 UJ	--	--	--	19	6,180	10 U	--	5 U	--	--	--	5 U	--	--
DP04	DP04-070625-7.5	6/25/2007	7.5	--	6 U	--	--	--	5.8	10,700	2 U	--	19	--	--	--	19	--	--
DP05	DP05-070626-7	6/26/2007	7	--	6 U	--	--	--	6.0	10,200	2 U	--	23	--	--	--	21	--	--
GEISS1	GEISS1-071213-.25	12/13/2007	0.25	--	15.1	--	--	--	205 J	57,700	74	--	31	--	--	--	273	--	--
	GEISS1-071213-1.5	12/13/2007	1.5	--	4	--	--	--	103 J	16,500	10 U	--	6	--	--	--	48	--	--
	GEI-SS1-BA-080605-1	6/5/2008	1	--	4.8	--	--	--	74	37,800	20	--	6 J	--	--	--	55 J	--	--
GEISS2	GEISS2-071213-1.5	12/13/2007	1.5	--	2.6	--	--	--	42 J	9,710	7	--	20	--	--	--	33	--	--
GEISS3	GEISS3-071213-1	12/13/2007	1	--	7.1	--	--	--	46 J	17,200	10	--	6	--	--	--	11	--	--
SLAG1	SLAG1-070627	6/27/2007	?	--	36	--	--	--	3,060	363,000	40 U	--	80	--	--	--	20	--	--
SLAG2	SLAG2-070627	6/27/2007	?	--	0.5 U	--	--	--	13.8	3,320	9 U	--	16	--	--	--	5 U	--	--
TP01	TP01-070625-1	6/25/2007	1	--	5 U	--	--	--	17.6	18,200	7 J	--	30	--	--	--	43	--	--
	TP01-070625-2.5	6/25/2007	2.5	--	6 U	--	--	--	19.2	18,300	2 UJ	--	47	--	--	--	34	--	--
TP02	TP02-070625-2	6/25/2007	2	--	13 J	--	--	--	167	99,000	130 J	--	54	--	--	--	363	--	--
	TP02-070625-3	6/25/2007	3	--	5 U	--	--	--	16.1	18,500	3 J	--	40	--	--	--	31	--	--
	TP02-BA-080605-2.5	6/5/2008	2.5	--	1.9	--	--	--	14.4	16,100	10	--	36 J	--	--	--	42 J	--	--
TP03	TP03-070626-1	6/26/2007	1	--	58 J	--	--	--	668	419,000	720	--	160 J	--	--	--	1,570	--	--
	TP03-070626-2	6/26/2007	2	--	6	--	--	--	37.4	24,300	27	--	25 J	--	--	--	237	--	--
	TP03-BS-080606-2	6/6/2008	2	--	29.1	--	--	--	260	130,000	280	--	54 J	--	--	--	1,460 J	--	--
	TP03-ASP-080606	6/6/2008	2	--	Arsenic III = 0.102 J Arsenic V = 10.8 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	TP03-CS-080606	6/6/2008	surface soil	--	28.1	--	--	--	318	156,000	370	--	60 J	--	--	--	1,820 J	--	--
TP04	TP04-070627-2	6/27/2007	2	--	6 U	--	--	--	47.2	21,200	7	--	30	--	--	--	57	--	--
	TP04-070627-4	6/27/2007	4	--	6 U	--	--	--	48.6	24,100	11	--	34	--	--	--	72	--	--
TP05	TP05-070627-2	6/27/2007	2	--	6 U	--	--	--	10.5	14,300	2 U	--	33	--	--	--	26	--	--
	TP05-070627-4	6/27/2007	4	--	6 U	--	--	--	14.1	15,000	3 U	--	39	--	--	--	33	--	--
TP06	TP06-070621-2	6/21/2007	2	--	5 U	--	--	--	14.9 J	18,100 J	2 U	--	43 J	--	--	--	29 J	--	--
	TP06-070621-4	6/21/2007	4	--	5 U	--	--	--	10.6 J	13,100 J	2 U	--	32 J	--	--	--	26 J	--	--
	TP06-070621-6.5	6/21/2007	6.5	--	6 U	--	--	--	10.8 J	14,100 J	2 U	--	47 J	--	--	--	33 J	--	--
TP07	TP07-070621-2	6/21/2007	2	--	5 U	--	--	--	18.5 J	20,100 J	3	--	36 J	--	--	--	28 J	--	--
	TP07-070621-4	6/21/2007	4	--	5 U	--	--	--	21.7 J	14,600 J	2 U	--	38 J	--	--	--	30 J	--	--
	TP07-070621-6.5	6/21/2007	6.5	--	6 U	--	--	--	11.2 J	13,100 J	2 U	--	32 J	--	--	--	28 J	--	--

TABLE 3
SUMMARY OF CHEMICAL ANALYTICAL DATA
METALS IN SOIL AND SLAG
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Location ID[1]	Sample ID	Collection Date	Sample Depth (feet bgs)	Metals														TCLP	
				Antimony (mg/kg)	Arsenic (III/V) (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	Arsenic (mg/L)	Lead (mg/L)
TP08	TP08-070621-1.5	6/21/2007	1.5	--	14 J	--	--	--	137 J	39,800 J	14	--	42 J	--	--	--	68 J	--	--
	TP08-070621-4	6/21/2007	4	--	180	--	--	--	95 J	143,000 J	10 U	--	28 J	--	--	--	44 J	--	--
	TP08-070621-6	6/21/2007	6	--	27 J	--	--	--	1,640 J	171,000 J	20 U	--	10 UJ	--	--	--	110 J	--	--
	TP08-BA-080606-4	6/6/2008	4	--	8.4	--	--	--	298	26,700	8	--	31 J	--	--	--	45 J	--	--
	TP08-ASP-080606	6/6/2008	2	--	Arsenic III = 0.023 UJ Arsenic V = 4.17 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TP09	TP09-070622-2	6/22/2007	2	--	5 U	--	--	--	10.8	13,700	2 U	--	37	--	--	--	24	--	--
	TP09-070622-4	6/22/2007	4	--	5 U	--	--	--	11.9	12,500	2 U	--	26	--	--	--	24	--	--
	TP09-070622-8	6/22/2007	8	--	6 U	--	--	--	14.1	14,700	2 U	--	37	--	--	--	25	--	--
TP10	TP10-070622-2	6/22/2007	2	--	5 U	--	--	--	12.3	15,100	6	--	27	--	--	--	25	--	--
	TP10-070622-6	6/22/2007	6	--	6 U	--	--	--	13.4	14,500	2 U	--	38	--	--	--	28	--	--
	TP10-070622-7.5	6/22/2007	7.5	--	6 U	--	--	--	19.2	13,200	3	--	43	--	--	--	26	--	--
	TP10-BA-080605-1	6/5/2008	1	--	1.9	--	--	--	28.9	18,100	6	--	48 J	--	--	--	29 J	--	--
TP11	TP11-070621-2	6/21/2007	2	--	6 U	--	--	--	69 J	17,400 J	3	--	46 J	--	--	--	35 J	--	--
	TP11-070621-6.5	6/21/2007	6.5	--	6 U	--	--	--	9.7 J	13,000 J	2 U	--	35 J	--	--	--	25 J	--	--
TP12	TP12-070622-1.5	6/22/2007	1.5	--	6.5	--	--	--	84.1	38,000	13	--	34	--	--	--	43	--	--
	TP12-070622-3	6/22/2007	3	--	5 U	--	--	--	6.7	11,300	2 U	--	21	--	--	--	19	--	--
	TP12-070622-7	6/22/2007	7	--	6 U	--	--	--	5.4	9,600	3 U	--	22	--	--	--	18	--	--
	TP12-BA-080605-2	6/5/2008	2	--	2.6	--	--	--	39.9	15,900	6	--	22 J	--	--	--	33 J	--	--
TP13	TP13-070625-2.5	6/25/2007	2.5	--	5 U	--	--	--	5.9	10,000	2 UJ	--	21	--	--	--	18	--	--
	TP13-070625-5	6/25/2007	5	--	5 U	--	--	--	5.9	11,700	2 UJ	--	24	--	--	--	22	--	--
	TP13-070625-8	6/25/2007	8	--	6 U	--	--	--	6.7	11,200	2 UJ	--	23	--	--	--	22	--	--
TP14	TP14-070626-2	6/26/2007	2	--	5 U	--	--	--	8.4	14,900	2 U	--	28 J	--	--	--	28	--	--
	TP14-070626-6	6/26/2007	6	--	5 U	--	--	--	4.1	8,400	2 U	--	19 J	--	--	--	17	--	--
	TP14-070626-8	6/26/2007	8	--	6 U	--	--	--	4.6	9,260	2 U	--	19 J	--	--	--	19	--	--
TP15	TP15-070621-2	6/21/2007	2	--	5 U	--	--	--	5.6 J	9,930 J	2 U	--	19 J	--	--	--	18 J	--	--
	TP15-070621-4	6/21/2007	4	--	5 U	--	--	--	5 J	10,100 J	2 U	--	21 J	--	--	--	19 J	--	--
	TP15-070621-6.5	6/21/2007	6.5	--	6 U	--	--	--	5.2 J	9,070 J	2 U	--	26 J	--	--	--	18 J	--	--
TP16	TP16-070622-2	6/22/2007	2	--	5 U	--	--	--	6.1	10,300	2 U	--	20	--	--	--	18	--	--
	TP16-070622-4	6/22/2007	4	--	5 U	--	--	--	6.0	11,300	2 U	--	22	--	--	--	21	--	--
	TP16-070622-7	6/22/2007	7	--	6 U	--	--	--	5.7	12,000	2 U	--	20	--	--	--	19	--	--
TP17	TP17-070626-2	6/26/2007	2	--	5 U	--	--	--	7.5	11,600	2 U	--	19 J	--	--	--	23	--	--
	TP17-070626-6	6/26/2007	6	--	6 U	--	--	--	4.5	8,590	2 U	--	20 J	--	--	--	17	--	--
	TP17-070626-8	6/26/2007	8	--	6 U	--	--	--	4.5	8,510	2 U	--	21 J	--	--	--	19	--	--
TP18	TP18-070626-1.5	6/26/2007	1.5	--	5 U	--	--	--	23	17,900	52	--	27 J	--	--	--	141	--	--
	TP18-070626-3	6/26/2007	3	--	5 U	--	--	--	4.3	7,460	2 U	--	18 J	--	--	--	17	--	--
	TP18-070626-8	6/26/2007	8	--	7 U	--	--	--	5.3	8,900	3 U	--	22 J	--	--	--	18	--	--
	TP18-BA-080605-2	6/5/2008	2	--	3.1	--	--	--	16.3	14,200	20	--	22 J	--	--	--	39 J	--	--
TP19	TP19-070621-2	6/21/2007	2	--	5 U	--	--	--	9.3 J	12,800 J	2 U	--	23 J	--	--	--	20 J	--	--
	TP19-070621-5.5	6/21/2007	5.5	--	5 U	--	--	--	4.9 J	9,130 J	2 U	--	19 J	--	--	--	18 J	--	--
	TP19-070621-7	6/21/2007	7	--	7 U	--	--	--	6.1 J	10,600 J	3 U	--	25 J	--	--	--	21 J	--	--
TP20	TP20-070625-2	6/25/2007	2	--	5 U	--	--	--	19.6	20,300	4 J	--	44	--	--	--	40	--	--
	TP20-070625-4	6/25/2007	4	--	5 U	--	--	--	19	18,800	2 UJ	--	47	--	--	--	33	--	--
	TP20-070625-6	6/25/2007	6	--	5 U	--	--	--	5.2	10,000	2 UJ	--	20	--	--	--	19	--	--
TP21	TP21-070625-2	6/25/2007	2	--	7.9 J	--	--	--	43.2	30,000	31 J	--	38	--	--	--	80	--	--
	TP21-070625-4	6/25/2007	4	--	5 U	--	--	--	26.2	17,800	33 J	--	44	--	--	--	58	--	--
TP22	TP22-070626-2	6/26/2007	2	--	64 J	--	--	--	1,630	371,000	40 U	--	140 J	--	--	--	20 U	--	--
	TP22-BS-080606-3	6/6/2008	3	--	2.0	--	--	--	9.5	15,300	3	--	28 J	--	--	--	32 J	--	--
	TP22-ASP-080606	6/6/2008	2	--	Arsenic III = 0.023 UJ Arsenic V = 1.00 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TP23	TP23-070622-0.5	6/22/2007	0.5	--	5 U	--	--	--	33.9	22,900	4	--	40	--	--	--	37	--	--
	TP23-070622-2	6/22/2007	2	--	5 U	--	--	--	15.3	15,200	2 U	--	39	--	--	--	26	--	--
	TP23-070622-7	6/22/2007	7	--	11	--	--	--	14.9	18,100	2 U	--	82	--	--	--	27	--	--
TP24	TP24-070622-2	6/22/2007	2	--	7 U	--	--	--	29.5	14,200	11	--	32	--	--	--	51	--	--
TP26	TP26-070622-2	6/22/2007	2	--	5 U	--	--	--	15.4	15,000	2 U	--	35	--	--	--	25	--	--
	TP26-070622-6.5	6/22/2007	6.5	--	6 U	--	--	--	15.6	14,200	2 U	--	49	--	--	--	28	--	--
TP27	TP27-070625-5	6/25/2007	5	--	6 U	--	--	--	14.8	16,800	3 J	--	41	--	--	--	34	--	--
TP28	TP28-070625-5	6/25/2007	5	--	6 U	--	--	--	97.1	24,600	4 J	--	57	--	--	--	40	--	--
TP30	TP30-070626-3.5	6/26/2007	3.5	--	5 U	--	--	--	6.7	14,800	2 U	--	32 J	--	--	--	42	--	--
	UBSS2-071212-.5	12/12/2007	0.5	--	41	--	--	--	776	208,000	80	--	80	--	--	--	60	--	--
TP32	TP32-071210-1.5	12/10/2007	1.5	--	51	--	--	--	5,810 J	119,000	10 U	--	21	--	--	--	159	--	--
	TP32-071210-5	12/10/2007	5	--	8.5	--	--	--	122 J	25,900	11	--	31	--	--	--	58	--	--
	TP32-BA-080606-3	6/6/2008	3	--	38.5	--	--	--	883	106,000	50	--	13 J	--	--	--	84 J	--	--
	TP32-ASP-080606	6/6/2008	2	--	Arsenic III = 0.053 J Arsenic V = 31.0 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	TP32-CS-080606	6/6/2008	surface soil	--	50.4	--	--	--	1,150	95,700	40	--	19 J	--	--	--	81 J	--	--

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METALS IN SOIL AND SLAG
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Location ID[1]	Sample ID	Collection Date	Sample Depth (feet bgs)	Metals														TCLP	
				Antimony (mg/kg)	Arsenic (III/V) (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	Arsenic (mg/L)	Lead (mg/L)
TP33	TP33-071211-2	12/11/2007	2	--	16	--	--	--	321 J	45,600	20	--	26	--	--	--	126	--	--
TP34	TP34-071210-1.5	12/10/2007	1.5	--	5.3	--	--	--	43 J	20,500	9	--	37	--	--	--	56	--	--
	TP34-071210-5	12/10/2007	5	--	22	--	--	--	144 J	46,000	17	--	29	--	--	--	120	--	--
TP37	TP37-071212-1.5	12/12/2007	1.5	--	1.5	--	--	--	8.7 J	16,400	2 U	--	32	--	--	--	27	--	--
	TP37-071212-5.5	12/12/2007	5.5	--	2.3	--	--	--	22.0	19,700	2 U	--	52	--	--	--	31	--	--
TP38	TP38-071212-1	12/12/2007	1	--	3.6	--	--	--	27.0	17,200	112	--	33	--	--	--	87	--	--
	TP38-071212-5	12/12/2007	5	--	2.6	--	--	--	29.1	23,100	6	--	51	--	--	--	37	--	--
	TP38-BA-080605-2	6/5/2008	2	--	3.0	--	--	--	23.8	18,400	147	--	36 J	--	--	--	79 J	--	--
TP39	TP39-071212-1	12/12/2007	1	--	2.4	--	--	--	21.1	18,700	13	--	32	--	--	--	51	--	--
	TP39-071212-5	12/12/2007	5	--	5.7	--	--	--	68.2	25,200	5	--	35	--	--	--	91	--	--
TP40	TP40-071212-.5	12/12/2007	0.5	--	47	--	--	--	1,230	269,000	60	--	100	--	--	--	70	--	--
	UBSS1-071212-.5	12/12/2007	0.5	--	56	--	--	--	1,080	243,000	50	--	90	--	--	--	60	--	--
	TP40-071212-5	12/12/2007	5	--	3.7	--	--	--	23.2	19,800	2 U	--	46	--	--	--	32	--	--
	TP40-BA-080605-1	6/5/2008	1	--	43.6	--	--	--	876	202,000	110	--	70 J	--	--	--	90 J	--	--
	TP40-CS-080605	6/5/2008	surface soil	--	44.0	--	--	--	1,050	260,000	210	--	90 J	--	--	--	80 J	--	--
TP41	TP41-071213-1	12/13/2007	1	--	3.1	--	--	--	36.8	18,200	8	--	24	--	--	--	47	--	--
	TP41-071213-3	12/13/2007	3	--	2.7	--	--	--	6.4	9,990	2 U	--	22	--	--	--	18	--	--
	TP41-BA-080605-2	6/5/2008	2	--	2.5	--	--	--	32.0	17,400	7	--	33 J	--	--	--	48 J	--	--
TP42	TP42-071212-2	12/12/2007	2	--	2.4	--	--	--	33.8	21,000	10	--	29	--	--	--	60	--	--
	TP42-071212-5	12/12/2007	5	--	2.6	--	--	--	43.6	20,300	9	--	27	--	--	--	56	--	--
	TP42-BA-080605-2.5	6/5/2008	2.5	--	2.0	--	--	--	38.3	18,200	35	--	26 J	--	--	--	63 J	--	--
TP43	TP43-071211-2	12/11/2007	2	--	2.3	--	--	--	15.5	15,400	2 U	--	34	--	--	--	28	--	--
	TP43-071211-5.5	12/11/2007	5.5	--	3.4	--	--	--	71.8	54,400	6 U	--	20	--	--	--	21	--	--
	TP43-071211-10	12/11/2007	10	--	6.7	--	--	--	250	29,200	8 U	--	4 U	--	--	--	9	--	--
Applicable Screening Levels																			
MTCA Method A[2]				--	**20**	--	**--**	**--**	--	--	**250**	**--**	--	--	--	--	--	--	--
MTCA Method B[3]				**32**	0.67	**160**	**80**	120,000	**3,000**	24,000	--	24	**1,600**	**400**	**400**	**5.6**	**1,600**	--	--
TEE Plants[4]				**5**	**18**	**10**	32	42	**70**	--	**120**	**0.3**	38	0.52	**560**	**1**	**160**	--	--
TEE Wildlife[4]				--	386	--	**14**	67	1,340	--	285	5.5	3,870	**0.3**	--	--	360	--	--
Background[5]				--	7	0.6	1	**48**	36	**58,700**	24	0.07	**48**	--	--	--	85	--	--
TCLP Values[6]				--	--	--	--	--	--	--	--	--	--	--	--	--	--	**5**	**5**

Notes:

[1] Approximate locations of soil samples are shown in Figures 3 and 4.

[2] MTCA Method A Soil Cleanup Levels for Unrestricted Land Use (Table 740-1; Chapter 173-340 WAC)

[3] MTCA Method B Soil Cleanup Levels based on soil direct contact. WAC 173-340-740 (Equations 740-1 and 740-2)

[4] Soil screening levels for Protection of Terrestrial Plants and Animals; soil biota not applicable per Terrestrial Ecological Evaluation (see Section 7 for discussion of TEE soil screening levels).

[5] Natural Background Soil Metals Concentrations in Washington State (Ecology, 1994). Puget Sound Region values presented.

[6] Maximum concentration of contaminants for the Toxicity Characteristics Leaching Procedure (40 CFR 261.24).

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

"--" = not analyzed or not applicable

"U" indicates analyte not detected. The number reported is the method reporting limit.

"J" value estimated by analytical laboratory

TCLP = Toxicity Characteristics Leaching Procedure

bgs = below ground surface

nd = Not detected

Bold and underline indicates value selected as human health and TEE soil screening level.

Shading indicates concentration exceeds at least one screening criteria and background.

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TABLE 4
SUMMARY OF CHEMICAL ANALYTICAL DATA
POLYCYCLIC AROMATIC HYDROCARBONS IN SOIL
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Location ID[1]	Sample ID	Collection Date	Sample Depth (feet bgs)	Noncarcinogenic Polycyclic Aromatic Hydrocarbons (µg/kg dry)												Carcinogenic Polycyclic Aromatic Hydrocarbons (µg/kg dry)							
				1-Methylnaphthalene	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(g,h,i)perylene	Dibenzofuran	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene	cPAH TEQ[4]
GeoEngineers (2007)																							
TP02	TP02-070625-2	6/25/2007	2	17	16	6.5 U	25	19	66	11	360	11	20	250	310	120	160	230	87	220	17	62	210
TP04	TP04-070627-2	6/27/2007	2	14	21	6.2 U	15	8.6	80	24	160	6.2 U	24	72	140	74	95	87	87	100	16	64	130
TP08	TP08-070621-4	6/21/2007	4	8.4	10	6.5 U	6.5 U	6.5 U	6.5 U	21	27	6.5 U	29	49	19	11	7.8	11	11	27	6.5 U	6.5 U	12
TP11	TP11-070621-2	6/21/2007	2	200 U	200 U	650 NJ	200 U	200 U	200 U	200 U	1,600	2,900	200 U	3,600	2,900	710	340 U	1,200 U	1,200 U	2,400	200 U	200 U	410
	TP11-070621-4	6/21/2007	4	290 UJ	290 UJ	730 J	290 UJ	290 UJ	290 UJ	290 UJ	610J	2,800J	290 UJ	320 UJ	1,300 J	460 J	290 UJ	290 UJ	290 UJ	1,500 J	290 UJ	290 UJ	264
	TP11-070621-6.5	6/21/2007	6.5	63 U	63 U	63 U	63 U	63 U	63 U	63 U	580	63 U	70 U	220 U	1,000	210	63 U	200 U	200 U	880	63 U	63 U	88
	TP11-070621-2seep	6/21/2007	2	68 U	68 U	68 U	68 U	68 U	68 U	68 U	140	140	68 U	110	280	68 U	68 U	75 U	75 U	210	68 U	68 U	54
TP24	TP24-070622-2	6/22/2007	2	1,000	3,300	1,600	74 U	240	81	840	1,600	3,400	1,300	2,200	3,700	900	380 NJ	840 U	840 U	2,800	74 U	74 U	590
TP26	TP26-070622-6.5	6/22/2007	6.5	60 U	60 U	790 NJ	60 U	180	60 U	120 UY	770	5,100	120 U	420 NJ	1,400	320	120 NJ	210 U	210 U	1,200	60 U	60 U	191
	TP26-070622-7	6/22/2007	7	58 U	58 U	2,500	58 U	300	58 U	58 U	910	14,000	220 U	540 U	2,200	400	58 U	340 U	340 U	1,900	58 U	58 U	130
TP27	TP27-070625-5	6/25/2007	5	6.5 U	6.5 U	6.5 U	6.5 U	6.5 U	6.5	6.5 U	18	6.5 U	6.5 U	21	19	11	7.8	7.1	7.1	19	6.5 U	6.5 U	11
TP28	TP28-070625-5	6/25/2007	5	15 U	22	15 U	15 U	16	15 U	28	84	71	15 U	220	96	41	19	19	19	86	15 U	15 U	29
TP29	TP29-070625-7	6/25/2007	7	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	4.8
TP22	TP22-070626-2	6/26/2007	2	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	4.8
DP02	DP02-070625-11	6/25/2007	11	51 U	51 U	51 U	51 U	51 U	51	51 U	520	51 U	51 U	200 U	970	290	51 U	130 U	130 U	620	51 U	51 U	64
	DP02-070625-13	6/25/2007	13	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	15
DP03	DP03-070626-11	6/26/2007	11	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	4.8
Applicable Screening Levels																							
MTCA Method B[2]				320,000	320,000	4,800,000	--	24,000,000	--	160,000	3,200,000	3,200,000	1,600,000	--	2,400,000	--	--	--	--	--	--	--	137
TEE Plants and Wildlife[3]				--	--	20,000	--	--	--	--	--	--	--	--	--	--	12,000	--	--	--	--	--	--

Notes:

[1] Approximate locations of soil samples are shown in Figures 3 and 4.

[2] MTCA Method B Soil Cleanup Levels based on soil direct contact. WAC 173-340-740 (Equations 740-1 and 740-2)

[3] Soil screening levels for Protection of Terrestrial Plants and Animals; soil biota not applicable per Terrestrial Ecological Evaluation (see Section 7 for discussion of TEE soil screening levels).

[4] Total cPAHs (toxic equivalent concentration), calculated using MTCA TEC methodology (WAC 173-340-708[8][e]). For non-detected cPAHs, one-half the practical quantitation limit was used in the calculation.

mg/kg = milligrams per kilogram

"--" = not analyzed

"U" = Analyte was not detected above the specified method reporting limit.

"J" value estimated by analytical laboratory

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TABLE 5
SUMMARY OF CHEMICAL ANALYTICAL DATA
PETROLEUM IN GROUNDWATER
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

			Laboratory Analytical Results			
Location ID[1]	**Sample ID**	**Sample Date**	**HCID**	**Diesel-range Hydrocarbons (mg/L)**	**Heavy Oil-range Hydrocarbons (mg/L)**	**Combined Total Petroleum Hydrocarbons[4] (mg/L)**
Hart Crowser (1996)[2,3]						
TP11	TP11, W-5	1996	--	--	0.2 U	0.2 U
TP12	TP12, W-4	1996	--	--	0.2 U	0.2 U
GeoEngineers (2007, 2009)						
DP01	DP01-070626-W	06/26/07	--	0.25 U	0.50 U	0.50 U
DP07	DP07-070626-W	06/26/07	--	0.25 U	0.50 U	0.50 U
MW02	MW02-070629	06/29/07	Diesel/Motor Oil	1.8 J	1.7 J	3.5 J
	MW03-070629 (dup)	06/29/07	--	0.25 UJ	0.50 UJ	0.50 UJ
	MW2-071212	12/12/07	DRO/RRO	0.52	0.54	1.1
	MW02-090109	01/09/09	DRO/Motor Oil	0.72 J	0.79	1.5
	MW02-090109-DUPE	01/09/09	--	0.25 UJ	0.50 U	0.50 U
MW03	MW03-070628	06/28/07	--	0.25 U	0.50 U	0.50 U
	MW3-071212	12/12/07	--	0.25 U	0.50 U	0.50 U
	MW03-090109	01/09/09	--	0.25 U	0.50 U	0.50 U
MW04	MW04-070628	06/28/07	--	0.25 U	0.50 U	0.50 U
	MW4-071212	12/12/07	--	0.25 U	0.50 U	0.50 U
	MW04-090109	01/09/09	--	0.25 U	0.50 U	0.50 U
MW05	MW05-070628	06/28/07	--	0.25 U	0.50 U	0.50 U
	MW5-071212	12/12/07	--	0.25 U	0.50 U	0.50 U
	MW05-090109	01/09/09	--	0.25 U	0.50 U	0.50 U
MTCA Method A Cleanup Level						0.5

Notes:

[1] Approximate locations of groundwater samples and monitoring wells are shown in Figure 4.

[2] It is not clear based on a review of the Hart Crowser report (1996) which test pits (TP-11 or TP-12) samples W-4 and W-5 were collected from. Table 2 of the Hart Crowser report presents the data as shown in this table. However, our review of the Hart Crowser report leads us to believe that sample W-4 was obtained from TP-11 and W-5 was obtained from TP-12.

[3] These samples likely are not representative of groundwater because they were obtained from with test pit explorations and not groundwater monitoring wells.

[4] Total Petroleum Hydrocarbons equals sum of diesel-range and heavy-oil range concentrations.

HCID = Hydrocarbon identification
MTCA = Model Toxics Control Act
DRO = Diesel Range Organics
RRO = Residual Range Organics
mg/L=milligrams per liter
"U" indicates analyte not detected. The number reported is the method reporting limit.
"J" value estimated by analytical laboratory
Shading indicates that the analyte was detected at a concentration exceeding the MTCA Method A groundwater cleanup level.

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TABLE 6
SUMMARY OF CHEMICAL ANALYTICAL DATA
METALS IN GROUNDWATER AND SURFACE WATER
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

				Metals								
Location ID[1]	Sample ID	Total/ Dissolved	Sample Date	Arsenic (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Zinc (µg/L)
Hart Crowser (1996) - Groundwater From Test Pit[2,3]												
TP11	TP11, W-5	Total	1996	4	5 U	10 U	330	33,000	290	0.2 U	26	870
TP12	TP12, W-4	Total	1996	22	5 U	10 U	10 U	8,800	3 U	0.2 U	27	26
GeoEngineers (2007) - Groundwater; Total Metals												
DP01	DP01-070626-W	Total	06/26/07	16.4	--	--	329	32,700	13	--	40	110
DP07	DP07-070626-W	Total	06/26/07	105	--	--	282	150,000	330	--	100	140
MW02	MW02-070629	Total	06/29/07	1.51	--	--	7	1,860 J	0.4	--	9.02	20
	MW03-070629 (dup)	Total	06/29/07	1.54	--	--	3	1,070 J	0.4 U	--	8.29	10 U
	MW2-071212	Total	12/12/07	1.3	--	--	4	230 U	1 U	--	37.9	10 U
	MW02-090109	Total	01/09/09	2.1	--	--	12	1430 J	1 U	--	48.2	10 U
	MW02-090109-DUPE	Total	01/09/09	1.9	--	--	10	710 J	1 U	--	40.5	10 U
MW03	MW03-070628	Total	06/28/07	4	--	--	10 U	260 J	10 U	--	11	50 U
	MW3-071212	Total	12/12/07	2	--	--	5	100 UJ	10 U	--	12	20 U
	MW03-090109	Total	01/09/09	4	--	--	4	100 U	10 U	--	17	20 U
MW04	MW04-070628	Total	06/28/07	0.47	--	--	2 U	380 J	0.4 U	--	3.28	10 U
	MW4-071212	Total	12/12/07	1.1	--	--	2 U	120 UJ	1 U	--	4.3	10 U
	MW04-090109	Total	01/09/09	1.6	--	--	2 U	170	1 U	--	5.4	10 U
MW05	MW05-070628	Total	06/28/07	1.87	--	--	2 U	230 J	0.4 U	--	3.19	10
	MW5-071212	Total	12/12/07	2.9	--	--	2 U	90 UJ	1 U	--	3.4	10 U
	MW05-090109	Total	01/09/09	2.1	--	--	2 U	50 U	1 U	--	3.9	10 U
GeoEngineers (2007) - Groundwater; Dissolved Metals												
MW02	MW02-070629	Dissolved	06/29/07	0.96 J	--	--	2 U	270 J	0.2 U	--	6.5	10 U
	MW03-070629 (dup)	Dissolved	06/29/07	0.91 J	--	--	2 U	260 J	0.2 U	--	6.4	10 U
	MW2-071212	Dissolved	12/12/07	1.2	--	--	2	50 UJ	1 U	--	34.7	10 U
	MW02-090109	Dissolved	01/09/09	1.6	--	--	12 J	120	1 U	--	53.4	10 U
	MW02-090109-DUPE	Dissolved	01/09/09	1.5	--	--	7 J	80	1 U	--	39.0	10 U
MW03	MW03-070628	Dissolved	06/28/07	2 U	--	--	10 U	250 UJ	10 U	--	10	50 U
	MW3-071212	Dissolved	12/12/07	2 U	--	--	10 U	250 UJ	10 U	--	13	50 U
	MW03-090109	Dissolved	01/09/09	5 U	--	--	4	100 U	10 U	--	18	20 U
MW04	MW04-070628	Dissolved	06/28/07	0.5 J	--	--	2 U	190 J	0.2 U	--	3.6	10 U
	MW4-071212	Dissolved	12/12/07	1.2	--	--	2 U	70 UJ	1 U	--	4.1	10 U
	MW04-090109	Dissolved	01/09/09	1.50	--	--	2 U	50 U	1 U	--	5.2	10 U
MW05	MW05-070628	Dissolved	06/28/07	1.8 J	--	--	2 U	50 UJ	0.2 U	--	3.0	10 U
	MW5-071212	Dissolved	12/12/07	2.6	--	--	2 U	50 UJ	1 U	--	3.9	10 U
	MW05-090109	Dissolved	01/09/09	2.2	--	--	2 U	50 U	1 U	--	4.0	10 U
GeoEngineers (2007) - Surface Water; Total Metals												
SW01	SW01-070629	Total	06/29/07	1.3	--	--	2 U	990 J	2.0	--	5.9	10 U
SW02	SW02-070629	Total	06/29/07	1.4	--	--	3	1,360 J	1.9	--	5.85	10 U
	SW01-070629 (dup)	Total	06/29/07	1.25	--	--	2	720 J	1.8	--	5.71	10 U
GeoEngineers (2007) - Surface Water; Dissolved Metals												
SW01	SW01-070629	Dissolved	06/29/07	0.93 J	--	--	2 U	50 UJ	0.2 U	--	2.9	10 U
SW02	SW02-070629	Dissolved	06/29/07	0.92 J	--	--	2 U	50 UJ	0.2 U	--	2.9	10 U
	SW01-070629 (dup)	Dissolved	06/29/07	0.92 J	--	--	2 U	50 UJ	0.2 U	--	3.0	10 U

TABLE 6
SUMMARY OF CHEMICAL ANALYTICAL DATA
METALS IN GROUNDWATER AND SURFACE WATER
DRAFT RI/FS

IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Location ID[1]	**Sample ID**	**Total/ Dissolved**	**Sample Date**	**Metals**								
				Arsenic (µg/L)	**Cadmium (µg/L)**	**Chromium (µg/L)**	**Copper (µg/L)**	**Iron (µg/L)**	**Lead (µg/L)**	**Mercury (µg/L)**	**Nickel (µg/L)**	**Zinc (µg/L)**
Applicable Screening Levels (MTCA Method A only applicable to arsenic in groundwater; other screening levels applicable to surface water and groundwater)												
MTCA Method A (groundwater only)[4]	--	--	--	5	--	--	--	--	--	--	--	--
Aquatic Life Marine Chronic (dissolved)[5]	--	--	--	36	8.8	50	2.4	--	8.1	0.025	8.2	81
Human Health Marine (dissolved)[6]	--	--	--	0.14	--	--	--	--	--	0.15	4,600	26,000
MTCA Method B Surface Water (total)[7]	--	--	--	0.098	20	240,000	2,700	--	--	--	1,100	17,000

Notes:

[1] Approximate locations of surface water samples and monitoring wells are shown in Figure 4.

[2] It is not clear based on a review of the Hart Crowser report (1996) which test pits (TP-11 or TP-12) samples W-4 and W-5 were collected from. Table 2 of the Hart Crowser report presents the data as shown in this table. However, our review of the Hart Crowser report leads us to believe that sample W-4 was obtained from TP-11 and W-5 was obtained from TP-12.

[3] These samples likely are not representative of groundwater because they were obtained from with test pit explorations and not groundwater monitoring wells.

[4] MTCA Method A cleanup levels for groundwater (Table 720-1; Chapter 173-340 WAC). This value is the arsenic background groundwater concentration for the State of Washington.

[5] Lowest available aquatic life marine chronic criteria from Chapter 173-201A, Clean Water Act Section 304, and National Toxics Rule (40 CFR 131). Metals criteria applicable to dissolved metals.

[6] Lowest available human health marine criteria from Clean Water Act Section 304 and National Toxics Rule (40 CFR 131)

[7] MTCA Method B surface water cleanup level [WAC 173-340-730(3)(b)(iii)]

µg/L = micrograms per liter

"--" = not analyzed or not applicable

"U" indicates analyte not detected. The number reported is the method reporting limit.

"J" value estimated by analytical laboratory

Shading indicates concentration exceeds at least one screening level.

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TABLE 7
SUMMARY OF CHEMICAL ANALYTICAL DATA
POLYCYCLIC AROMATIC HYDROCARBONS IN GROUNDWATER
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

				Noncarcinogenic Polycyclic Aromatic Hydrocarbons µg/L											Carcinogenic Polycyclic Aromatic Hydrocarbons µg/L							
Location ID[1]	**Sample Identification**	**Date Sampled**	**1-Methylnaphthalene**	**2-Methylnaphthalene**	**Acenaphthene**	**Acenaphthylene**	**Anthracene**	**Benzo(g,h,i)perylene**	**Dibenzofuran**	**Fluoranthene**	**Fluorene**	**Naphthalene**	**Phenanthrene**	**Pyrene**	**Benzo(a)anthracene**	**Benzo(a)pyrene**	**Benzo(b)fluoranthene**	**Benzo(k)fluoranthene**	**Chrysene**	**Dibenzo(a,h)anthracene**	**Indeno(1,2,3-cd)pyrene**	**cPAH TEQ**
GeoEngineers (2007)																						
DP01	DP01-070626-W	06/26/07	0.03	0.05	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.05	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
DP07	DP07-070626-W	06/26/07	0.02	0.03	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.05	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
MW02	MW02-070629	06/29/07	--	0.10 U	0.68	0.10 U	0.10 U	0.10 U	0.10 U	0.20	3.0	0.11 NJ	0.11 NJ	0.34 J	0.10 U	0.10 U	0.10 U	0.10 U	0.3 J	0.10 U	0.10 U	0.078 J
	MW03-070629 (dup)	06/29/07	--	0.10 U	0.53	0.10 U	0.10 U	0.10 U	0.10 U	0.10 UJ	2.2	0.10 U	0.10 U	0.10 U	0.10 UJ	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
	MW2-071212	12/12/07	0.010 U	0.010 U	0.010 U	0.010 U	0.017	0.010 U	0.010 U	0.014 U	0.010 U	0.011 U	0.010 U	0.059	0.010 U	0.010 U	0.013	0.010 U	0.059	0.010 U	0.010 U	0.0089
	MW02-090109	01/09/09	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.048	0.021	0.010 UJ	0.010 U	0.010 U	0.060	0.010 U	0.010 U	0.0097
	MW02-090109-DUPE	01/09/09	0.010 U	0.010 U	0.010 U	0.010 U	0.022	0.010 U	0.010 U	0.02	0.011	0.010 U	0.02	0.063	0.028	0.032 J	0.010 U	0.010 U	0.081	0.010 U	0.010 U	0.038 J
MW03	MW03-070628	06/28/07	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.01	0.010 U	0.021	0.010 U	0.010 U	0.015	0.023	0.015	0.012	0.016	0.010 U	0.015	0.010 U	0.010 U	0.017
	MW3-071212	12/12/07	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.013 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
	MW03-090109	01/09/09	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
MW04	MW04-070628	06/28/07	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
	MW4-071212	12/12/07	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.012 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
	MW04-090109	01/09/09	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.012 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
MW05	MW05-070628	06/28/07	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.018	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
	MW5-071212	12/12/07	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.012 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
	MW05-090109	01/09/09	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.012 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Applicable Screening Criteria																						
Aquatic Life Marine Chronic[2]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Human Health Marine[3]	--	--	--	--	990	--	40,000	--	--	140	5,300	--	--	4,000	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
MTCA Method B Surface Water[4]	--	--	--	--	640	--	26,000	--	--	90	3,500	4,900	--	2,600	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Notes:

[1] Approximate locations of monitoring wells are shown in Figure 3.

[2] Lowest available aquatic life marine chronic criteria from Chapter 173-201A, Clean Water Act Section 304, and National Toxics Rule (40 CFR 131)

[3] Lowest available human health marine criteria from Clean Water Act Section 304 and National Toxics Rule (40 CFR 131)

[4] MTCA Method B surface water cleanup level [WAC 173-340-730(3)(b)(iii)]

Shading indicates concentration exceeds at least one screening level.

µg/L = micrograms per liter

"--" = not analyzed or not applicable

"U" indicates analyte not detected. The number reported is the method reporting limit.

"J" value estimated by analytical laboratory

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TABLE 8
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IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

	Sample ID				**Field Screening Results[2]**					
Location ID[1]	**Sample ID**	**Collection Date**	**Sample Depth (feet or inches bgs)**		**Headspace Vapors (ppm)**	**Sheen**	**HCID**	**Diesel-range Hydrocarbons[3] (mg/kg)**	**Heavy Oil-range Hydrocarbons[3] (mg/kg)**	**Combined Total Petroleum Hydrocarbons[4] (mg/kg)**
Hart Crowser (1996)										
SS-1	SS-1	Mar-07	6	inches	--	--	0.1 U	--	--	--
SS-2	SS-2	Mar-07	6	inches	--	--	0.1 U	--	--	--
Ecology (2005)										
05284010; Location 001	05284010; Location 001	11/3/2005	0.3 to 0.5	feet	--	--	SW heavy fuel oil	--	40,600	40,600
05284011; Location 002	05284011; Location 002	11/3/2005	0.25	feet	--	--	SW heavy fuel oil	--	550	550
05444013; Location 004	05444013; Location 004	11/3/2005	0.25	feet	--	--	SW heavy fuel oil	--	1,000	1,000
Jefferson County (2007)										
Location 1	07034900, Location 1	1/16/2007	6	inches	--	--	nd	--	--	--
	07034901, Location 1	1/16/2007	12	inches	--	--	nd	--	--	--
	07034902, Location 1	1/16/2007	18	inches	--	--	nd	--	--	--
Location 2	07034903, Location 2	1/16/2007	6	inches	--	--	EW heavy fuel oil	--	88	88
	07034904, Location 2	1/16/2007	12	inches	--	--	EW heavy fuel oil	--	63	63
	07034905, Location 2	1/16/2007	18	inches	--	--	EW heavy fuel oil	--	97	97
Location 3	07034906, Location 3	1/16/2007	6	inches	--	--	EW heavy fuel oil	--	240	240
	07034907, Location 3	1/16/2007	12	inches	--	--	EW heavy fuel oil	--	2,300	2300
	07034908, Location 3	1/16/2007	18	inches	--	--	EW heavy fuel oil	--	610	610
Location 4	07034909, Location 4	1/16/2007	6	inches	--	--	EW heavy fuel oil	--	170	170
	07034910, Location 4	1/16/2007	12	inches	--	--	EW heavy fuel oil	--	670	670
	07034911, Location 4	1/16/2007	18	inches	--	--	EW heavy fuel oil	--	104	104
Location 5	07034912, Location 5	1/16/2007	6	inches	--	--	VW heavy fuel oil	--	110	110
	07034913, Location 5	1/16/2007	12	inches	--	--	VW heavy fuel oil	--	230	230
	07034914, Location 5	1/16/2007	18	inches	--	--	VW heavy fuel oil	--	450	450
Location 6	07034915, Location 6	1/16/2007	6	inches	--	--	nd	--	--	--
	07034916, Location 6	1/16/2007	12	inches	--	--	nd	--	--	--
	07034917, Location 6	1/16/2007	18	inches	--	--	nd	--	--	--
Location 7	07034918, Location 7	1/16/2007	6	inches	--	--	VW heavy fuel oil	--	180	180
	07034919, Location 7	1/16/2007	12	inches	--	--	nd	--	--	--
	07034920, Location 7	1/16/2007	18	inches	--	--	VW heavy fuel oil	--	745	745
Location 8	07034921, Location 8	1/16/2007	6	inches	--	--	nd	--	--	--
	07034922, Location 8	1/16/2007	12	inches	--	--	nd	--	--	--
	07034923, Location 8	1/16/2007	18	inches	--	--	nd	--	--	--
Location 9	07034924, Location 9	1/16/2007	6	inches	--	--	nd	--	--	--
	07034925, Location 9	1/16/2007	12	inches	--	--	nd	--	--	--
	07034926, Location 9	1/16/2007	18	inches	--	--	nd	--	--	--

TABLE 8
SUMMARY OF CHEMICAL ANALYTICAL DATA
PETROLEUM IN INTERTIDAL SEDIMENT
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IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Location ID[1]	Sample ID				Field Screening Results[2]		HCID	Diesel-range Hydrocarbons[3] (mg/kg)	Heavy Oil-range Hydrocarbons[3] (mg/kg)	Combined Total Petroleum Hydrocarbons[4] (mg/kg)
	Sample ID	Collection Date	Sample Depth (feet or inches bgs)		Headspace Vapors (ppm)	Sheen				
Location 10	07034927, Location 10	1/16/2007	6	inches	--	--	nd	--	--	--
	07034928, Location 10	1/16/2007	12	inches	--	--	nd	--	--	--
	07034929, Location 10	1/16/2007	18	inches	--	--	nd	--	--	--
Location 11	07034930, Location 11	1/16/2007	6	inches	--	--	nd	--	--	--
	07034931, Location 11	1/16/2007	12	inches	--	--	nd	--	--	--
	07034932, Location 11	1/16/2007	18	inches	--	--	VW heavy fuel oil	--	39	39
Location 12	07034933, Location 12	1/16/2007	6	inches	--	--	EW heavy fuel oil	--	--	--
	07034934, Location 12	1/16/2007	12	inches	--	--	EW heavy fuel oil	--	--	--
	07034935, Location 12	1/16/2007	18	inches	--	--	EW heavy fuel oil	--	--	--
GeoEngineers (2007)										
SED01	SED01-070628-0-4	06/28/2007	0-4	inches	0	NS	--	5.3 U	13	13
	SED01-070628-4-24	06/28/2007	4-24	inches	0	VSS	DRO/Motor Oil	13	34	47
SED02	SED02-070628-0-4	06/28/2007	0-4	inches	0	NS	Motor Oil	11	45	56
	SED02-070628-4-18	06/28/2007	4-18	inches	1	MS	DRO/Motor Oil	7,200	8,500	15700
SED03	SED03-070629-0-4	06/29/2007	0-4	inches	0	NS	DRO/RRO	10	27	37
	SED03-070629-4-12	06/29/2007	4-12	inches	0	NS	--	ARCHIVED		--
SED05	SED05-070628-0-4	06/28/2007	0-4	inches	0	NS	--	5.5 U	11 U	--
	SED05-070628-4-24	06/28/2007	4-24	inches	0	NS	--	ARCHIVED		
	SED05-070628-24-36	06/28/2007	24-36	inches	0	NS	--	ARCHIVED		
SED06	SED06-070628-0-4	06/28/2007	4-24	inches	0	NS	--	ARCHIVED		
	SED06-070628-4-24	06/28/2007	24-36	inches	0	NS	--	ARCHIVED		
	SED06-070628-24-36	06/28/2007	0-4	inches	0	NS	RRO	5.4 U	14	14
SED07	SED07-070628-0-4	06/28/2007	0-4	inches	0	NS	--	6.1 U	12 U	--
	SED07-070628-4-24	06/28/2007	4-24	inches	0	NS	--	ARCHIVED		
SED09	SED09-070629-0-4	06/29/2007	0-4	inches	0	NS	DRO/RRO	9.4	21	30.4
	SED09-070629-4-24	06/29/2007	4-24	inches	0	NS	--	ARCHIVED		
SED11	SED11-070628-0-4	06/28/2007	0-4	inches	0	NS	--	5.8 U	12 U	--
	SED11-070628-4-24	06/28/2007	4-24	inches	0	NS	--	ARCHIVED		
SED16	SED16-070628-0-4	06/28/2007	0-4	inches	0	NS	--	5.9 U	12 U	--
	SED16-070628-4-24	06/28/2007	4-24	inches	0	NS	--	ARCHIVED		
SED17	SED17-070629-0-4	06/29/2007	0-4	inches	0	NS	--	5.8 U	12 U	--
	SED17-070629-4-24	06/29/2007	4-24	inches	0	NS	--	ARCHIVED		
SED18	SED18-071210-2.5	12/10/2007	2.5	feet	0	SS	--	ARCHIVED		
	SED18-071210-5	12/10/2007	5	feet	0	MS	DRO/Motor Oil	3,200	2,900	6100
	SED18-071210-7.5	12/10/2007	7.5	feet	0	MS	DRO/Motor Oil	620	670	1290
	SED18-071210-10	12/10/2007	10	feet	0	MS	DRO/Motor Oil	450	500	950
	SED18-071210-12.5	12/10/2007	12.5	feet	0	NS	DRO/Motor Oil	22	35	57
SED20	SED20-071210-1.5	12/10/2007	1.5	feet	0	MS	DRO/Motor Oil	1,000	1,000	2000
	SED20-071210-3.5	12/10/2007	3.5	feet	0	MS	DRO/Motor Oil	110	120	230
	SED20-071210-5	12/10/2007	5	feet	0	MS	DRO/Motor Oil	460	490	950
	SED20-071210-6.5	12/10/2007	6.5	feet	0	NS	DRO	7.9	12 U	7.9

TABLE 8
SUMMARY OF CHEMICAL ANALYTICAL DATA
PETROLEUM IN INTERTIDAL SEDIMENT
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Location ID[1]	**Sample ID**				**Field Screening Results[2]**		**HCID**	**Diesel-range Hydrocarbons[3] (mg/kg)**	**Heavy Oil-range Hydrocarbons[3] (mg/kg)**	**Combined Total Petroleum Hydrocarbons[4] (mg/kg)**
	Sample ID	**Collection Date**	**Sample Depth (feet or inches bgs)**		**Headspace Vapors (ppm)**	**Sheen**				
SED21	SED21-071210-2.5	12/10/2007	2.5	feet	0	SS	DRO/Motor Oil	120	230	350
	SED21-071210-5	12/10/2007	5	feet	0	NS	DRO	9.7	18	27.7
	SED21-071210-7.5	12/10/2007	7.5	feet	0	NS	--	ARCHIVED		
SED22	SED22-071210-2.5	12/10/2007	2.5	feet	0	NS	--	ARCHIVED		
	SED22-071210-5	12/10/2007	5	feet	0	NS	--	ARCHIVED		
	SED22-071210-7.5	12/10/2007	7.5	feet	0	NS	--	ARCHIVED		
SED23	SED23-071210-2.5	12/10/2007	2.5	feet	0	NS	DRO/RRO	6.4	14	20.4
	SED23-071210-5	12/10/2007	5	feet	0	NS	--	ARCHIVED		
	SED23-071210-7.5	12/10/2007	7.5	feet	0	NS	--	ARCHIVED		
MTCA Method A Soil Cleanup Level[5]										**2,000**
Sediment bioassay screening level[6]										**136**

Notes:

[1] Approximate locations of sediment samples are shown in Figures 3 and 4.

[2] Field screening methods are described in Appendix A. NS=No sheen; SS=slight sheen; MS=moderate sheen; HS=heavy sheen. Headspace vapors measured with a TLV combustible gas indicator or photoionozation detector (PID).

[3] Analyzed by Ecology Method NWTPH-Dx

[4] Combined Total Petroleum Hydrocarbons equals sum of diesel-range and heavy-oil range concentrations.

[5] MTCA Method A soil cleanup levels for unrestricted land use (Table 740-1;Chapter 173-340WAC).

[6] This value is a sediment screening level derived from bioassays conducted on intertidal sediments obtained at the Irondale Site (see Appendix D).

MTCA = Model Toxics Control Act
HCID = Hydrocarbon identification
DRO = Diesel Range Organics
RRO = Residual Range Organics
mg/kg=milligrams per kilogram
ppm=parts per million
Shading indicates that the analyte was detected at a concentration exceeding the sediment bioassay screening level of 136 mg/kg.
"U" indicates analyte not detected. The number reported is the method reporting limit.
"EW" indicates extremely weathered as noted by analytical laboratory.
"VW" indicates very weathered as noted by analytical laboratory.
"SW" indicates severely weathered as noted by analytical laboratory.

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TABLE 9a

SUMMARY OF CHEMICAL ANALYTICAL DATA - SMS ANALYTES IN INTERTIDAL SEDIMENT (VALUES PRESENTED AS DRY WEIGHT OR ORGANIC CARBON NORMALIZED PER SMS)[2]

DRAFT RI/FS

IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Chemical	SED01-070628-0-4	SED01-070628-4-24	SED02-070628-0-4	SED02-070628-4-18	SED03-070628-0-4	SED05-070628-0-4	SED06-070628-0-4	SED07-070628-0-4	SED09-070628-0-4	SED11-070628-0-4	SED16-070628-0-4	SED17-070628-0-4	SED18-0701210-5	SED20-0701210-1.5	SED21-0701210-5	SMS Criteria[2]	
																SQS	CSL
Conventionals																	
Total Solids (%)	91.1	83	89.2	73.2	78.9	87.2	90.5	80.4	85	89.4	92.3	91	81.4	81.7	78.4	--	--
Total Volatile Solids (%)	4.56 J	1.3 J	3.9 J	8.03 J	2.2 J	1.74 J	0.01 UJ	2.15 J	1.79 J	5.61 J	0.01 UJ	1.97 J	--	--	--	--	--
Total Organic Carbon (%)	0.162 J	0.376 J	0.339 J	10.4 J	0.84 J	0.791 J	0.206 J	0.284 J	1.03 J	0.258 J	0.214 J	0.752 J	6.24	3.21	1.11	--	--
Ammonia (mg/kg)	0.23	0.12	0.16	0.16	5.17	0.41	0.24	0.16	1.05	1.88	0.18	1.02	--	--	--	--	--
Total Sulfides (mg/kg)	1,120 J	827 J	1,860 J	2,000 J	2,600	252 J	527 J	47.9 J	87.7	902 J	242 J	1,210	--	--	--	--	--
Grain Size (%)																	
Gravel	47.4	27.3	25.5	55.8	30.8	32.4	25.4	21.5	23.4	40.1	41.3	25.6	--	--	--	--	--
Sand, Very Coarse	27.2	9.0	21.8	14.8	16.2	17.5	10.7	28.3	9.3	24.7	19.9	26.6	--	--	--	--	--
Sand, Coarse	7.9	15.8	16.9	11.0	5.5	39.3	16.3	32.7	9.7	12.2	22.8	13.8	--	--	--	--	--
Sand, Medium	3.9	32.3	17.3	7.3	8.2	6.1	21.8	9.1	17.6	7.4	5.9	8.2	--	--	--	--	--
Sand, Fine	10.5	13.6	14.2	4.2	27.9	2.7	21.8	6.4	30.8	11.2	8.4	21.8	--	--	--	--	--
Sand Very Fine	0.9	1.4	1.1	0.8	10.4	1.1	3.6	1.1	7.9	2.2	1.7	2.1	--	--	--	--	--
Silt, Coarse	0	0	0	4.2	0	0	0	0	0	0	0	0	--	--	--	--	--
Silt, Medium	0	0	0	0.5	0	0	0	0	0	0	0	0	--	--	--	--	--
Silt, Fine	0	0	0	0.4	0	0	0	0	0	0	0	0	--	--	--	--	--
Silt, Very Fine	0	0	0	0.3	0	0	0	0	0	0	0	0	--	--	--	--	--
Clay, 8-9 Phi	0	0	0	0.2	0	0	0	0	0	0	0	0	--	--	--	--	--
Clay, 9-10 Phi	0	0	0	0.1	0	0	0	0	0	0	0	0	--	--	--	--	--
Clay, >10 Phi	0	0	0	0.5	0	0	0	0	0	0	0	0	--	--	--	--	--
Metals (mg/kg dry weight)																	
Arsenic	30 U	5 U	30 U	20 U	10 U	30 U	10 U	6 U	10 U	30 U	10 U	30 U	--	--	--	57	93
Cadmium	1 U	0.2 U	1 U	0.8	0.6 U	1 U	0.5 U	0.2U	0.6 U	1 U	0.5 U	1 U	--	--	--	5.1	6.7
Chromium	24	21.6	13	9	15	13	10	18.1	16	12	16	13	--	--	--	260	270
Copper	42	54.3	29	91.1	26.8	18.0	8.8	7.2	35.3	40	20.4	24	--	--	--	390	390
Iron	23,700	21,800	17,100	14,300	15,700	9,880	9,580	11,300	25,100	13,600	26,100	12,400	--	--	--	--	--
Lead	10 U	6	10 U	7 U	7	10 U	5 U	2 U	11	10 U	5 U	10 U	--	--	--	450	530
Mercury	0.04 U	0.05 U	0.05 U	0.06 U	0.06 U	0.04 U	0.04 U	0.05 U	0.04 U	0.05 U	0.04 U	0.04 U	--	--	--	0.41	0.59
Silver	2 U	0.3 U	2 U	1 U	0.9U	2U	0.8 U	0.4 U	0.9 U	2 U	0.8 U	2 U	--	--	--	6.1	6.1
Zinc	43	79	32	160	44	16	16	21	57	8	22	22	--	--	--	410	960
LPAHs (mg/kg OC)																	
Acenaphthylene	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	66	66
Acenaphthene	37.65 U[6]	16.49 U[6]	<18.29[6]	4.33 U	7.38 U	7.71 U	30.1 U[6]	21.5 U[6]	6.02 U	<23.64[6]	<28.97[6]	8.11 U	1.92 U	2.52 U	1.80 U	16	57
Anthracene	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	220	1,200
Fluorene	37.65 U[6]	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U[6]	21.5 U	6.02 U	<23.64[6]	<28.97[6]	8.11 U	1.92 U	2.52 U	1.80 U	23	79
Naphthalene	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	99	170
Phenanthrene	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	12.64	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	2.16	100	480
1-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	1.92 U	2.52 U	1.80 U		
2-Methylnaphthalene	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	38	64
Total LPAH[3]	ND	ND	ND	ND	ND	12.64	ND	ND	ND	ND	ND	ND	ND	ND	2.16	370	780
HPAHs (mg/kg OC)																	
Benzo(a)anthracene	37.65 U	16.49 U	18.29 U	6.83	7.38 U	8.47	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	4.97	2.52 U	1.80 U	110	270
Benzo(a)pyrene	37.65 U	16.49 U	18.29 U	17.31(7)	7.38 U	5.69 J	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	99	210
Benzo(b)fluoranthene	37.65 U	16.49 U	18.29 U	4.62	7.38 U	5.82 J	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	--	--
Benzo(k)fluoranthene	37.65 U	16.49 U	18.29 U	4.62	7.38 U	4.93 J	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	2.08	2.52 U	1.80 U	--	--
Total Benzofluoranthenes[4]	ND	ND	ND	9.24	ND	10.75 J	ND	ND	ND	ND	ND	ND	2.08	ND	ND	230	450
Benzo(g,h,i)perylene	37.65 U[6]	16.49 U	18.29 U	2.69 J	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	31	78
Chrysene	37.65 U	16.49 U	18.29 U	31.73(7)	7.38 U	8.98	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	12.8	6.23	1.80 U	110	460
Dibenzo(a,h)anthracene	3.77 U	1.65 U	1.83 U	1.35 U	0.738 U	0.771 U	3.01 U	2.15 U	0.602 U	2.364 U	2.897 U	0.811 U	1.92 U	2.49 U	0.559 U	12	33
Fluoranthene	37.65 U	16.49 U	18.29 U	3.65 J	4.76 J	18.96	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	4.49	2.52 U	3.24	160	1,200
Indeno(1,2,3-cd)pyrene	37.65 U[6]	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	34	88
Pyrene	37.65 U	16.49 U	18.29 U	22.12	4.05 J	16.43	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	12.3	8.10	3.6	1,000	1,400
Total HPAHs[5]	ND	ND	ND	102.21	8.81	66.63	ND	ND	ND	ND	ND	ND	38.8	14.3	6.84	960	5,300
Chlorinated Hydrocarbons (mg/kg OC)																	
Hexachlorobenzene	3.77 U[6]	1.65 U[6]	1.83 U[6]	**1.35 U**	0.738 U[6]	0.771 U[6]	3.01 U[6]	2.15 U[6]	0.602 U[6]	2.364 U[6]	2.897 U[6]	0.811 U[6]	1.92 U[6]	2.49 U[6]	0.559 U[6]	0.38	2.3
Hexachlorobutadiene	3.77 U	1.65 U	1.83 U	1.35 U	0.738 U	0.771 U	3.01 U	2.15 U	0.602 U	2.364 U	2.897 U	0.811 U	1.92 U	2.49 U	0.559 U	3.9	6.2
1,2-Dichlorobenzene	3.77 U[6]	1.65 U	1.83 U	1.35 U	0.738 U	0.771 U	3.01 U[6]	2.15 U	0.602 U	2.364 U[6]	2.897 U[6]	0.811 U	1.92 U	2.49 U[6]	0.559 U	2.3	2.3
1,3-Dichlorobenzene	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	--	--
1,4-Dichlorobenzene	3.77 U[6]	1.65 U	1.83 U	1.35 U	0.738 U	0.771 U	3.01 U	2.15 U	0.602 U	2.364 U	2.897 U	0.811 U	1.92 U	2.49 U	0.559 U	3.1	9
1,2,4-Trichlorobenzene	3.77 U[6]	1.65 U[6]	1.83 U[6]	**1.35 U**	0.738 U	0.771 U	3.01 U[6]	2.15 U[6]	0.602 U	2.364 U[6]	2.897 U[6]	0.811 U	1.92 U[6]	2.49 U[6]	0.559 U	0.81	1.8

TABLE 9a

SUMMARY OF CHEMICAL ANALYTICAL DATA - SMS ANALYTES IN INTERTIDAL SEDIMENT (VALUES PRESENTED AS DRY WEIGHT OR ORGANIC CARBON NORMALIZED PER SMS)[2]

DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Chemical	SED01-070628-0-4	SED01-070628-4-24	SED02-070628-0-4	SED02-070628-4-18	SED03-070628-0-4	SED05-070628-0-4	SED06-070628-0-4	SED07-070628-0-4	SED09-070628-0-4	SED11-070628-0-4	SED16-070628-0-4	SED17-070628-0-4	SED18-0701210-5	SED20-0701210-1.5	SED21-0701210-5	SMS Criteria[2]	
																SQS	CSL
Phthalates (mg/kg OC)																	
Diethyl phthalate	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	3.69	61	110
Dimethyl phthalate	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	53	53
Di-n-butyl phthalate	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	220	1700
Di-n-octyl phthalate	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	1.80 U	58	4500
Bis (2-ethylhexyl) phthalate	37.65 U	16.49 U	18.29 U	4.33 U	7.38 U	7.71 U	30.1 U	21.5 U	6.02 U	23.64 U	28.97 U	8.11 U	1.92 U	2.52 U	2.25	47	78
Butyl benzyl phthalate	3.77 U	1.65 U	1.83 U	1.35 U	0.738 U	0.771 U	3.01 U	2.15 U	0.602 U	2.364 U	2.897 U	0.811 U	1.92 U	2.52 U	1.44 U	4.9	64
Phenols & Misc. (µg/kg dry weight)																	
Pentachlorophenol	30 U	31 U	31 U	**680 U**	31 U	30 U	31 U	30 U	31 U	31 U	31 U	31 U	**610 U**	**400 U**	31 U	360	690
Phenol	61 U	62 U	62 U	**450 U**	32 U	61 U	62 U	61 U	62 U	61 U	61	61 U	120 U	81 U	20 U	420	1,200
2 Methylphenol	6.1 U	6.2 U	6.2 U	**140 U**	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	**120 U**	**80 U**	6.2 U	63	63
4 Methylphenol	61 U	62 U	<62	450 U	32 U	61 U	62 U	61 U	62 U	61 U	300	61 U	120 U	81 U	20 U	670	670
2,4-Dimethylphenol	6.1 UJ	6.2 UJ	6.2 UJ	**140 UJ**	6.2 UJ	6.1 UJ	6.2 UJ	6.1 UJ	6.2 UJ	6.1 UJ	6.2 UJ	6.1 UJ	140	88	6.2	29	29
Miscellaneous Compounds (µg/kg dry weight)																	
Benzoic acid (dry weight)	610 U	620 U	320 U	**4,500 U**	620 U	610 U	620 U	610 U	620 U	610 U	620 U	610 U	**1,200 U**	**810 U**	200 U	650	650
Benzyl alcohol (dry weight)	30 UJ	31 UJ	31 UJ	**450 U**	31 UJ	30 UJ	31 UJ	30 UJ	31 UJ	31 UJ	31 UJ	31 UJ	**120 U**	**81 U**	20 U	57	73
Dibenzofuran (TOC normalized)	37.65 U[6]	16.49 U[6]	18.29 U[6]	4.3 U	7.38 U	7.71 U	30.1 U[6]	21.5 U[6]	6.02 U	23.64 U[6]	28.97 U[6]	8.11 U	1.92 U	2.52 U	1.80 U	15	58
N-Nitrosodiohenylamine (TOC normalized)	3.77 U	1.65 U	1.83 U	4.33 U	0.738 U	0.771 U	3.01 U	2.15 U	0.602 U	2.364 U	2.897 U	0.811 U	1.92 U	2.49 U	0.559 U	11	11

Notes:

[1] Approximate locations of sediment samples are shown in Figure 4.

[2] SMS = Sediment Management Standards Criteria; SQS = Sediment Quality Standards; CSL = Cleanup Screening Level.

[3] Total LPAHs = The sum of Acenaphthalene, Acenaphthene, Anthracene, Fluorene, Napthalene and Phenanthrene.

[4] Total benzofluoranthenes = The sum of the "b" and "k" isomers.

[5] Total HPAHs = The sum of Benzo(a)anthracene, Benzo(a) pyrene, Total Benzofluoranthenes, Benzo(g,h,i)perylene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-c,d)pyrene and pyre

[6] Elevated non-detections are due to normalization by total organic carbon content. The dry weight values were less than the Puget Sound Estuary Program dry weight apparent effects thresholds (see Table 9l

[7] Dry weight chemical concentrations (for organic carbon-normalized chemicals) were also compared against 1988 Puget Sound Estuary Program dry weight apparent effects thresholds to evaluate effectes of total organic carbon levels in these samples (i.e., less than 0.5 percent or greater than 3.5 percent; see Table 9b and Section 6.3.2.1 for detai

Shading indicates that the detected concentration exceeds the SMS SQS (see Note 7 for SED02-070628-4-18 benzo(a)pyrene and chrysene exceedances).

Bold indicates elevated non-detections that are greater than the applicable Puget Sound apparent effects thresholds

< = Chemical not detected above reported level.

ND = not detected

-- = Not available or not applicable.

"UJ" = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate.

"U" = indicates analyte not detected. The number reported is the method reporting limit

"J" = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

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TABLE 9b

SUMMARY OF CHEMICAL ANALYTICAL DATA - SMS ANALYTES IN INTERTIDAL SEDIMENT (VALUES PRESENTED AS DRY WEIGHT FOR CHEMICALS WITH ORGANIC CARBON NORMALIZED DATA IN TABLE 9A) [2]

DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Chemical	SED01-070628-0-4	SED01-070628-4-24	SED02-070628-0-4	SED02-070628-4-18	SED03-070628-0-4	SED05-070628-0-4	SED06-070628-0-4	SED07-070628-0-4	SED09-070628-0-4	SED11-070628-0-4	SED16-070628-0-4	SED17-070628-0-4	SED18-0701210-5	SED20-0701210-1.5	SED21-0701210-5	1988 PSEP[2]	
																LAET	2LAET
Conventionals																	
Total Solids (%)	91.1	83	89.2	73.2	78.9	87.2	90.5	80.4	85	89.4	92.3	91	81.4	81.7	78.4	--	--
Total Volatile Solids (%)	4.56 J	1.3 J	3.9 J	8.03 J	2.2 J	1.74 J	0.01 UJ	2.15 J	1.79 J	5.61 J	0.01 UJ	1.97 J	--	--	--	--	--
Total Organic Carbon (%)	0.162 J	0.376 J	0.339 J	10.4 J(7)	0.84 J	0.791 J	0.206 J	0.284 J	1.03 J	0.258 J	0.214 J	0.752 J	6.24(7)	3.21(7)	1.11	--	--
Ammonia (mg/kg)	0.23	0.12	0.16	0.16	5.17	0.41	0.24	0.16	1.05	1.88	0.18	1.02	--	--	--	--	--
Total Sulfides (mg/kg)	1,120 J	827 J	1,860 J	2,000 J	2,600	252 J	527 J	47.9 J	87.7	902 J	242 J	1,210	--	--	--	--	--
LPAHs (ug/kg dry weight)																	
Acenaphthylene	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	1,300	1,300
Acenaphthene	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	500	730
Anthracene	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	960	4,400
Fluorene	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	540	1,000
Naphthalene	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	2,100	2,400
Phenanthrene	61 U	62 U	62 U	450 U	62 U	100	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	24	1,500	5,400
1-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	120 U	81 U	20 U	--	--
2-Methylnaphthalene	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	670	1,400
Total LPAH[5]	ND	ND	ND	ND	ND	100	ND	ND	ND	ND	ND	ND	ND	ND	24	5,200	13,000
HPAHs (ug/kg dry weight)																	
Benzo(a)anthracene	61 U	62 U	62 U	710	62 U	67	62 U	61 U	62 U	61 U	62 U	61 U	310	81 U	20 U	1,300	1,600
Benzo(a)pyrene	61 U	62 U	62 U	1,800	62 U	45 J	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	1,600	3,000
Benzo(b)fluoranthene	61 U	62 U	62 U	480	62 U	46 J	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	--	--
Benzo(k)fluoranthene	61 U	62 U	62 U	480	62 U	39 J	62 U	61 U	62 U	61 U	62 U	61 U	130	81 U	20 U	--	--
Total Benzofluoranthenes[6]	ND	ND	ND	960	ND	85 J	ND	ND	ND	ND	ND	ND	130	ND	ND	3,200	3,600
Benzo(g,h,i)perylene	61 U	62 U	62 U	280 J	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	670	720
Chrysene	61 U	62 U	62 U	3,300	62 U	71	62 U	61 U	62 U	61 U	62 U	61 U	800	200	20 U	1,400	2,800
Dibenzo(a,h)anthracene	6.1 U	6.2 U	6.2 U	140 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	120 U	80 U	6.2 U	230	540
Fluoranthene	61 U	62 U	62 U	380 J	40 J	150	62 U	61 U	62 U	61 U	62 U	61 U	280	81 U	36	1,700	2,500
Indeno(1,2,3-cd)pyrene	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	600	690
Pyrene	61 U	62 U	62 U	2,300	34 J	130	62 U	61 U	62 U	61 U	62 U	61 U	770	260	40	2,600	3,300
Total HPAHs[7]	ND	ND	ND	9,730	74	548	ND	ND	ND	ND	ND	ND	2,290	460	76	12,000	17,000
Chlorinated Hydrocarbons (ug/kg dry weight)																	
Hexachlorobenzene	6.1 U	6.2 U	6.2 U	**140 U**	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	**120 U**	**80 U**	6.2 U	22	70
Hexachlorobutadiene	6.1 U	6.2 U	6.2 U	**140 U**	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	**120 U**	**80 U**	6.2 U	11	120
1,2-Dichlorobenzene	6.1 U	6.2 U	6.2 U	**140 U**	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	**120 U**	**80 U**	6.2 U	35	50
1,3-Dichlorobenzene	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	--	--
1,4-Dichlorobenzene	6.1 U	6.2 U	6.2 U	**140 U**	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	**120 U**	80 U	6.2 U	110	120
1,2,4-Trichlorobenzene	6.1 U	6.2 U	6.2 U	**140 U**	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	**120 U**	**80 U**	6.2 U	31	51
Phthalates (ug/kg dry weight)																	
Diethyl phthalate	61 U	62 U	62 U	**450 U**	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	41 U	200	1,200
Dimethyl phthalate	61 U	62 U	62 U	**450 U**	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	**120 U**	**81 U**	20 U	71	160
Di-n-butyl phthalate	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	1,400	5,100
Di-n-octyl phthalate	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	6,200	--
Bis (2-ethylhexyl) phthalate	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	25	1,300	1,900
Butyl benzyl phthalate	6.1 U	6.2 U	6.2 U	**140 U**	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	**120 U**	**81 U**	16 U	63	900
Miscellaneous Compounds (µg/kg dry weight)																	
Dibenzofuran	61 U	62 U	62 U	450 U	62 U	61 U	62 U	61 U	62 U	61 U	62 U	61 U	120 U	81 U	20 U	540	700
N-Nitrosodiohenylamine	6.1 U	6.2 U	6.2 U	**450 U**	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	6.2 U	6.1 U	**120 U**	**80 U**	6.2 U	28	40

Notes:

[1] Approximate locations of sediment samples are shown in Figure 4.

[2] PSEP = Puget Sound Estuary Program; LAET = LowestM Apparent Effects Threshold; 2LAET = Second Lowest Apparent Effects Threshold (PSEP, 1988).

[3] Total LPAHs = The sum of Acenaphthalene, Acenaphthene, Anthracene, Fluorene, Napthalene and Phenanthrene.

[4] Total benzofluoranthenes = The sum of the "b" and "k" isomers.

[5] Total HPAHs = The sum of Benzo(a)anthracene, Benzo(a) pyrene, Total Benzofluoranthenes, Benzo(g,h,i)perylene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-c,d)pyrene and pyrene.

Shading indicates that the detected concentration exceeds the SMS SQS (see Note 7 for SED02-070628-4-18 benzo(a)pyrene and chrysene exceedances).

Bold indicates elevated non-detections that are greater than the applicable Puget Sound apparent effects thresholds.

< = Chemical not detected above reported level.

ND = not detected

-- = Not available or not applicable.

"UJ" = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate.

"U" = indicates analyte not detected. The number reported is the method reporting limit.

"J" = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

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TABLE 10a

SMS CHEMISTRY FOR SUBTIDAL SURFACE (0–10 CM) SEDIMENT GRABS (VALUES PRESENTED AS DRY WEIGHT OR ORGANIC CARBON NORMALIZED PER SMS)^{1}

DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Station Number Collection Date	WA SMS SQS	WA SMS CSL	ID-04-SD (SED4) 12/7/2007	Q	ID-50-SD (SED50) 11/30/2007	Q	ID-51-SD (SED51) 11/30/2007	Q	ID-52-SD (SED52) 11/30/2007	Q	ID-53-SD (SED53) 11/30/2007	Q	ID-54-SD (SED54) 11/30/2007	Q	ID-55-SD (SED55) 12/7/2007	Q	ID-56-SD (SED56) 11/30/2007	Q	ID-57-SD (SED57) 11/30/2007	Q	ID-58-SD SED58) 12/7/2007	Q	ID-59-SD (SED59) 12/7/2007	Q
Metals in mg/kg dw																								
Arsenic	57	93	7	U	7	U	7		6	U	7	U	7	U	6	U	8	U	7	U	7	U	7	U
Cadmium	5.1	6.7	0.3	U	1.2		1.2		0.4		0.8		0.4		0.7		0.5		1		0.3	U	0.3	
Chromium	260	270	18.5	J	16	J	14.7	J	17.6	J	15.1	J	8.4	J	10.6	J	16.9	J	9.6	J	11.8	J	22.1	J
Copper	390	390	28.5		8.9		10.7		25.5		10.5		4.9		4.4		13.9		9.2		11		10.6	
Lead	450	530	8		3		3	U	4		3	U	3	U	3	U	5		3	U	3	U	4	
Mercury	0.41	0.59	0.06	U	0.05	U	0.05	U	0.05	U	0.07	U	0.07	U	0.05	U	0.07	U	0.08	U	0.06	U	0.07	U
Silver	6.1	6.1	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	3	U	0.4	U	0.4	U	0.04	U
Zinc	410	960	68	J	30	J	29	J	35	J	28	J	16	J	18	J	36	J	19	J	21	J	39	J
LPAH in mg/kg TOC																								
Naphthalene	99	170	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	UJ	1.9	UJ	5.3	U	2	J	1.8	UJ	1.7	U	2.7	U
Acenaphthylene	66	66	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	J	1.9	UJ	5.3	U	0.9	UJ	1.8	UJ	1.7	U	2.7	U
Acenaphthene	16	57	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	UJ	1.9	UJ	5.3	U	0.9	UJ	1.8	UJ	1.7	U	2.7	U
Fluorene	23	79	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	UJ	1.9	UJ	5.3	U	1.5	J	1.8	UJ	1.7	U	2.7	U
Phenanthrene	100	480	4.9	U	1.3	UJ	4.8	J	26.6	J	8.6	J	1.9	UJ	5.3	U	11.2	J	1.8	J	1.7	U	2.7	U
Anthracene	220	1,200	4.9	U	1.3	UJ	1.7	UJ	6.7	J	2.3	J	1.9	UJ	5.3	U	2.5	J	1.8	UJ	1.7	U	2.7	U
2-Methylnaphthalene	38	64	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	UJ	1.9	UJ	5.3	U	0.9	UJ	1.8	UJ	1.7	U	2.7	U
Total LPAH	370	780	4.9	U	1.3	UJ	4.8	J	33.3	J	12.1	J	1.9	UJ	5.3	U	17.1	J	1.8	J	1.7	U	2.7	U
HPAH in mg/kg TOC																								
Fluoranthene	160	1,200	4.9	U	2.2	J	7.4	J	40.8	J	14.7	J	1.9	UJ	9.5		23.7	J	3.7	J	1.7	U	2.7	U
Pyrene	1,000	1,400	4.9	U	2.2	J	8.5	J	40.8	J	15.3	J	1.9	UJ	9.8		22.8	J	4.2	J	1.7	U	2.7	U
Benzo(a)anthracene	110	270	4.9	U	1.3	UJ	3.3	J	15.6	J	5.8	J	1.9	UJ	5.3	U	10.7	J	1.8	UJ	1.7	U	2.7	U
Chrysene	110	460	4.9	U	1.5	J	4.2	J	16	J	6.7	J	1.9	UJ	5.3	U	11.2	J	1.9	J	1.7	U	2.7	U
Benzofluoranthenes	230	450	4.9	U	1.3	UJ	5.2	J	23.9	J	11.9	J	1.9	UJ	5.3	U	20	J	2.1	J	1.7	U	2.7	U
Benzo(a)pyrene	99	210	4.9	U	1.3	UJ	3.5	J	16.3	J	6.1	J	1.9	UJ	5.3	U	11.6	J	1.9	J	1.7	U	2.7	U
Indeno(1,2,3-cd)pyrene	34	88	4.9	U	1.3	UJ	1.7	UJ	6.2	J	1.7	J	1.9	UJ	5.3	U	3.3	J	1.8	UJ	1.7	U	2.7	U
Dibenz(a,h)anthracene	12	33	4.9	U	1.3	UJ	1	J	1.6	J	0.9	J	0.6	UJ	1.6	U	0.3	J	0.5	UJ	0.5	U	2.7	U
Benzo(g,h,i)perylene	31	78	4.9	U	1.3	UJ	1.7	UJ	6.4	J	1.5	J	1.9	UJ	5.3	U	3.3	J	1.8	UJ	1.7	U	2.7	U
Total HPAH	960	5,300	4.9	U	5.9	J	33.1	J	167.6	J	64.6	J	1.9	UJ	19.3		106.9	J	13.7	J	1.7	U	2.7	U
Chlorinated Aromatics in mg/kg TOC																								
1,3-Dichlorobenzene	—	—	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	UJ	1.9	UJ	5.3	U	0.9	UJ	1.8	UJ	1.7	U	2.7	U
1,4-Dichlorobenzene	3.1	9	1.6	U	0.4	UJ	0.5	UJ	1.1	UJ	0.4	UJ	0.6	UJ	1.6	U	0.3	UJ	0.5	UJ	0.5	U	0.8	U
1,2-Dichlorobenzene	2.3	2.3	1.6	U	0.4	UJ	0.5	UJ	1.1	UJ	0.4	UJ	0.6	UJ	1.6	U	0.3	UJ	0.5	UJ	0.5	U	0.8	U
1,2,4-Trichlorobenzene	0.81	1.8	1.6	U	0.41	UJ	0.53	UJ	1.08	UJ	0.37	UJ	0.58	UJ	1.61	U	0.28	UJ	0.54	UJ	0.52	U	0.84	U
Hexachlorobenzene	0.38	2.3	1.6	U	0.41	UJ	0.53	UJ	1.08	UJ	0.37	UJ	0.58	UJ	1.61	U	0.28	UJ	0.54	UJ	0.52	U	0.84	U
Phthalate Esters in mg/kg TOC																								
Dimethylphthalate	53	53	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	UJ	1.9	UJ	5.3	U	0.9	UJ	1.8	UJ	1.7	U	2.7	U
Diethylphthalate	61	110	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	UJ	1.9	J	5.3	U	0.9	UJ	1.8	UJ	1.7	U	2.7	U
Di-n-Butylphthalate	220	1,700	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.5	J	1.9	UJ	9		1.2	J	6.8	J	6.4		9	
Butylbenzylphthalate	4.9	64	1.6	U	0.4	UJ	0.5	UJ	1.1	UJ	0.4	UJ	0.6	UJ	1.6	U	0.3	UJ	0.5	UJ	0.5	U	0.8	U
bis(2-Ethylhexyl)phthalate	47	78	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	5.3	J	1.9	J	7.9		3.1	J	1.8	UJ	1.7		2.7	U
Di-n-Octylphthalate	58	4,500	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	UJ	1.9	UJ	5.3	U	0.9	UJ	1.8	UJ	1.7	U	2.7	U
Ionizable Organic Compounds in µg/kg dw																								
Phenol	420	1,200	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	97	J	20	UJ	32		27	
2-Methylphenol	63	63	6.1	U	6.2	UJ	6.2	UJ	6.1	UJ	6.1	UJ	6.1	UJ	6.1	U	6	UJ	6.1	UJ	6.1	U	6.2	U
4-Methylphenol	670	670	19	U	28	J	20	UJ	20	UJ	52	J	20	UJ	20	U	69	J	20	UJ	20	U	20	U
2,4-Dimethylphenol	29	29	6.1	U	6.2	UJ	6.2	UJ	6.1	UJ	6.1	UJ	6.1	UJ	6.1	U	6	UJ	6.1	UJ	6.1	U	6.2	U
Pentachlorophenol	360	690	30	U	31	UJ	31	UJ	30	UJ	30	UJ	30	UJ	31	U	30	UJ	30	UJ	30	U	31	U
Benzyl Alcohol	57	73	19	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	19	UJ	20	UJ	20	U	20	U
Benzoic Acid	650	650	190	U	200	UJ	200	UJ	200	UJ	200	UJ	200	UJ	200	U	190	UJ	200	UJ	200	U	200	U

TABLE 10a

SMS CHEMISTRY FOR SUBTIDAL SURFACE (0–10 CM) SEDIMENT GRABS (VALUES PRESENTED AS DRY WEIGHT OR ORGANIC CARBON NORMALIZED PER SMS)[1]

DRAFT RI/FS

IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Station Number Collection Date	WA SMS SQS	WA SMS CSL	ID-04-SD (SED4) 12/7/2007	Q	ID-50-SD (SED50) 11/30/2007	Q	ID-51-SD (SED51) 11/30/2007	Q	ID-52-SD (SED52) 11/30/2007	Q	ID-53-SD (SED53) 11/30/2007	Q	ID-54-SD (SED54) 11/30/2007	Q	ID-55-SD (SED55) 12/7/2007	Q	ID-56-SD (SED56) 11/30/2007	Q	ID-57-SD (SED57) 11/30/2007	Q	ID-58-SD SED58) 12/7/2007	Q	ID-59-SD (SED59) 12/7/2007	Q
Miscellaneous Extractables in mg/kg TOC																								
Dibenzofuran	15	58	4.9	U	1.3	UJ	1.7	UJ	3.5	UJ	1.2	UJ	1.9	UJ	5.3	U	0.9	UJ	1.8	UJ	1.7	U	2.7	U
Hexachlorobutadiene	3.9	6.2	1.6	U	0.4	UJ	0.5	UJ	1.1	UJ	0.4	UJ	0.6	UJ	1.6	U	0.3	UJ	0.5	UJ	0.5	U	0.8	U
N-Nitrosodiphenylamine	11	11	1.6	U	0.4	UJ	0.5	UJ	1.1	UJ	0.4	UJ	0.6	UJ	1.6	U	0.3	UJ	0.5	UJ	0.5	U	0.8	U
Diesel Range Hydrocarbons	–	–	64.4	U	16.6	UJ	21.2	UJ	44.3	UJ	15.3	UJ	23.6	UJ	66	U	11.6	UJ	22.1	UJ	21.2	U	34	U
Motor Oil	–	–	128.9	U	33.1	UJ	42.4	UJ	88.7	UJ	30.7	UJ	47.2	UJ	131.9	U	23.3	UJ	44.2	UJ	42.4	U	67.9	U
PCBs in mg/kg TOC																								
Aroclor-1016	–	–	4.9	U	1.3	UJ	1.6	UJ	3.4	UJ	1.2	UJ	1.9	UJ	5	U	0.9	UJ	1.8	UJ	1.6	U	2.7	U
Aroclor-1242	–	–	4.9	U	1.3	UJ	1.6	UJ	3.4	UJ	1.2	UJ	1.9	UJ	5	U	0.9	UJ	1.8	UJ	1.6	U	2.7	U
Aroclor-1248	–	–	4.9	U	1.3	UJ	1.6	UJ	3.4	UJ	1.2	UJ	1.9	UJ	5	U	0.9	UJ	1.8	UJ	1.6	U	2.7	U
Aroclor-1254	–	–	4.9	U	1.3	UJ	1.6	UJ	3.4	UJ	1.2	UJ	1.9	UJ	5	U	0.9	UJ	1.8	UJ	1.6	U	2.7	U
Aroclor-1260	–	–	4.9	U	1.3	UJ	1.6	UJ	3.4	UJ	1.2	UJ	1.9	UJ	5	U	0.9	UJ	1.8	UJ	1.6	U	2.7	U
Aroclor-1221	–	–	4.9	U	1.3	UJ	1.6	UJ	3.4	UJ	1.2	UJ	1.9	UJ	5	U	0.9	UJ	1.8	UJ	1.6	U	2.7	U
Aroclor-1232	–	–	4.9	U	1.3	UJ	1.6	UJ	3.4	UJ	1.2	UJ	1.9	UJ	5	U	0.9	UJ	1.8	UJ	1.6	U	2.7	U
Total PCBs	12	65	4.9	U	1.3	UJ	1.6	UJ	3.4	UJ	1.2	UJ	1.9	UJ	5	U	0.9	UJ	1.8	UJ	1.6	U	2.7	U

Notes:

[1] Data table from SAIC Draft Data Report dated April 21, 2008 (See Table 2, Appendix C).

dw = dry weight

Q = Data qualification

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

U - The compound was analyzed for, but was not detected above, the reported sample quantitation limit.

UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate.

LPAH = low molecular weight polycyclic aromatic hydrocarbons

HPAH = high molecular weight polycyclic aromatic hydrocarbons

Shading indicates that sample exceeds SMS SQL criteria

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TABLE 10b

SMS CHEMISTRY FOR SUBTIDAL SURFACE (0–10 CM) SEDIMENT GRABS (VALUES PRESENTED AS DRY WEIGHT FOR CHEMICALS WITH ORGANIC CARBON NORMALIZED DATA IN TABLE 10A) [1]

DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Station Number Collection Date	1988 PSEP LAET	1988 PSEP 2LAET	ID-04-SD (SED4) 12/7/2007	Q	ID-50-SD (SED50) 11/30/2007	Q	ID-51-SD (SED51) 11/30/2007	Q	ID-52-SD (SED52) 11/30/2007	Q	ID-53-SD (SED53) 11/30/2007	Q	ID-54-SD (SED54) 11/30/2007	Q	ID-55-SD (SED55) 12/7/2007	Q	ID-56-SD (SED56) 11/30/2007	Q	ID-57-SD (SED57) 11/30/2007	Q	ID-58-SD SED58) 12/7/2007	Q	ID-59-SD (SED59) 12/7/2007	Q
LPAH in mg/kg DW																								
Naphthalene	2,100	2,400	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	42	J	20	UJ	20	U	20	U
Acenaphthylene	1,300	1,300	19	U	20	UJ	20	UJ	20	UJ	20	J	20	UJ	20	U	19	UJ	20	UJ	20	U	20	U
Acenaphthene	500	730	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	19	UJ	20	UJ	20	U	20	U
Fluorene	540	1,000	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	32	J	20	UJ	20	U	20	U
Phenanthrene	1,500	5,400	19	U	20	UJ	57	J	150	J	140	J	20	UJ	20	U	240	J	20	J	20	U	20	U
Anthracene	960	4,400	19	U	20	UJ	20	UJ	38	J	38	J	20	UJ	20	U	53	J	20	UJ	20	U	20	U
2-Methylnaphthalene	670	1,400	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	19	UJ	20	UJ	20	U	20	U
Total LPAH	5,200	13,000	19	U	20	UJ	57	J	188	J	198	J	20	UJ	20	U	367	J	20	J	20	U	20	U
HPAH in mg/kg DW																								
Fluoranthene	1,700	2,500	19	U	33	J	87	J	230	J	240	J	20	UJ	36	0	510	J	42	J	20	U	20	U
Pyrene	2,600	3,300	19	U	33	J	100	J	230	J	250	J	20	UJ	37	0	490	J	47	J	20	U	20	U
Benzo(a)anthracene	1,300	1,600	19	U	20	UJ	39	J	88	J	94	J	20	UJ	20	U	230	J	20	UJ	20	U	20	U
Chrysene	1,400	2,800	19	U	23	J	50	J	90	J	110	J	20	UJ	20	U	240	J	21	J	20	U	20	U
Benzofluoranthenes	3,200	3,600	19	U	20	UJ	61	J	135	J	194	J	20	UJ	20	U	430	J	24	J	20	U	20	U
Benzo(a)pyrene	1,600	3,000	19	U	20	UJ	41	J	92	J	100	J	20	UJ	20	U	250	J	21	J	20	U	20	U
Indeno(1,2,3-cd)pyrene	600	690	19	U	20	UJ	20	UJ	35	J	27	J	20	UJ	20	U	72	J	20	UJ	20	U	20	U
Dibenz(a,h)anthracene	230	540	19	U	20	UJ	12	J	9	J	14	J	6	UJ	6	U	7	J	6	UJ	6	U	20	U
Benzo(g,h,i)perylene	670	720	19	U	20	UJ	20	UJ	36	J	24	J	20	UJ	20	U	70	J	20	UJ	20	U	20	U
Total HPAH	12,000	17,000	19	U	89	J	390	J	945	J	1053	J	20	UJ	73	0	2299	J	155	J	20	U	20	U
Chlorinated Aromatics in mg/kg DW																								
1,3-Dichlorobenzene	—	—	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	19	UJ	20	UJ	20	U	20	U
1,4-Dichlorobenzene	110	120	6	U	6	UJ	6	UJ	6	UJ	6	UJ	6	UJ	6	U	6	UJ	6	UJ	6	U	6	U
1,2-Dichlorobenzene	35	50	6	U	6	UJ	6	UJ	6	UJ	6	UJ	6	UJ	6	U	6	UJ	6	UJ	6	U	6	U
1,2,4-Trichlorobenzene	31	51	6	U	6	UJ	6	UJ	6	UJ	6	UJ	6	UJ	6	U	6	UJ	6	UJ	6	U	6	U
Hexachlorobenzene	22	70	6	U	6	UJ	6	UJ	6	UJ	6	UJ	6	UJ	6	U	6	UJ	6	UJ	6	U	6	U
Phthalate Esters in mg/kg DW																								
Dimethylphthalate	71	160	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	19	UJ	20	UJ	20	U	20	U
Diethylphthalate	200	1,200	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	J	20	U	19	UJ	20	UJ	20	U	20	U
Di-n-Butylphthalate	1,400	5,100	19	U	20	UJ	20	UJ	20	UJ	24	J	20	UJ	34	0	26	J	77	J	75	0	66	0
Butylbenzylphthalate	63	900	6	U	6	UJ	6	UJ	6	UJ	6	UJ	6	UJ	6	U	6	UJ	6	UJ	6	U	6	U
bis(2-Ethylhexyl)phthalate	1,300	1,900	19	U	20	UJ	20	UJ	20	UJ	87	J	20	J	30	0	67	J	20	UJ	20	0	20	U
Di-n-Octylphthalate	6,200	--	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	19	UJ	20	UJ	20	U	20	U
Miscellaneous Extractables in mg/kg DW																								
Dibenzofuran	540	700	19	U	20	UJ	20	UJ	20	UJ	20	UJ	20	UJ	20	U	19	UJ	20	UJ	20	U	20	U
Hexachlorobutadiene	11	120	6	U	6	UJ	6	UJ	6	UJ	6	UJ	6	UJ	6	U	6	UJ	6	UJ	6	U	6	U
N-Nitrosodiphenylamine	28	40	6	U	6	UJ	6	UJ	6	UJ	6	UJ	6	UJ	6	U	6	UJ	6	UJ	6	U	6	U
Diesel Range Hydrocarbons	—	—	250	U	250	UJ	250	UJ	250	UJ	250	UJ	250	UJ	250	U	250	UJ	250	UJ	250	U	250	U
Motor Oil	—	—	500	U	500	UJ	500	UJ	500	UJ	500	UJ	500	UJ	500	U	500	UJ	500	UJ	500	U	500	U
PCBs in mg/kg DW																								
Aroclor-1016	—	—	19	U	19	UJ	19	UJ	19	UJ	20	UJ	20	UJ	19	U	19	UJ	20	UJ	19	U	20	U
Aroclor-1242	—	—	19	U	19	UJ	19	UJ	19	UJ	20	UJ	20	UJ	19	U	19	UJ	20	UJ	19	U	20	U
Aroclor-1248	—	—	19	U	19	UJ	19	UJ	19	UJ	20	UJ	20	UJ	19	U	19	UJ	20	UJ	19	U	20	U
Aroclor-1254	—	—	19	U	19	UJ	19	UJ	19	UJ	20	UJ	20	UJ	19	U	19	UJ	20	UJ	19	U	20	U
Aroclor-1260	—	—	19	U	19	UJ	19	UJ	19	UJ	20	UJ	20	UJ	19	U	19	UJ	20	UJ	19	U	20	U
Aroclor-1221	—	—	19	U	19	UJ	19	UJ	19	UJ	20	UJ	20	UJ	19	U	19	UJ	20	UJ	19	U	20	U
Aroclor-1232	—	—	19	U	19	UJ	19	UJ	19	UJ	20	UJ	20	UJ	19	U	19	UJ	20	UJ	19	U	20	U
Total PCBs	130	1,000	19	U	19	UJ	19	UJ	19	UJ	20	UJ	20	UJ	19	U	19	UJ	20	UJ	19	U	20	U

Notes:

[1] Table 10a edited to include dry weight data for organic carbon normalized chemicals; data for Table 10b received by GeoEngineers from SAIC on August 5, 2009. Table 10a from SAIC Draft Data Report dated April 14, 2009 (see Table 2, Appendix C)

DW = dry weight; LAET = lowest apparent effects threshold (PSEP, 1988); 2LAET = second lowest apparent effects threshold

Q = Data qualification

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

U - The compound was analyzed for, but was not detected above, the reported sample quantitation limit.

UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate.

LPAH = low molecular weight polycyclic aromatic hydrocarbons

HPAH = high molecular weight polycyclic aromatic hydrocarbons

Shading indicates that sample exceeds SMS SQL criteria

TABLE 11

CONVENTIONAL PARAMETERS FOR SUBTIDAL SURFACE (0–10 CM) SEDIMENT GRABS[1]

DRAFT RI/FS

IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Station Number Collection Date Conventionals	**ID-04-SD (SED4) 12/7/2007**	**Q**	**ID-50-SD (SED50) 11/30/2007**	**Q**	**ID-51-SD (SED51) 11/30/2007**	**Q**	**ID-52-SD (SED52) 11/30/2007**	**Q**	**ID-53-SD (SED53) 11/30/2007**	**Q**	**ID-54-SD (SED54) 11/30/2007**	**Q**	**ID-55-SD (SED55) 12/7/2007**	**Q**	**ID-56-SD (SED56) 11/30/2007**	**Q**	**ID-57-SD (SED57) 11/30/2007**	**Q**	**ID-58-SD SED58) 12/7/2007**	**Q**	**ID-59-SD (SED59) 12/7/2007**	**Q**
TOC (% dw)	0.388	J	1.51	J	1.18	J	0.564	J	1.63	J	1.06	J	0.379	J	2.15	J	1.13	J	1.18	J	0.736	J
TVS (% dw)	1.31		2.32	J	2.34	J	1.66	J	2.93		1.37	J	1.42		3.27	J	2.28	J	1.34		2.36	
Total Solids (% ww)	77.5		67		72.9		70.9		58.4	J	68.8		73.4		58		64		73		63.9	
Ammonia (mg-N/kg dw)	2.95		10.9		19		12.6		30		12.8		5.36		12.1		7.62		3.54		5.13	
Total Sulfides (mg/kg dw)	707	J	126	J	371	J	690	J	73.7	J	1130	J	148	J	290	J	201	J	131	J	110	J
Grain Size (mm)^2																						
9.5 (gravel)	0.1		0.1		0.1		0.1		0.1		2.1		0.1		0.1		0.1		0.1		0.1	
4.75 (gravel)	1.1		0.1		0.1		1.2		0.1		0.5		0.1		0.6		0.1		0.1		0.1	
2 (sand)	1.9		0.2		0.5		1.4		1.1		0.8		0.1		1.1		0.7		0.4		0.1	
0.85 (sand)	7.4		2.5		3.3		6.5		5.5		3		1.1		1.8		1.8		2		0.2	
0.425 (sand)	11.8		6.7		7.3		12.8		13		11		8.1		8.7		6.2		11.4		1.4	
0.25 (sand)	14.7		14		16.5		14.1		17.4		24.4		22.3		20.5		18.6		28.7		6.2	
0.15 (sand)	28		28.3		30.6		19.1		24.6		28.6		27.6		23.1		31.7		29.7		13.8	
0.075 (silt)	30.4		30.2		26.3		31.7		22.9		21.5		29.1		23.2		25.5		17.6		30.2	
0.032 (silt)	0.4		8.3		6		6.1		5.9		2.3		5.1		2.7		5.1		1.1		34.2	J
0.022 (silt)	0.4		1.8		1.8		1.8		0.9		0.1		0.9		1.9		1.4		0.1		1	
0.013 (silt)	0.1		1.3		0.9		0.4		1.4		0.1		0.9		1.9		1.4		0.9		1	
0.009 (silt)	0.1		0.1		0.5		0.1		0.1		0.1		0.9		2.9		0.1		0.9		2.1	
0.007 (silt)	0.8		0.1		0.1		0.1		0.9		1.7		0.5		1.9		1.4		1.4		1.5	
0.0032 (silt)	0.8		1.8		1.4		0.9		1.8		0.4		0.5		1.9		1.4		1.8		2.1	
0.0013 (clay)	0.1		1.3		1.4		0.9		0.5		0.9		0.9		2.9		1.4		0.5		2.1	
<0.0013 (clay)	2.4		3.6		3.6		3.1		4.1		3		1.9		4.8		3.6		3.6		4.1	

Note:

[1] Data table from SAIC Draft Data Report dated April 21, 2008 (See Table 3, Appendix C).

[2] Grain size by wet-sieving

Q = Data qualification J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

TOC = total organic carbon percentage by weight.

TVS = total volatile soilds percentage by weight

TABLE 12a
SMS CHEMISTRY FOR INTERTIDAL BIOASSAY SEDIMENT GRABS (VALUES PRESENTED AS DRY WEIGHT OR ORGANIC CARBON NORMALIZED PER SMS) [1]
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

SampleID	**WA**	**WA**	**ID-100-15-21-SD (SED100)**			**ID-101-8-14-SD (SED101)**			**ID-102-9-15-SD (SED102)**			**ID-108-12-18-SD (SED108)**			**ID-000-MIX**			**ID-MIX-000-D***		
Collection Date	**SQS**	**CSL**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**
Metals in mg/kg DW																				
Arsenic	57	93	10	U	U	20	U	U	20	U	U	6	U	U	6	U	U	--	--	--
Cadmium	5.1	6.7	0.6	U	U	0.6	U	U	0.6	U	U	0.2	U	U	0.2	U	U	--	--	--
Chromium	--	--	17	--	--	16	--	--	14	--	--	20.1	--	--	18.4	--	--	--	--	--
Copper	390	390	113	--	--	112	--	--	76.7	--	--	19.7	--	--	30.4	--	--	--	--	--
Lead	450	530	25	--	--	17	--	--	10	--	--	4	--	--	8	--	--	--	--	--
Mercury	0.41	0.59	0.06	--	--	0.07	--	--	0.05	--	--	0.05	U	U	0.04	U	U	--	--	--
Silver	6.1	6.1	0.9	U	U	0.9	U	U	0.9	U	U	0.3	U	U	0.4	U	U	--	--	--
Zinc	410	960	144	--	--	99	--	--	57	--	--	29	--	--	124	--	--	--	--	--
LPAH in mg/kg TOC																				
Naphthalene	99	170	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Acenaphthylene	66	66	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Acenaphthene	16	57	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Fluorene	23	79	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Phenanthrene	100	480	0.99	U	U	0.24	J	J	0.65			0.43	J	J	0.23	U	J	0.47	U	DNR
Anthracene	220	1200	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
1-Methylnaphthalene	—	—	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
2-Methylnaphthalene	38	64	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Total LPAH	960	5300	0.99	U	U	0.24	J	J	0.65			0.43	J	J	0.45	U	U	0.47	U	DNR
HPAH in mg/kg TOC																				
Fluoranthene	160	1200	0.94	J	J	0.58	--	--	1.06	--	--	0.39	J	J	0.49	U	--	0.47	U	DNR
Pyrene	1000	1400	0.94	J	J	0.77	--	--	1.44	--	--	0.35	J	J	0.89	--	--	0.68	--	DNR
Benzo(a)anthracene	110	270	0.99	U	U	0.34	J	J	0.67	--	--	0.71	U	U	0.35	U	J	0.47	U	DNR
Chrysene	110	460	0.54	J	J	0.48			1.38	--	--	0.71	U	U	0.87	--	--	0.49	--	DNR
Benzo(b)fluoranthene	--	--	0.99	U	U	0.34	J	J	0.5	J	J	0.71	U	U	0.31	U	J	0.47	U	DNR
Benzo(k)fluoranthene	--	--	0.99	U	U	0.29	J	J	0.62	--	--	0.71	U	U	0.45	U	U	0.47	U	DNR
Benzofluoranthenes	230	450	0.99	U	U	0.63	J	J	1.11	J	J	0.71	U	U	0.45	U	U	0.47	U	DNR
Benzo(a)pyrene	99	210	0.99	U	U	0.29	J	J	0.38	J	J	0.71	U	U	0.45	U	U	0.47	U	DNR
Indeno(1,2,3-cd)pyrene	34	88	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Dibenz(a,h)anthracene	12	33	0.3	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
Benzo(g,h,i)perylene	31	78	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Total HPAH	960	5300	2.41	J	J	3.08	J	J	6.04	J	J	0.74	J	J	2.25	--	--	1.17	--	--
Chlorinated Aromatics in mg/kg TOC																				
1,3-Dichlorobenzene	--	--	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
1,4-Dichlorobenzene	3.1	9	0.3	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
1,2-Dichlorobenzene	2.3	2.3	0.3	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
1,2,4-Trichlorobenzene	0.81	1.8	0.3	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
Hexachlorobenzene	0.38	2.3	0.3	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR

TABLE 12a

SMS CHEMISTRY FOR INTERTIDAL BIOASSAY SEDIMENT GRABS (VALUES PRESENTED AS DRY WEIGHT OR ORGANIC CARBON NORMALIZED PER SMS) [1]

DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

SampleID	**WA**	**WA**	**ID-100-15-21-SD (SED100)**			**ID-101-8-14-SD (SED101)**			**ID-102-9-15-SD (SED102)**			**ID-108-12-18-SD (SED108)**			**ID-000-MIX**			**ID-MIX-000-D***		
Collection Date	**SQS**	**CSL**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**
Phthalate Esters in mg/kg TOC																				
Dimethylphthalate	53	53	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Diethylphthalate	61	110	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Di-n-Butylphthalate	220	1700	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Butylbenzylphthalate	4.9	64	0.74	U	U	0.36	U	U	0.47	U	U	0.57	U	U	0.35	U	U	0.35	U	DNR
bis(2-Ethylhexyl) phthalate	47	78	0.99	U	U	0.31	J	J	0.59	U	U	0.46	J	J	0.45	U	U	0.47	U	DNR
Di-n-Octylphthalate	58	4500	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Phenols in µg/kg DW																				
Phenol	420	1200	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
2-Methylphenol	63	63	6.1	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.1	U	DNR
4-Methylphenol	670	670	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
2,4-Dimethylphenol	29	29	6.1	U	U	6.2	U	U	6.8			6.2	U	U	6.2	U	U	6.1	U	DNR
Pentachlorophenol	360	690	30	U	U	31	U	U	31	U	U	31	U	U	31	U	U	30	U	DNR
Miscellaneous Extractables in mg/kg TOC																				
Benzyl Alcohol (µg/kg DW)	57	73	30	U	U	31	U	U	31	U	U	31	U	U	19	U	R	30	U	DNR
Benzoic Acid (µg/kg DW)	650	650	200	U	U	200	U	U	200	U	U	200	U	U	190	U	U	200	U	DNR
Dibenzofuran	15	58	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Hexachlorobutadiene	3.9	6.2	0.3	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
N-Nitrosodiphenylamine	28	130	0.3	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR

Notes:

[1] Data table from SAIC Draft Data Report dated April 14, 2009 (see Table 3-1, Appendix D).

DW = dry weight; HPAH = high molecular weight polycyclic aromatic hydrocarbon

DNR = do not report, use results for original ID-000-MIX sample

* = ID-000-MIX-D normalized using TOC from ID-000-MIX

LPAH = low molecular weight polycyclic aromatic hydrocarbon

"LQ" laboratory qualifier

"VQ" validator qualifier

"U" indicates analyte not detected. The number is the method reporting limit.

"J" value estimated by analytical laboratory

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TABLE 12b

SMS CHEMISTRY FOR INTERTIDAL BIOASSAY SEDIMENT GRABS (VALUES PRESENTED AS DRY WEIGHT FOR CHEMICALS WITH ORGANIC CARBON NORMALIZED DATA IN TABLE 12A)[1]

DRAFT RI/FS

IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

SampleID	**1988 PSEP**		**ID-100-15-21-SD (SED100)**			**ID-101-8-14-SD (SED101)**			**ID-102-9-15-SD (SED102)**			**ID-108-12-18-SD (SED108)**			**ID-000-MIX**			**ID-MIX-000-D***		
Collection Date	**LAET**	**2LAET**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**
LPAH in mg/kg DW																				
Naphthalene	2,100	2,400	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Acenaphthylene	1,300	1,300	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Acenaphthene	500	730	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Fluorene	540	1,000	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Phenanthrene	1,500	5,400	20	U	U	10	J	J	22			12	J	J	10	U	J	20	U	DNR
Anthracene	960	4,400	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
1-Methylnaphthalene			20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
2-Methylnaphthalene	670	1,400	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Total LPAH	5,200	13,000	20	U	U	10	J	J	22			12	J	J	19	U	U	20	U	DNR
HPAH in mg/kg DW																				
Fluoranthene	1,700	2,500	19	J	J	24	--	--	36	--	--	11	J	J	21	U	--	20	U	DNR
Pyrene	2,600	3,300	19	J	J	32	--	--	49	--	--	10	J	J	38	--	--	29	--	DNR
Benzo(a)anthracene	1,300	1,600	20	U	U	14	J	J	23	--	--	20	U	U	15	U	J	20	U	DNR
Chrysene	1,400	2,800	11	J	J	20			47	--	--	20	U	U	37	--	--	21	--	DNR
Benzo(b)fluoranthene	--	--	20	U	U	14	J	J	17	J	J	20	U	U	13	U	J	20	U	DNR
Benzo(k)fluoranthene	--	--	20	U	U	12	J	J	21	--	--	20	U	U	19	U	U	20	U	DNR
Benzofluoranthenes	3,200	3,600	20	U	U	26	J	J	38	J	J	20	U	U	19	U	U	20	U	DNR
Benzo(a)pyrene	1,600	3,000	20	U	U	12	J	J	13	J	J	20	U	U	19	U	U	20	U	DNR
Indeno(1,2,3-cd)pyrene	600	690	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Dibenz(a,h)anthracene	230	540	6.1	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.1	U	DNR
Benzo(g,h,i)perylene	670	720	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Total HPAH	12,000	17,000	49	J	J	128	J	J	206	J	J	21	J	J	96	--	--	50	--	--
Chlorinated Aromatics in mg/kg DW																				
1,3-Dichlorobenzene	--	--	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
1,4-Dichlorobenzene	110	120	6.1	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.1	U	DNR
1,2-Dichlorobenzene	35	50	6.1	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.1	U	DNR
1,2,4-Trichlorobenzene	31	51	6.1	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.1	U	DNR
Hexachlorobenzene	22	70	6.1	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.1	U	DNR
Phthalate Esters in mg/kg DW																				
Dimethylphthalate	71	160	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Diethylphthalate	200	1,200	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Di-n-Butylphthalate	1,400	5,100	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Butylbenzylphthalate	63	900	15	U	U	15	U	U	16	U	U	16	U	U	15	U	U	15	U	DNR
bis(2-Ethylhexyl)phthalate	1,300	1,900	20	U	U	13	J	J	20	U	U	13	J	J	19	U	U	20	U	DNR
Di-n-Octylphthalate	6,200	--	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Miscellaneous Extractables in mg/kg DW																				
Dibenzofuran	540	700	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
Hexachlorobutadiene	11	120	6.1	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.1	U	DNR
N-Nitrosodiphenylamine	28	40	6.1	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.1	U	DNR

Notes:

[1] Table 12a edited to include dry weight data for organic carbon normalized chemicals; data for Table 12b received by GeoEngineers from SAIC on August 5, 2009. Table 12a from SAIC Draft Data Report dated April 14, 2009 (see Table 3-1, Appendix D).

DW = dry weight; HPAH = high molecular weight polycyclic aromatic hydrocarbon; LAET = lowest apparent effects threshold (PSEP, 1988); 2LAET = second lowest apparent effects threshold.

DNR = do not report, use results for original ID-000-MIX sample

* = ID-000-MIX-D normalized using TOC from ID-000-MIX

LPAH = low molecular weight polycyclic aromatic hydrocarbon

"LQ" laboratory qualifier

"VQ" validator qualifier

"U" indicates analyte not detected. The number is the method reporting limit.

"J" value estimated by analytical laboratory

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TABLE 13
TOTAL PETROLEUM HYDROCARBON RESULTS FOR INTERTIDAL BIOASSAY SEDIMENT GRABS
DRAFT RI/FS
IRONDALE AND STEEL PLANT, IRONDALE, WASHINGTON

SampleID	Collection Date	Motor Oil (mg/kg)	LQ	VQ	Diesel Range Hydrocarbons (mg/kg)	LQ	VQ
ID-100-15-21-SD (SED100)	1/8/2009	21	--	--	9.1	--	--
ID-101-8-14-SD (SED101)	1/8/2009	150	--	--	85	--	--
ID-102-9-15-SD (SED102)	1/8/2009	410	--	--	280	--	--
ID-103-11-17-SD (SED103)	1/8/2009	38	--	--	20	--	--
ID-104-13-19-SD (SED104)	1/8/2009	3600	--	--	5400	--	--
ID-106-13-19-SD (SED106)	1/8/2009	2600	--	--	3600	--	--
ID-107-8-14-SD (SED107)	1/8/2009	3100	--	--	4000	--	--
ID-108-12-18-SD (SED108)	1/8/2009	94	--	--	42	--	--
ID-000-MIX	1/29/2009	330	--	--	360	--	--
ID-000-MIX-D1	1/29/2009	240	--	DNR	260	--	DNR
ID-000-MIX-D2	1/29/2009	230	--	DNR	230	--	DNR
ID-000-MIX-D3	1/29/2009	210	--	DNR	210	--	DNR
SB-REF-ID-01	1/29/2009	13	U	U	6.6	U	U
SB-REF-ID-02	1/29/2009	12	U	U	6.2	U	U

Notes:

DNR = do not report, use results for original ID-000-MIX sample

"U" indicates analyte not detected. The number is the method reporting limit.

"LQ" laboratory qualifier

"VQ" validator qualifier

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TABLE 14
CONVENTIONAL PARAMETERS FOR INTERTIDAL BIOASSAY SEDIMENT GRABS[1]
DRAFT RI/FS
IRONDALE AND STEEL PLANT, IRONDALE, WASHINGTON

SampleID	**ID-100-15-21-SD (SED100)**	**ID-101-8-14-SD (SED101)**	**ID-102-9-15-SD (SED102)**	**ID-103-11-17-SD (SED103)**	**ID-104-13-19-SD (SED104)**	**ID-106-13-19-SD (SED106)**	**ID-107-8-14-SD (SED107)**	**ID-108-12-18-SD (SED107)**	**ID-000-MIX**	**SB-REF-ID-01**	**SB-REF-ID-02**
Collection Date	**1/8/2009**	**1/8/2009**	**1/8/2009**	**1/8/2009**	**1/8/2009**	**1/8/2009**	**1/8/2009**	**1/8/2009**	**1/29/2009**	**1/29/2009**	**1/29/2009**
Total Organic Carbon (%)	2.03	4.16	3.41	1.35	5.57	3.91	4.81	2.82	4.26	0.232	0.354
Total Volatile Solids (%)	1.75	6.94	9.32	3.07	3.81	4.56	4.68	1.79	1.95	0.74	0.79
Total Solids (%)	77.2	69.8	71	72.7	73.1	74.2	74.1	70.7	74.6	76.6	73.3
Preserved Total Solids (%)	75.1	68.9	70.2	75.6	70	68.7	70.8	74.6		76.7	74.5
N-Ammonia (mg-N/kg)	0.61	0.21	0.6	0.13	0.13	0.13	0.16	0.13	0.32	4.68	2.57
Sulfide (mg/kg)	343	2170	742	13	706	4.26	299	498		1.5	1.33
Grain Size (%)											
Gravel	17.6	29.3	18	16	20	14.3	34.6	12.1	14.1	0.7	0.5
Very Coarse Sand	10.3	10.3	18.3	4.2	15.8	11.1	10.1	4.3	4.7	0.7	0.8
Coarse Sand	15.4	15	14.1	15.4	17.5	18.2	18	17.9	17	7.7	3.7
Medium Sand	35.5	22.8	24.1	41.6	29.7	33.3	26.1	51.1	41.4	54.4	55.5
Fine Sand	14.5	11.5	19.4	20.1	11.3	17.1	9.1	11.1	18.7	32	37.6
Very Fine Sand	3.3	4.1	4.5	1.9	1.9	3.3	1.2	1.4	2	3.5	0.9
Total Fines	3.4	7	1.7	1	3.8	2.7	0.9	2	2	0.9	0.9

Notes:

[1] Data table from SAIC Draft Data Report dated April 14, 2009 (see Table 3-1, Appendix D).

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TABLE 15
SUMMARY OF CHEMICAL ANALYTICAL DATA
METALS IN SEDIMENT FROM PRE-RI STUDIES
DRAFT RI/FS REPORT
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Location ID[1]	Sample ID	Collection Date	Sample Depth (inches bgs)	TOC %	Metals Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)
Hart Crowser (1996)																		
SS-1	SS-1	March-96	6	--	--	1.8	--	0.5 U	7.2	7.1	8,400	5 U	0.13 U	14	--	--	--	15
SS-2	SS-2	March-96	6	--	--	3.1	--	0.5 U	9.9	22	7,200	7.7	0.13 U	7.6	--	--	--	17
Jefferson County (2001)																		
BS1	BS1	10/25/2001	unknown	--	nd	2.7	nd	nd	15.1	4.9	--	nd	0.0	21	nd	nd	nd	17.6
BS2	BS2	10/25/2001	unknown	--	nd	4.8	nd	nd	11.4	10.8	--	nd	nd	20.4	nd	nd	nd	22.3
BS3	BS3	10/25/2001	unknown	--	nd	4.0	1.2	nd	11	412	--	nd	nd	14.8	nd	nd	nd	47.1
Ecology (2005)																		
Location 001	05284010; Location 001	11/3/2005	0.3 to 0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 002	05284011; Location 002	11/3/2005	0.25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 004	05444013; Location 004	11/3/2005	0.25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Jefferson County (2007)																		
Location 1	07034900, Location 1	January-07	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034901, Location 1	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034902, Location 1	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 2	07034903, Location 2	January-07	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034904, Location 2	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034905, Location 2	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 3	07034906, Location 3	January-07	6	0.34 J	0.20 U	5.0	--	0.11	21	50.6	33,300	12.4	0.0072	28.3	--	0.10 U	--	69
	07034907, Location 3	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034908, Location 3	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 4	07034909, Location 4	January-07	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034910, Location 4	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034911, Location 4	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 5	07034912, Location 5	January-07	6	1.65 J	0.20 U	4.1	--	0.12	26.7	34.0	28,900	14.3	0.0095	31.5	--	0.10 U	--	55
	07034913, Location 5	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034914, Location 5	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 6	07034915, Location 6	January-07	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034916, Location 6	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034917, Location 6	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 7	07034918, Location 7	January-07	6	2.21 J	0.20 U	4.7	--	0.11	24 J	35.6 J	23,000	16.7	0.012	32.6	--	0.10 U	--	86
	07034919, Location 7	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034920, Location 7	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 8	07034921, Location 8	January-07	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034922, Location 8	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034923, Location 8	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 9	07034924, Location 9	January-07	6	0.59 J	0.20 U	3.0	--	0.16	26.8	28.8	18,000	5.92	0.012	38.7	--	0.10 U	--	47
	07034925, Location 9	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034926, Location 9	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 10	07034927, Location 10	January-07	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034928, Location 10	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034929, Location 10	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 11	07034930, Location 11	January-07	6	0.30 J	0.20 U	3.3	--	0.11	23.6	31.1	17,600	10.3	0.006	25.7	--	0.10 U	--	53
	07034931, Location 11	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034932, Location 11	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Location 12	07034933, Location 12	January-07	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034934, Location 12	January-07	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07034934, Location 12	January-07	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Applicable Screening Level																		
Sediment Criteria - SQS[2]			--	--	--	57	--	5.1	260	390	--	450	0.41	--	--	6.1	--	410
Sediment Criteria - CSL[3]			--	--	--	93	--	6.7	270	390	--	530	0.59	--	--	6.1	--	960

Notes:

[1] Approximate locations of sediment samples are shown in Figure 3

[2] Marine Sediment Quality Standards - Chemical Criteria (Table I; Chapter 173-204 WAC - Sediment Management Standards

[3] Puget Sound Marine Sediment Cleanup Screening Levels and Minimum Cleanup Levels - Chemical Criteria (Table III; Chapter 173-204 WAC - Sediment Management Standard

mg/kg = milligrams per kilogram

"--" = not analyzed or not applicable

"J" indicates an estimated concentration.

"U" indicates analyte not detected. The number reported is the method reporting limit.

nd = Not detected

TOC = Total organic carbon

Shading indicates concentration exceeds at least one screening level.

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TABLE 16
SUMMARY OF CHEMICAL ANALYTICAL DATA
POLYCYCLIC AROMATIC HYDROCARBONS IN SEDIMENT FROM PRE-RI STUDIES
DRAFT RI/FS REPORT
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

					Polycyclic Aromatic Hydrocarbons											
Location ID[1]	**Sample ID**	**Collection Date**	**Sample Depth (inches bgs)**	**TOC %**	**1-Methylnaphthalene (mg/kg TOC)[5]**	**2-Chloronaphthalene (mg/kg TOC)[5]**	**2-Methylnaphthalene (mg/kg TOC)[5]**	**Acenaphthene (mg/kg TOC)[5]**	**Acenaphthylene (mg/kg TOC)[5]**	**Anthracene (mg/kg TOC)[5]**	**Benzo(a)anthracene (mg/kg TOC)[5]**	**Benzo(a)pyrene (mg/kg TOC)[5]**	**Benzo(b)fluoranthene (mg/kg TOC)[5]**	**Benzo(ghi)perylene (mg/kg TOC)[5]**	**Benzo(k)fluoranthene (mg/kg TOC)[5]**	**Total Benzo Fluoranthenes (mg/kg TOC)[4,5]**
Jefferson County (2007)																
Location 3	07034906, Location 3	January-07	6	0.34 J	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	5.29	3.53	3.53	8.82
Location 5	07034912, Location 5	January-07	6	1.65 J	0.73	0.73	0.73	0.73	0.73	0.73	2.36	1.21	2.36	0.73	0.97	3.33
Location 7	07034918, Location 7	January-07	6	2.21 J	0.54	0.54	0.54	0.54	0.54	0.54	0.81	0.54	1.22	0.54	0.54	1.76
Applicable MTCA Cleanup Levels																
Sediment Criteria - SQS[1] (mg/kg OC)		--	--	--	--	--	38	16	66	220	110	99	230	31	230	230
Sediment Criteria - CSL[2] mg/kg OC)		--	--	--	--	--	64	57	66	1,200	270	210	450	78	450	450

					Polycyclic Aromatic Hydrocarbons										
Location ID	**Sample ID**	**Collection Date**	**Sample Depth (inches bgs)**	**TOC %**	**Carbazole (mg/kg TOC)[5]**	**Chrysene (mg/kg TOC)[5]**	**Dibenzo(a,h)anthracene (mg/kg TOC)[5]**	**Dibenzofuran (mg/kg TOC)[5]**	**Fluoranthene (mg/kg TOC)[5]**	**Fluorene (mg/kg TOC)[5]**	**Indeno(1, 2, 3-cd)pyrene (mg/kg TOC)[5]**	**Naphthalene (mg/kg TOC)[5]**	**Phenanthrene (mg/kg TOC)[5]**	**Pyrene (mg/kg TOC)[5]**	**Retene ug/kg**
Jefferson County (2007)															
Location 3	07034906, Location 3	January-07	6	0.34 J	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	5.29	3.53	3.53
Location 5	07034912, Location 5	January-07	6	1.65 J	0.73	0.73	0.73	0.73	0.73	0.73	2.36	1.21	2.36	0.73	0.97
Location 7	07034918, Location 7	January-07	6	2.21 J	0.54	0.54	0.54	0.54	0.54	0.54	0.81	0.54	1.22	0.54	0.54
Applicable MTCA Cleanup Levels															
Sediment Criteria - SQS[2]		--	--	--	--	110	12	15	160	23	34	99	100	1,000	--
Sediment Criteria - CSL[3]		--	--	--	--	460	33	58	1,200	79	88	170	480	1,400	--

Notes:

[1] Approximate locations of sediment samples are shown in Figure 3.

[2] Marine Sediment Quality Standards - Chemical Criteria (Table I; Chapter 173-204 WAC - Sediment Management Standards)

[3] Puget Sound Marine Sediment Cleanup Screening Levels and Minimum Cleanup Levels - Chemical Criteria (Table III; Chapter 173-204 WAC - Sediment Management Standards)

[4] Sum of the "b" and "k" isomers.

[5] Concentrations are shown in milligrams per kilogram normalized with reference to percent total organic carbon (TOC).

mg/kg = milligrams per kilogram

"--" = not analyzed or not applicable

"J" indicates an estimated concentration.

TOC = Total Organic Carbon

Shading indicates concentration exceeds at least one screening criteria.

TABLE 17
SUMMARY OF GROUNDWATER ELEVATIONS
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Well Number[1]	**Date Installed**	**TOC Elevation[2]**	**Screen Interval Elevation[2]**	**Date Measured**	**Time Measured**	**Depth to Groundwater[3] (feet)**	**Groundwater Elevation[4] (feet)**	**Tide[5]**			
								Tide Elevation (feet relative to MLLW)	**Rising/Falling**	**High**	**Low**
MW-02	6/25/2007	14.30	10.55 to 0.55	12/13/2007	3:30 PM	4.97	9.33	6.88	falling	8:07 AM	12:13 AM (12/14/07)
				1/8/2009	3:27 PM	4.23	10.07	5.33	falling	11:39 AM	7:38 PM
				1/9/2009	10:28 AM	4.31	9.99	8.34	rising	12:37 PM	7:50 AM
MW-03	6/26/2007	12.79	9.09 to -5.91	12/13/2007	3:40 PM	5.48	7.31	6.87	falling	8:07 AM	12:13 AM (12/14/07)
				1/8/2009	3:15 PM	5.51	7.28	5.83	falling	11:39 AM	7:38 PM
				1/9/2009	10:20 AM	4.00	8.79	8.34	rising	12:37 PM	7:50 AM
MW-04	6/25/2007	14.49	11.57 to -3.43	12/13/2007	3:53 PM	5.72	8.77	6.87	falling	8:07 AM	12:13 AM (12/14/07)
				1/8/2009	3:06 PM	4.43	10.06	6.16	falling	11:39 AM	7:38 PM
				1/9/2009	10:12 AM	4.84	9.65	8.30	rising	12:37 PM	7:50 AM
MW-05	6/26/2007	14.17	10.85 to -4.15	12/13/2007	3:45 PM	6.05	8.12	6.87	falling	8:07 AM	12:13 AM (12/14/07)
				1/8/2009	3:04 PM	4.89	9.28	6.28	falling	11:39 AM	7:38 PM
				1/9/2009	10:16 AM	4.83	9.34	8.33	rising	12:37 PM	7:50 AM

Notes:

[1] See Figure 2 for approximate exploration locations.

[2] TOC=Top of well casing. Elevation relative to mean sea level.

[3] The depths to groundwater were measured relative to the tops of the well casings.

[4] Groundwater elevation relative to mean sea level.

[5] NOAA tide data for Port Townsend Station.

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TABLE 18
SITE-SPECIFIC EARTHWORM BIOACCUMULATION FACTORS
METALS IN SOIL AND WORMS
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

	Media	Arsenic (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
TP40							
UBSS1-071212-.5	Soil - dw	56	1,080	243,000	50	90	60
UBS1-071212-.5	Worm - ww	1.1	14.0	2,330	3	1	157
UBS1-071212-.5	Worm - dw[1]	6.875	87.5	14562.5	18.75	6.25	981.25
Bioaccumlation Factor - dw		0.123	0.081	0.060	0.375	0.069	16.354
TP30							
UBSS2-071212-.5	Soil - dw	41	776	208,000	80	80	60
UBS2-071212-.5	Worm - ww	0.39	5	161	**0.15**	0.3	55.7
UBS2-071212-.5	Worm - dw[1]	2.4375	31.25	1006.25	0.9375	1.875	348.125
Bioaccumlation Factor - dw		0.059	0.040	0.005	0.012	0.023	5.802
TP41							
TP41-071213-1	Soil - dw	3.1	37	18,200	8	24	47
TP41-071213-W	Worm - ww	0.4	1.51	176	**0.15**	0.3	83.3
TP41-071213-W	Worm - dw[1]	2.5	9.4375	1100	0.9375	1.875	520.625
Bioaccumlation Factor - dw		0.806	0.256	0.060	0.117	0.078	11.077
Bioacumulation Factor - dw							
Maximum		0.806	0.256	0.060	0.375	0.078	16.4
Average		0.330	0.126	0.042	0.168	0.057	11.1
MTCA Default (Table 749-4)		1.160	0.880	na	0.690	0.780	3.190

Notes:

[1] Earthworm dry weight concentrations calculated using an assumed earthworm percent moisture of 84 percent (EPA, 1993)

Shading indicates values that were used to calculate site-specific wildife screening levels (avian and mammalian predators)

Bold and underline indicates that metal was not detected and value is 1/2 method reporting limit.

dw = dry weight

ww = wet weight

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TABLE 19
SITE-SPECIFIC PLANT UPTAKE COEFFICIENTS
METALS IN SOIL AND PLANTS
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

	Media	**Arsenic (mg/kg)**	**Copper (mg/kg)**	**Iron (mg/kg)**	**Lead (mg/kg)**	**Nickel (mg/kg)**	**Zinc (mg/kg)**
TP40							
TP40-CP-080605	Plant - ww	**0.04**	1.74	16	**0.4**	0.5	6.0
TP40-CP-080605	Plant - dw	0.26	11.4	105.3	2.6	3.3	39.5
TP40-CS-080605	Soil - dw	44.0	1050	260,000	210	90	80
Plant Uptake Factor - dw		0.006	0.011	0.00040	0.013	0.037	0.49
TP03							
TP03-CP-080606	Plant - ww	**0.04**	1.67	41	**0.4**	**0.2**	6.8
TP03-CP-080606	Plant - dw	0.17	7.26	178.26	1.74	0.87	29.57
TP03-CS-080606	Soil - dw	28.1	318	156,000	370	60	1,820
Plant Uptake Factor - dw		0.006	0.023	0.0011	0.0047	0.014	0.016
TP32							
TP32-CP-080606	Plant - ww	**0.04**	1.17	25	**0.4**	0.4	7.1
TP32-CP-080606	Plant - dw	0.22	6.39	136.61	2.19	2.19	38.80
TP32-CS-080606	Soil - dw	50.4	1,150	95,700	40	19	81
Plant Uptake Factor - dw		0.0043	0.0056	0.0014	0.05	0.12	0.48
Plant Uptake Factor - dw							
Maximum Kplant		0.006	0.023	0.0014	0.05	0.12	0.49
Average Kplant		0.006	0.013	0.0010	0.024	0.055	0.33
MTCA Default Kplant (Table 749-3)		0.06	0.02	na	0.0047	0.047	0.095

Notes:

[1] Plant dry weight concentrations calculated using sample-specific percent moisture:

TP40 = 84.8%
TP03 = 77%
TP32 = 81.7%

Shading indicates values that were used to calculate site-specific wildife screening levels (mammalian herbivors)

Bold and underline indicates that metal was not detected and value is 1/2 method reporting limit.

dw = dry weight
ww = wet weight

TABLE 20
SITE-SPECIFIC WILDLIFE SCREENING LEVEL CALCULATIONS - METALS
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

MTCA Table 749-4 Exposure Parameters and Values

Parameter	Avian Predator (Robin)	Mammalian Predator (Shrew)	Mammalian Herbivore (Vole)	Units
Proportion of Contaminated Food	0.52	0.5	1	unitless
Food Ingestion Rate	0.207	0.45	0.315	kg/kg-day
Soil Ingestion Rate	0.0215	0.0045	0.0079	kg/kg-day
Home Range	0.6	0.1	0.08	acres

Table 749-5 Values and Site-Specific BAFs

Metal	Table 749-5 Values						Site-Specific BAFs		Site-specific Kplant	
	RGAF	**MTCA Default BAF**	**Trobin**	**Tshrew**	**Tvole**	**Kplant**	**Max BAF**	**AVG BAF**	**Max Kplant**	**AVG Kplant**
Arsenic V	1	1.16	22	35	35	0.06	0.806	0.330	0.006	0.006
Copper	1	0.88	61.7	44	33.6	0.02	0.256	0.126	0.023	0.013
Lead	1	0.69	11.3	20	20	0.0047	0.375	0.168	0.05	0.024
Nickel	1	0.78	107	175.8	134.4	0.047	0.078	0.057	0.12	0.055
Zinc	1	3.19	131	703.3	537.4	0.095	16.354	11.078	0.49	0.33

MTCA Default Wildlife Soil Screening Levels

	Avian Predator (Robin)	Mammalian Predator (Shrew)	Mammalian Herbivore (Vole)	Lowest
Arsenic V	150	132	1,310	132
Copper	531	217	2,370	217
Lead	118	125	2,130	118
Nickel	1,020	977	5,920	977
Zinc	360	974	14,200	360

Site-Specific Wildlife Soil Screening Levels (Average BAF/Kplant)

	Avian Predator (Robin)	Mammalian Predator (Shrew)	Mammalian Herbivore (Vole)	Lowest
Arsenic V	386	445	3,630	386
Copper	1,760	1,340	2,790	1,340
Lead	285	473	1,290	285
Nickel	3,870	10,100	5,300	3,870
Zinc	110	282	4,810	110

Notes:

Shading indicates values that were selected as Wildlife Soil Screening Levels

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TABLE 21
DRAFT SOIL CLEANUP LEVELS[1]
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Receptor	Basis	TPH[3]		cPAHs		Arsenic (Arsenic V for Eco)		Copper		Iron		Lead		Nickel		Zinc	
		Value	**Note**	**Value**	**Note**	**Value**	**Note**	**Value**	**Note**	**Value**	**Note**	**Value**	**Note**	**Value**	**Note**	**Value**	**Note**
Human Health	**Default MTCA values**	2,000	Method A	0.137	Method B	20	Background	3,000	Method B	58,700	Background	250	Method A	1,600	Method B	1,600	Method B
TEE - Soil Biota	**Bioassays - 100% worm survival for metals; no TEE CULS required.**	136	Site-specific[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TEE - Plants	**Default TEE values. Plant bioassays were inconclusive.**	--	--	NA	NA	18	EPA SSL	70	EPA SSL	--	--	120	EPA SSL	48	Background	160	EPA SSL
TEE - Wildlife	**Co-located soil/worm samples. Values based on site-specific bioaccumulation factor (BAF)**	6,000	Table 749-3	NA	NA	386	Site-Specific	1,340	Site-Specific	--	--	285	Site-Specific	3,870	Site-Specific	360	Table 749-3
Selected Value		136 and 2,000		0.137		18		70		58,700		120		48		160	

Notes:

[1] All values are milligrams per kilogram

[2] 136 mg/kg is site-specific combined TPH cleanup level developed for sediment (See Appendix D for details). It is applicable to upland soil adjacent to former above ground storage tank due to the potential transport of upland soil to sediment via erosion. The MTCA Method A soil cleanup level at 2,000 mg/kg is applicable to soil above the bluff and in the northshore fill area.

[3] Total Petroleum Hydrocarbons equals sum of diesel-range and heavy-oil range concentrations.

Shading indicates lowest applicable soil screening level

-- = Not available

EPA SSL = US Environmental Protection Agency Soil Screening Level

NA = Not applicable (bioassay indicated no adverse effects to soil biota)

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TABLE 22
SITE SPECIFIC ARARS
DRAFT RI/FS
IRONDALE AND STEEL PLANT, IRONDALE, WASHINGTON

Authorizing Statute	Implementing Regulation	Description	Rationale
Potential Chemical-Specific ARARs			
National Toxics Rule; 33 USC 1251	Water Quality Standards; 40 CFR 131.36(b)(1)	Establishes surface water quality standards that protect aquatic life and human health. Washington adopted these standards in Chapter 173-201A WAC.	Potentially applicable to surface water and potentially relevant and appropriate to sediment and groundwater that are likely to impact surface water quality.
WA Water Pollution Control Act; Chapter 90.48 RCW	Water Quality Standards for Surface Waters; Chapter 173-201A WAC	Establishes narrative and numeric surface water quality standards for waters of the state.	Potentially applicable to surface water and potentially relevant and appropriate sediment and groundwater that are likely to impact surface water quality.
Clean Water Act; 33 USC 1251-1387	Section 304a of the Clean Water Act; WAC 173-340-730(2)(b)(i)(B)	Establishes surface water quality standards that protect aquatic life and human health. Washington adopted these standards in Chapter 173-201A WAC.	Potentially applicable to surface water and potentially relevant and appropriate to sediment and groundwater that are likely to impact surface water quality.
Hazardous Waste Management; Chapter 70.105D RCW	Washington Model Toxics Control Act Cleanup Regulation; Chapter 173-340 WAC	Establishes groundwater, surface water, and soil cleanup levels.	Potentially applicable to surface water and potentially relevant and appropriate to sediment and groundwater that are likely to impact surface water quality and to soils at the site.
Potential Location-Specific ARARs			
Shoreline Management Act of 1971; Chapter 90.58 RCW	Shoreline Management Act; Chapters 173-18, 173-22, and 173-27 WAC.	The substantive requirements of this statute and its implementing regulations apply to activities within 200 feet of shorelines in the state.	Proposed remedial actions must be consistent with the approved Washington State coastal zone management program.
Construction Projects in State Waters; Chapter 77.55 RCW	Hydraulic Code Rules; Chapter 220-110 WAC	Apply to work conducted in Puget Sound or within the designated shoreline that changes the natural flow or bed of the water body (and therefore has the potential to affect fish habitat).	May apply to remedial actions that take place on the shoreline.
Endangered Species Act; 16 USC 1531 et seq.	Endangered Species Act; 50 CFR Parts 17, 222, and 402	Act protects fish, wildlife, and plant species whose existence is threatened or endangered.	Applies to cleanup actions that may affect a listed threatened or endangered species or designated critical habitat.
Potential Action-Specific ARARs			
Hazardous Waste Management; Chapter 70.105D RCW	Selection of Cleanup Actions; WAC 173-340-350	Minimum requirements and procedures for conducting remedial investigation and feasibility studies.	Applicable to remedial action selection and implementation.
Hazardous Waste Management; Chapter 70.105D RCW	Institutional Controls; WAC 173-340-440	Institutional control requirements.	Potentially applicable to remedial action selection and implementation.
Hazardous Waste Management; Chapter 70.105D RCW	Compliance Monitoring Requirements; WAC 173-340-410, -720(9), -730(7), -740(7), and -745(8)	Compliance monitoring requirements for groundwater, surface water, and soil.	Potentially applicable to remedial action selection and implementation.

TABLE 22
SITE SPECIFIC ARARS
DRAFT RI/FS
IRONDALE AND STEEL PLANT, IRONDALE, WASHINGTON

Authorizing Statute	Implementing Regulation	Description	Rationale
Potential Action-Specific ARARs			
Ecology Area of Contamination Policy	8/20/1991 Interprogram Policy	Allows movement/placement of excavated contaminated material within the regulated site without triggering dangerous waste designation.	Could be applicable for containment remedial alternatives.
Ecology Construction Stormwater General Permit	State of Washington Water Pollution Control Law; RCW Chapter 90.48	Applies to construction activities that disturb 1 or more acres.	Substantive requirements could be addressed through project stormwater pollution prevention plan.
Water Well Construction; Chapter 18.104 RCW	Minimum Standards for Construction and Maintenance of Wells; Chapter 173-160 WAC	Applies to the construction and maintenance of monitoring wells	Potentially applicable to wells constructed for groundwater withdrawal and monitoring and decommissioning of existing or future wells.
Hazardous Waste Management; Chapter 70.105 RCW	Dangerous Waste Regulations; Chapter 173-303 WAC	Applies if dangerous wastes are generated during remedial program	These regulations must be fully complied with for any off site disposal of waste determined to be dangerous waste. This would only apply to upland remedial options as dredged sediment is exempt from waste classification.
WA Water Pollution Control; Chapter 90.48 RCW	NPDES Permit Program; Chapter 173-220 WAC	Applicable to the discharge of pollutants and other wastes and materials to the surface waters of the state	NPDES may be required for discharges related to ongoing remedial actions or discharge of stormwater/drainage.
State Environmental Policy Act (SEPA); Chapter 43.21C.110 RCW	SEPA Rules; Chapter 197-11 WAC	Applies if future construction/remedial action occurs at the site	Applies if future construction/ remedial action occurs at the site.
Solid Waste Management Chapter 43.21A RCW	Minimum Functional Standards for Solid Waste Handling WAC 173-304	Establishes minimum functional standards for the handling of solid waste.	Applies if non-dangerous wastes are generated during remedial program
Transportation of Hazardous Material; 49 USC 5101-5127	Hazardous Materials Regulations; 49 CFR Parts 171 through 180	Regulations that govern the transportation of hazardous materials.	Applies to any hazardous materials transported off-site as part of remediation.
Hazardous Waste-Land Disposal Restrictions; USEPA	40 CFR 268/22 CCR 66268	Establishes land disposal restrictions and treatment standards for hazardous wastes applicable to generators.	Any hazardous wastes generated as a result of on-site activities or by treatment systems must meet land disposal restriction requirements.
WA Water Pollution Control; Chapter 90.48 RCW	Federal Water Pollution Control Act Certification; Chapter 173-225 WAC	Applies to activities that may result in a discharge into navigable waters.	Substantive compliance with this requirement will be potentially applicable to alternatives where substantive compliance with NPDES or Section 404 permit is required.
WA Water Pollution Control; Chapter 90.48 RCW	Mixing Zones; WAC 173-201A-400	Applies to the allowable size and location of a mixing zone.	Potentially applicable to remedial alternatives that would require substantive compliance with NPDES permit requirements.

TABLE 22
SITE SPECIFIC ARARS
DRAFT RI/FS
IRONDALE AND STEEL PLANT, IRONDALE, WASHINGTON

Authorizing Statute	Implementing Regulation	Description	Rationale
Potential Action-Specific ARARs			
WA Water Pollution Control; Chapter 90.48 RCW	Short Term Modifications (to State Water Quality Criteria); Chapter 173-201A-410	Criteria may be modified for a specific water body on a short-term basis when necessary to accommodate essential activities, respond to emergencies, or to otherwise protect the public interest, even though such activities may result in a temporary reduction.	Substantive provisions potentially applicable to remedial alternatives involving excavation of sediments.
USACE permit	Section 404 Permit Program	Applies to dredging or filling in the waters of the U.S.	Permit may not be required but substantive compliance with typical permit conditions will be required.
Archeological and Historic Preservation	Federal Archeological and Historical Preservation Act; 16 USCA 496a-1	The Site is part of the Irondale National Historic District designated by the National Park Service and is also listed in the Washington State Heritage Register and the National Park Service Historic American Engineering Record.	Will be applicable for remedial alternatives that include grading and excavation activities.
Washington Clean Air Act; Chapter 70.94 RCW	General Requirements for Air Pollution Sources; Chapter 173-400 WAC. Controls for New Sources of Toxic Air Pollutants; Chapter 173-460 WAC	Establishes technically feasible and reasonably attainable standards and rules generally applicable to the control and/or prevention of the emission of air contaminants.	May apply to remedial alternatives that produce emissions to air.

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TABLE 23
PRELIMINARY REMEDIAL TECHNOLOGY SCREENING
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON
(SHADED REMEDIAL TECHNOLOGIES ARE RETAINED FOR FURTHER EVALUATION)

General Response Action	Remediation Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Summary of Screening	Applicable Site Sub-Unit (s) (Sediment Remediation Area, Former AST Area, TP08 Vicinity, Power House Complex, and Steel Production Building)
UPLAND SOIL								
No Action	No Action	None	No institutional or engineering controls or treatment.	Not effective for protecting human health and environment.	Implementable but not acceptable to the general public or government agencies.	None	Sometimes used as a baseline for comparison. Not retained.	Applicable for soil in all sub-units.
Institutional Controls/ Access Control	Institutional Control	Deed Notification/ Restriction and Fencing/ Warning Signage	Implement deed notification to inform future owners of the presence of potentially hazardous substances at the site and /or implement deed restriction to restrict certain activities and uses of the site. Construct or maintain existing site fencing and signage to control site access by the general public thereby reducing potential exposure to contaminants.	Effectiveness for protection of human health would depend on enforcement of and compliance with deed restrictions. Not applicable for ecological risks.	Technically implementable. Specific legal requirements and authority would need to be met. Signage would be easily implemented as a component of maintaining site as park space, but would require maintenance to ensure effectiveness.	Low capital	Potentially applicable in combination with other technologies. Retained.	Applicable for soil in all sub-units.
Soil Containment	Capping	Surface Cap	Installation of surface cap over contaminated soil areas to reduce contaminant migration and to prevent exposure. Caps may include asphalt or concrete paving, synthetic membranes, soil, and buildings or structures.	Effective for preventing direct contact exposure (i.e. dermal contact or ingestion). Limits infiltration and leachate formation, but less effective than source removal options for protection of groundwater.	Technically implementable. The selected capping technology must be consistent with proposed future land use.	Moderate capital. Low O&M.	Applicable technology where contaminants pose little threat to groundwater. Retained.	Applicable for soil in all sub-units.
Soil Removal/Disposal	Removal with Land Disposal	Excavation and Landfill	Excavation of contaminated soil using common excavation methods. Excavation on steep portions of site may require shoring, building foundations may have to be removed, and excavation in AST area may require wet excavation or dewatering. Disposal of impacted soil at a permitted, off-site landfill.	Effective for complete range of contaminant groups.	Technically implementable using common excavation and transport methods. Impacted soil must be profiled for disposal and pre-treatment may be required for some soil.	Moderate to high capital. Negligible O&M.	Applicable in all areas. Retained.	Applicable for soil in all sub-units.
Soil Removal with Ex Situ Soil Treatment	Physical/Chemical Treatment	Stabilization	Contaminants are physically bound or enclosed within a stabilized mass using Portland cement or another pozzolanic material. This technology has been reliably demonstrated for contaminants such as heavy metals.	Stabilization is a common and effective technology for reducing the leachability of metals in soil.	Technically implementable. However most processes result in significant increase in volume. Difficult to implement in soil with free product (i.e., petroleum).	Moderate capital. Low O&M. Moderate cost relative to other ex situ physical/chemical options. Significant cost savings for disposal.	Potentially applicable for metals-impacted soil. Retained.	Applicable for soil at the Steel Production Building, Power House Complex and TP08 vicinity.
		Soil Washing	Wash soil with water-based surfactants, detergents, acids, etc., to remove chemicals from soil particles. Treat or dispose of high chemical concentration residuals fluids.	Most effective for high-concentration inorganic chemicals, SVOCs and fuels. Removal of organics adsorbed to clay-sized particles may be difficult.	Difficult to implement for complex waste mixtures. Complex mixtures of contaminants can make formulation of washing fluids difficult. Residuals may be difficult to extract from matrix and may require additional treatment/disposal.	High capital and O&M. High cost relative to other ex situ physical/chemical options.	Difficult to implement. Difficult to formulate washing fluids for complex waste mixtures. Soils may remain toxic due to difficulty extracting residual fluids. Not retained.	
		Incineration	High temperatures, 871-1,204^{o} C (1,600-2,200^{o} F), are used to combust (in the presence of oxygen) organic constituents in hazardous wastes.	Effective for destroying hydrocarbons. Not effective for inorganic chemicals.	Technically implementable. Incineration would be accomplished at a permitted off-site facility.	High capital and high O&M. High cost relative to other ex situ options.	High cost relative to other ex situ technologies and not effective for metals. Not retained.	
		Thermal Desorption	Wastes are heated within a continuous flow reactor to 320 to 560^{o} C to volatilize organic contaminants. A carrier gas or vacuum system transports volatilized organics to the gas treatment system.	Effective for SVOCs and fuels. Fine grained soils increase treatment time as a result of binding of contaminants to soil.	Technically implementable. However, particles size screening, dewatering to achieve acceptable moisture content, and off-gas treatment may be required.	High capital. High O&M. Lower cost than incineration.	High cost relative other ex situ technologies. Extensive preparation for treatment will be required. Not retained.	
	Biological Treatment	Biopiles	Excavated soils are mixed with soil amendments and placed on a treatment area that includes leachate collection systems and a form of aeration.	Solid-phase (soil) process is most effective for non-halogenated VOCs and fuel hydrocarbons. Not effective for metals.	Difficult to implement. Treatment area may require complete enclosure. Addition of amendment material results in volumetric increase in treated material. Leachate and off-gas may require treatment.	Moderate capital and O&M. Moderate cost relative to other ex situ biological options.	Limited effectiveness for some halogenated VOCs, not effective for metals and difficult to implement. Not retained.	
		Composting	Controlled biological process by which excavated soils are mixed with bulking agents and organic amendments to enhance microorganism conversion of organic contaminants to innocuous, stabilized byproducts.	Most effective for treatment of fuels and PAHs. Not effective for treatment of metals.	Difficult to implement. Treatment area may require complete enclosure. Addition of amendment material results in volumetric increase in treated material. Off-gas may require treatment.	Moderate capital and O&M. Moderate cost relative to other ex situ biological options.	Difficult to implement. Generally not cost effective for volatile compounds compared to other in situ technologies. Not retained.	
In Situ Soil Treatment	Biological Treatment	Bioventing	Oxygen is supplied through direct low-flow air injection into residual contamination in soil.	Effective in higher permeability soil for petroleum hydrocarbons and non-halogenated VOCs amenable to aerobic bioremediation. Degradation is relatively slow. Ineffective for inorganics and non-degradable organic constituents.	Technically implementable. Monitoring of off-gasses at ground surface may be required. Venting requires infrastructure of air injection piping, blower, controls, etc.	Moderate capital and O&M. Low cost relative to other in situ options.	Slow technology. Not effective for metals or other recalcitrant contaminants. Not retained.	
		Natural Attenuation	Natural processes such as volatilization, biodegradation, adsorption, and chemical reactions with soil materials can reduce contaminant concentrations to acceptable levels.	Generally not effective for quickly reducing risk to human health and ongoing threats to groundwater. Shallow metals can be reduced through natural uptake by native plants. Effectiveness is highest in combination with other technologies as a final step to achieve cleanup levels when risks to human health and the environment are low.	Technically implementable. Monitoring may be required to ensure adequate reduction rate. May require institutional controls during treatment period.	Negligible capital. Low O&M. Low cost relative to other in situ options.	Slow technology. Can be effective for areas of residual hydrocarbons in soil and groundwater. Not retained as a primary technology.	
	Phytoremediation	Phytoextraction	Plants, called "Hyperaccumulators" have the capacity to extract and store large amounts of contaminants (metals, hydrocarbons etc.) from soil and use them as nutrients during metabolism. Phytoremediation typically involves interaction of plant roots and microorganisms associated with them to remediate soil. Phytoextraction applicability has been demonstrated for individual site contaminants, but the effectiveness at treating all of the target metals under site conditions is unproven.	Technology has been effective in laboratory or field studies for removal of arsenic, copper, iron, nickel, and zinc. Most effective for treatment of sites with low to moderate levels of shallow soil contamination over large areas. The combined suite of metals present at the site, in addition to high concentrations of iron, may be treatable but would require extensive pilot testing over a long period to confirm.	Technically implementable. However, there has been little commercial application. Soil amendments including use of fertilizers, water, chelating agents to assist binding, and disposal of accumulated waste materials or plant materials may be necessary. Pilot testing that would be required will significantly delay implementation of full-scale remediation.	Moderate capital and O&M. High cost relative to other in situ options.	Site use would be amenable to plantings, but would require removal of existing plants. Effectiveness not certain without completion of long-term field pilot testing. Not retained.	
	Physical/Chemical Treatment	Soil Flushing	The extraction of contaminants from soil with aqueous solution accomplished by passing fluid through in-place soils using an injection or infiltration process. Extraction fluids must be recovered from underlying aquifer.	Effective for VOCs and inorganic chemicals. Presence of fine grained soils limits effectiveness.	Technically implementable. However, there has been little commercial application. Regulatory concerns over potential to wash contaminants beyond fluid capture zones and introduction of surfactants in to the subsurface make permitting difficult.	High capital and O&M. High cost relative to other in situ options.	High cost relative to other in situ soil treatment technologies. Not retained.	
		Soil Vapor Extraction	Vacuum is applied through extraction pipes to create a pressure/concentration gradient in impacted areas, which induces gas-phase volatiles to diffuse through soil to extraction wells. The process includes a system for treating off-gas. Air flow also induces aerobic bioremediation of petroleum hydrocarbons.	Effective for VOCs in granular soils. Presence of fine grained soils reduces effectiveness. Not significantly effective for heavier hydrocarbons or in low permeability soil. Ineffective for inorganics and non-volatile organic constituents.	Technically implementable. Typical application involves numerous extraction wells, conveyance piping, and large scale vacuum blowers.	High capital and O&M. High cost relative to other in situ options.	Generally not effective for non-volatile contaminants. Not retained.	

TABLE 23
PRELIMINARY REMEDIAL TECHNOLOGY SCREENING
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON
(SHADED REMEDIAL TECHNOLOGIES ARE RETAINED FOR FURTHER EVALUATION)

General Response Action	Remediation Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Summary of Screening	Applicable Site Sub-Unit (s) (Sediment Remediation Area, Former AST Area, TP08 Vicinity, Power House Complex, and Steel Production Building)
SEDIMENT								
No Action	No Action	None	No institutional controls or treatment.	Not effective for protecting human health and environment.	Implementable but not acceptable to the general public or government agencies.	None	Sometimes used as a baseline for comparison. Not retained.	Applicable for sediment in the Sediment Remediation Area.
Sediment Containment	Capping	Surface Cap	Containment for sediments involves placing an engineered aggregate cap to isolate material that could otherwise not be effectively removed through excavation or dredging. In the aquatic environment, the cap must be designed to withstand erosive forces generated by wave action, and must be thick enough to provide the required isolation of the material contained by the cap.	Effective for preventing direct contact exposure and for containing source material from erosion. Aquatic caps are designed using methods developed by the U.S. Army Corps of Engineers. Digging (such as for clams) would need to be prohibited in capped areas.	Technically implementable. Aquatic caps have been successfully constructed in multiple Puget Sound locations.	Moderate capital. Potentially moderate O&M depending on the design of the cap to resist wave erosion.	Applicable for containment of deeper contaminated soil/sediment. Retained.	Applicable for containment of deeper contaminated sediment in the Sediment Remediation Area.
Sediment Removal/Disposal	Removal/Disposal at Landfill	Excavation/Dredging with Disposal at Landfill and backfill with habitat mix	Excavation of impacted material using common excavation methods. Removal of sediments could be performed from the water using barge-mounted excavation equipment (i.e. dredging), or from the land at low tide using land-based earthwork equipment. Transport and disposal of impacted sediment at a permitted, off-site landfill.	Effective for complete range of contaminant groups. Dredging is considered in conjunction with capping where the target sediments cannot be completely removed due to access issues.	Technically implementable. Dredging is commonly used in the marine environment to remove impacted sediments. Impacted sediment must be profiled to verify that the materials meet land disposal restrictions.	Moderate to high capital. Potentially moderate O&M depending on the nature of any cap that is required.	Common removal and disposal method for contaminated sediment. Retained.	Applicable for sediment in the Sediment Remediation Area.
	Removal/Open-water disposal at a suitable non-dispersive DMMP site	Excavation/Dredging and transport with bottom-dump barge release	Excavation of impacted material using common excavation methods. Removal of sediments could be performed from the water using barge-mounted excavation equipment (i.e. dredging), or from the land at low tide using land-based earthwork equipment. Sediments targeted for open-water disposal would require a suitability determination from the DMMP.	Approval for open-water disposal expected to be difficult for high-concentration TPH sediments. Dredging is considered in conjunction with capping where the target sediments cannot be completely removed due to access issues.	Technically implementable. Impacted sediment must be profiled to verify that the materials meet DMMP suitability criteria. Dredging is commonly used in the marine environment to remove impacted sediments.	Low to moderate capital cost depending on the degree of rehandling required. Potentially moderate O&M depending on the nature of any cap that is required.	Approval for open water disposal of site sediments expected to be difficult. Not Retained.	
In Situ Sediment Treatment	Biological Treatment	Natural Attenuation	Natural biotransformation processes such as biodegradation and sedimentation can reduce contaminant concentrations to acceptable levels over time.	Generally not effective for quickly reducing risk from contaminants in the aquatic environment.	Technically implementable. Monitoring may be required to ensure adequate reduction rate. May require institutional controls during treatment period.	Negligible capital. Low O&M.	Slow technology that may not be effective for treatment of areas of higher lower concentrations of contaminants. Not Retained.	

TABLE 24
PRELIMINARY REMEDIAL ALTERNATIVES
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Site Subunit	Matrix	Contaminants Exceeding Proposed Cleanup Levels	Objective	PRELIMINARY CLEANUP ACTION ALTERNATIVE COMPONENTS				
				ALTERNATIVE 1 (Institutional Controls)	**ALTERNATIVE 2 (Capping - All Sub-Units)**	**ALTERNATIVE 3 (Excavation + Institutional Controls)**	**ALTERNATIVE 4 (Excavation + Capping)**	**ALTERNATIVE 5 (Excavation - All Sub-Units)**
				Institutional Controls with Limited Action	Capping: Sediment Remediation Area, Former AST Area, TP08 Vicinity, Power House Complex and Steel Production Building Natural Attenuation of Petroleum in Groundwater.	Excavation: Sediment Remediation Area, Former AST Area, and TP08 Vicinity Institutional Controls: Steel Production Building and Power House Complex	Excavation: Sediment Remediation Area, Former AST Area and TP08 Vicinity Capping: Steel Production Building and Powerhouse Complex	Excavation: Sediment Remediation Area, Former AST Area, TP08 Vicinity, Power House Complex and Steel Production Building
Upland Soil Areas (Steel Production Building and Power House Complex)	Soil Exceeding Human Health and Ecological Cleanup Levels	Metals	Prevent human and terrestrial ecological contact with soil containing contaminants above proposed cleanup levels based on risk to respective receptors.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Install cap across areas with contaminants above human health and ecological risk-based cleanup levels. Cap to be designed as permeable exposure barrier for human and ecological receptors. -Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Implement signage to notify site users of restricted activities in capped areas.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of remaining contamination in soil.	- Excavate the hot spots (soil exceeding human health cleanup levels) in the former buildings and work areas to achieve site cleanup levels. Backfill to restore original land topography, restore site features and surfaces. - Dispose of contaminated soil at approved off-site disposal landfill based on contaminant concentrations.
TP-08 Vicinity	Soil Exceeding Human Health and Ecological Cleanup Levels	Metals	Prevent human and terrestrial ecological contact with soil containing contaminants above proposed cleanup levels based on risk to respective receptors.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Install cap across areas with contaminants above human health and ecological risk-based cleanup levels. Cap to be designed as permeable exposure barrier for human and ecological receptors. '-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Implement signage to notify site users of restricted activities in capped areas.	- Excavate contaminated soil in TP-08 metal contamination hot spot to a depth of 6-feet. Dispose of soil at approved off-site landfill. Backfill and restore to original grade.	- Excavate contaminated soil in TP-08 metal contamination hot spot to a depth of 6-feet. Dispose of soil at approved off-site landfill. Backfill and restore to original grade.	- Excavate contaminated soil in TP-08 metal contamination hot spot to a depth of 6-feet. Dispose of soil at approved off-site landfill. Backfill and restore to original grade.
6,000 Barrel AST Area	Soil Exceeding Human Health and Ecological Cleanup Levels	TPH, Metals	Prevent human and terrestrial ecological contact with soil containing contaminants above proposed cleanup levels based on risk to respective receptors. Remove soil with high residual TPH with potential to cause contamination of adjacent marine sediments.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Install cap across areas with contaminants above human health and ecological risk-based cleanup levels. cap to be designed as permeable exposure barrier for human and ecological receptors. -Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Implement signage to notify site users of restricted activities in capped areas.	- Excavate soil in the AST area to a depth of 11 feet bgs exceeding human health and terrestrial ecological cleanup levels. - Dispose of contaminated soil at approved off-site disposal landfill based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline where excavated.	- Excavate soil in the AST area to a depth of 11 feet bgs exceeding human health and terrestrial ecological cleanup levels. - Dispose of contaminated soil at approved off-site disposal landfill based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline where excavated.	- Excavate soil in the AST area to a depth of 11 feet bgs exceeding human health and terrestrial ecological cleanup levels (depth based on known contamination at TP26/DP02). - Dispose of contaminated soil at approved off-site disposal landfill based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline where excavated.
Intertidal Sediment	Sediments Exceeding SMS Criteria and Risk-Based Cleanup levels	TPH, PAHs	Prevent human and ecological exposure to contaminated sediment.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Remove upper layer of sediment to the extent required to place cap material without altering marine topography - Install cap and armoring material across areas with contaminants above cleanup levels in sediments to prevent further erosion of contaminated sediment. -Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Prohibit digging in capped areas.	- Remove sediments exceeding cleanup levels ranging from 2 to 7 feet below mud line using a barge-mounted clamshell dredge, or from the shore at low tide using land-based earthwork equipment. - Backfill to restore original land topography, restore site features and surfaces. - Transport and dispose of contaminated sediment at an approved off-site disposal landfill.	- Remove sediments exceeding cleanup levels ranging from 2 to 7 feet below mud line using a barge-mounted clamshell dredge, or from the shore at low tide using land-based earthwork equipment. - Backfill to restore original land topography, restore site features and surfaces. - Transport and dispose of contaminated sediment at an approved off-site disposal landfill.	- Remove sediments exceeding cleanup levels ranging from 2 to 7 feet below mud line using a barge-mounted clamshell dredge, or from the shore at low tide using land-based earthwork equipment. - Backfill to restore original land topography, restore site features and surfaces. - Transport and dispose of contaminated sediment at an approved off-site disposal landfill.
Groundwater	Groundwater Exceeding Groundwater Cleanup Levels	TPH, PAHs, Metals	Remove free product with potential to cause contamination of adjacent Marine Area sediments.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Monitor a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.	- Remove free product to the extent feasible, when encountered during excavation at the AST and intertidal areas. - Monitor a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.	- Remove free product to the extent feasible, when encountered during excavation at the AST and intertidal areas.. - Monitor a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.	- Remove free product to the extent feasible, when encountered during excavation at the AST and intertidal areas.. - Monitor a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.

TABLE 25
EVALUATION OF CLEANUP ACTION ALTERNATIVES
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON

	ALTERNATIVE 1 **(Institutional Controls)**	**ALTERNATIVE 2** **(Capping - All Sub-Units)**	**ALTERNATIVE 3** **(Excavation + Institutional Controls)**	**ALTERNATIVE 4** **(Excavation + Capping)**
Alternative Description	- Institutional controls and limited action. '-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site.	- Install cap across upland and sediment areas with contaminants above human health and ecological risk-based cleanup levels. Cap to be designed as permeable exposure barrier for human and ecological receptors. -Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Implement signage to notify site users of restricted activities in capped areas.	- Excavate to the extent feasible, soil to a depth of 11 ft BGS in the Former AST Area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 6 ft BGS in the TP08 Vicinity area exceeding human health and terrestrial ecological cleanup levels. - Dredge or Excavate sediments to the extent feasible, to a depth of 2 to 7 ft BGS exceeding human health and aquatic ecological cleanup levels. - Dispose of contaminated soil and sediments at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. -Implement signage, deed notifications and institutional controls for the power house complex and steel production building areas. -Monitor groundwater a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.	- Excavate to the extent feasible, soil to a depth of 11 ft BGS in the Former AST Area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 6 ft BGS in the TP08 Vicinity area exceeding human health and terrestrial ecological cleanup levels. - Dredge or Excavate sediments to the extent feasible, to a depth of 5 ft BGS exceeding human health and aquatic ecological cleanup levels. - Dispose of contaminated soil and sediments at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Install geotextile fabric and soil cap across the power house complex and steel production building areas. -Implement deed notifications and institutional controls for the power house complex and steel production building areas. - Monitor groundwater a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.
Alternative Ranking Under MTCA				
1. Compliance with MTCA Threshold Criteria				
Protection of Human Health and the Environment	No - This alternative would not be protective of human health and the environment because it would leave a significant amount of contaminated soil and sediments in place at shallow depths along the shoreline.	Yes - Alternative would protect human health and the environment through a combination of capping and institutional controls.	Yes - Alternative would protect human health and the environment through a combination of removal and institutional controls.	Yes - Alternative would protect human health and the environment through a combination of removal of the highest concentrations of contaminants in upland soil near the shoreline as well as within the marine environment.
Compliance With Cleanup Standards	No - This alternative would not comply with cleanup standards because it would leave a significant amount of contaminated soil and sediments in place at shallow depths along the shoreline.	Yes - This alternative would require acceptance of the use of alternative points of compliance for measurement of compliance with cleanup standards. Immobilizing site contaminants using capping would include long term monitoring to ensure compliance with cleanup standards at the conditional points of compliance.	Yes - Alternative is expected to comply with cleanup standards in the most accessible portions of the site, while contamination in upland areas away from the shoreline (power house complex and steel production building areas) are addressed using institutional controls to prevent exposure to soil left in place.	Yes - Alternative is expected to comply with cleanup standards in the most accessible portions of the site, while contamination in upland areas away from the shoreline (power house comlex and steel production building areas) are addressed by capping in place.
Compliance With Applicable State and Federal Regulations	No - This alternative would not comply with applicable state and federal regulations because it would leave a significant amount of contaminated soil and sediments in place at shallow depths along the shoreline.	Yes - Alternative complies with applicable state and federal regulations. Future development of property could potentially require additional environmental cleanup or special provisions	Yes - Alternative complies with applicable state and federal regulations in all areas of the site except the power house complex and steel production building areas. Future development of property could potentially require additional environmental cleanup or special provisions.	Yes - Alternative complies with applicable state and federal regulations in all areas of the site except the power house complex and steel production building areas. Future development of property could potentially require additional environmental cleanup or special provisions.
Provision for Compliance Monitoring	Yes - This Alternative allows for compliance monitoring through the use of traditional groundwater monitoring as well as regular soil and sediment sampling.	Yes - Alternative includes provisions for monitoring of groundwater to assess natural attenuation processes and sediment to ensure cap function.	Yes - Alternative includes provisions for compliance groundwater monitoring.	Yes - Alternative includes provisions for compliance groundwater monitoring.
2. Restoration Time Frame				
	Initial restoration time frame is relatively short. However, potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.
3. Disproportionate Cost Analysis Relative Benefits Ranking (Scored from 1-lowest to 5-highest)				
Protectiveness	Not Applicable - Alternative does not meet MTCA threshold criteria.	Score = 2 Achieves a medium-low level of overall protectiveness as a result of capping in place of the contaminated soil and sediments at the Site. Most upland soil would be effectively isolated from site users, but the reliability of notification methods as the primary prevention method at an uncontrolled site is questionable.	Score = 3 Achieves a medium level of overall protectiveness as a result of removal of majority of contaminated soil in areas that are most accessible and nearest the shoreline. However, this alternative would leave in place the contaminated soil in the power house complex and the steel production building area, which will be addressed through implementation of institutional controls such as signage and deed restrictions.	Score = 4 Achieves a medium-high level of overall protectiveness as a result of removal of majority of contaminated soil in areas that are most accessible and nearest the shoreline. However, this alternative would leave in place the contaminated soil in the power house complex and the steel production building area, which will be addressed by capping the contamianted soil in place to reduce the potential for exposure.
Permanence	Not Applicable - Alternative does not meet MTCA threshold criteria.	Score = 2 Achieves permanent reduction of toxicity and mobility of hazardous substances at the Site without overall reduction of mass. The quantity of impacted soil and sediments allowed to remain on site is greater than with Alternatives 3 through 6.	Score = 4 Achieves permanent reduction of mass, toxicity, and mobility of hazardous substances at the Site, but to a lower degree than Alternative 5. The quantity of impacted soil allowed to remain on site is greater than with Alternative 5.	Score = 3 Achieves permanent reduction of mass, toxicity, and mobility of hazardous substances at the Site, but to a lower degree than Alternatives 4 and 5. The quantity of impacted soil allowed to remain on site is greater than with Alternatives 4 and 5.
Long-Term Effectiveness	Not Applicable - Alternative does not meet MTCA threshold criteria.	Score = 2 Prevents human and ecological contact to the contaminated soil and sediments but; does not remove hazardous substances from the Site. Effectiveness on a long term relies on monitoring and maintenance of capped areas.	Score = 4 Removes the majority of hazardous substances from the Site and utilizes approved off-site disposal facilities for final disposition, but leaves soil on site that exceeds cleanup levels. The use of institutional controls reduces the risk to human health and the environment from the residual contamination left in place. Future development may require modification of the remedy.	Score = 3 Removes portion of hazardous substances from the Site and utilizes approved off-site disposal facilities for final disposition, but leaves soil on site that exceeds cleanup levels. The use of institutional controls reduces the risk to human health and the environment from the residual contamination left in place. Future development may require modification of the remedy.
Management of Short-Term Risks	Not Applicable - Alternative does not meet MTCA threshold criteria.	Score = 4 Involves capping of soils and sediments in the areas of park currently used by the public. However, the earthwork methods required under this alternative are well established and capable of reducing short-term risks.	Score = 3 Involves extensive soil removal across the upland areas, and sediment dredging using earth based equipment, including excavation in the park areas currently used by the public. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.	Score = 3 Involves extensive soil removal across the upland areas, and sediment dredging using earth based equipment, including excavation in the park areas currently used by the public. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.
Technical and Administrative Implementability	Not Applicable - Alternative does not meet MTCA threshold criteria.	Score = 4 Capping of upland areas will require clearing of trees and other vegetation to allow placement of geotextile and fill but generally utilizes common earthwork methods. Temporary site closure to public would allow facilitation of project.	Score = 3 Utilizes the same general construction methods as Alternatives 4 through 6. Temporary site closure to public would allow facilitation of project.	Score = 3 Utilizes the same general construction methods as Alternatives 4 through 6. Temporary site closure to public would allow facilitation of project.
Consideration of Public Concerns	Not Applicable - Alternative does not meet MTCA threshold criteria.	Score = 3 Addresses the exposure of human and ecological contact to the contaminated soil and sediments. The remaining contaminated soil left in place would require maintenance of institutional controls and impose limitations on future use and development of the public property.	Score = 4 Addresses the most accessible soil and sediments that poses the greatest risk to human health and the environment. The remaining contaminated soil left in place would require maintenance of institutional controls and impose limitations on future use and development of the public property.	Score = 4 Addresses the most accessible soil and sediments that poses the greatest risk to human health and the environment. The remaining contaminated soil left in place would require maintenance of institutional controls and impose limitations on future use and development of the public property.

TABLE 25
EVALUATION OF CLEANUP ACTION ALTERNATIVES
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON

	ALTERNATIVE 5 (Excavation - All Sub-Units)
Alternative Description	- Excavate to the extent feasible, soil to a depth of 11 ft BGS in the AST area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 6 ft BGS in the TP-08 vicinity area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 6 ft BGS in the power house complex area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 3 ft BGS in the steel production building area exceeding human health and terrestrial ecological cleanup levels. - Dredge or Excavate sediments to the extent feasible, to a depth of 5 ft BGS exceeding human health and aquatic ecological cleanup levels. - Dispose of contaminated soil and sediments at approved off-site disposal facility based on contaminant concentrations. -Monitor groundwater a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.
Alternative Ranking Under MTCA	
1. Compliance with MTCA Threshold Criteri	
Protection of Human Health and the Environment	Yes - Alternative would protect human health and the environment through a combination of removal and incompliance monitoring.
Compliance With Cleanup Standards	Yes - Alternative is expected to comply with cleanup standards as negotiated with Ecology.
Compliance With Applicable State and Federal Regulations	Yes - Alternative complies with applicable state and federal regulations in all portions of the site.
Provision for Compliance Monitoring	Yes - Alternative includes provisions for compliance groundwater monitoring.
2. Restoration Time Frame	
	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.
3. Disproportionate Cost Analysis Relative	
Protectiveness	Score = 5 Achieves a high level of overall protectiveness as a result of excavation in all contaminated portions of the site and removal of contaminated soil and sediments to the extent feasible.
Permanence	Score = 5 Achieves permanent reduction of mass, toxicity, and mobility of hazardous substances at the Site, in soil and sediments to a degree higher than all other alternatives.
Long-Term Effectiveness	Score = 5 Removes the majority of hazardous substances from the Site and utilizes approved off-site disposal facilities for final disposition. Leaves the least mass of soil on site that exceeds cleanup levels.
Management of Short-Term Risks	Score = 3 Involves extensive soil removal across the entire upland area, and sediment dredging using earth based equipment, including excavation in the park areas currently used by the public. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.
Technical and Administrative Implementability	Score = 2 Utilizes the same general construction methods as Alternatives 3 and 4, with the addition of excavaiton being performed in the vicinity of the steel production building, lowering the relative implementability. Temporary site closure to public would allow facilitation of project.
Consideration of Public Concerns	Score = 4 Addresses all areas of contamination in soil and sediments on the site. Aggressiveness of alternative results in significant interruptions of usability of the site by the public.

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TABLE 26
COST ESTIMATE - REMEDIAL ALTERNATIVE 2 (CAPPING)
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON

ITEM No.	DESCRIPTION	PLAN QUANT	UNIT	UNIT PRICE	AMOUNT (2009$)	NOTE
	Design, Permitting, and Administrative Costs					
1	Design and Permitting	1	LS	$75,000.00	$75,000	Prepare design, contracting documents, permit applications for in-water work.
2	Institutional Controls	1	LS	$50,000.00	$50,000	Develop restrictive covenants for contamination left in place, implement signage and other notifications.
				Subtotal	**$125,000**	
Pre-Construction Total					**$125,000**	
	Mobilization and Site Preparation					
3	Mobilization/Site Controls/Demobilization	1	LS	$4,500.00	$4,500	Wyser Construction cost estimate, April 2009
4	Erosion control	1	LS	$2,500.00	$2,500	
5	Demolition	1	LS	$5,000.00	$5,000	
6	Site Restoration	1	LS	$10,000.00	$10,000	
				Subtotal	**$22,000**	
	Soil and Sediment Capping					
7	Clearing and Grubbing upland cap area	1.4	Acre	$7,500.00	$10,900	Unit cost based on bid costs for similar project in NW Washington.
8	Install upland geotextile	7,014	SY	$2.25	$15,800	
9	Place 2-foot lift of fill in Upland cap areas	4,676	CY	$17.00	$79,500	
10	Dredge/Excavate upper 2-foot of sediment below MHHW	519	CY	$15.00	$7,800	
11	Contaminated Soil (non-haz) Transport and Disposal at approved off-site facility	933	TON	$81.67	$76,200	Basis: Wyser Bid - 2009
12	Purchase, Place and Compact Granular Marine Backfill Material	130	CY	$32.00	$4,100	Unit cost based on bid costs for similar project in NW Washington.
13	Purchase, Place and Compact Rock/Armor Backfill Material	389	CY	$48.00	$18,700	
					$213,000	
	Groundwater Monitoring					
14	Perform initial 4 quarterly monitoring events, monitor for TPH, cPAHs and metals only	4	Ea	$2,200.00	$8,800	Based on recent groundwater sampling costs at the site.
15	Perform annual monitoring events for 5 years, monitor for TPH, cPAHs and metals only	5	Ea	$2,200.00	$9,525	Total cost is discounted for net present value based on 5% discount rate.
				Subtotal	**$18,325**	
	Contractor Overhead (Based on total of Tasks 1-22)	10.00%	%		$44,082	
	Sales Tax	8.2%	%		$39,762	Sales Tax applied to sum of construction items and construction overhead.
	Total Purchase and Installation Subtotal				**$524,670**	
	Construction Management and Field Monitoring	10.0%	%		$52,467	
	Construction Contingency (Concept design level)	15.0%	%		$86,571	Low contingency associated with more simple remedy.
Construction Total					**$663,707**	
OVERALL PROJECT TOTAL COSTS					**$789,000**	Costs for removing slag outcrop material associated with shoreline restoration activities are not included in overall project costs.

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TABLE 27
COST ESTIMATE - REMEDIAL ALTERNATIVE 3 (EXCAVATION + INSTITUTIONAL CONTROLS)
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON

ITEM No.	DESCRIPTION	PLAN QUANT	UNIT	UNIT PRICE	AMOUNT (2009$)	NOTE
	Design, Permitting, and Administrative Costs					
1	Design and Permitting	1	LS	$100,000.00	$100,000	Prepare design, contracting documents, permit applications for in-water work. Increased complexity of design relative to Alternative 2.
2	Institutional Controls	1	LS	$40,000.00	$40,000	Develop restrictive covenants for contamination left in place, implement signage and other notifications. Reduced scope of covenants for upland areas.
				Subtotal	**$140,000**	
Pre-Construction Total					**$140,000**	
	Mobilization, Site Preparation, Site Restoration					
3	Mobilization/Site Controls/Demobilization	1	LS	$4,500.00	$4,500	Wyser Construction cost estimate, April 2009
4	Erosion control	1	LS	$2,500.00	$2,500	
5	Demolition	1	LS	$5,000.00	$5,000	
6	Site Restoration	1	LS	$10,000.00	$10,000	
				Subtotal	**$22,000**	
	Soil and Sediment Removal, Backfill, and Pavement Restoration					
7	Installation of Sheet Pile Wall	6,000	SF	$18.70	$112,200	Assume temporary sheet pile along shoreline and adjacent to the AST TPH areas requiring remedial action (See Fig. 14). Assumed sheet pile wall 300 feet long and 20 feet deep. Unit cost based on Means 2005 estimates (20 feet deep excavation, 27 psf, drive.
8	Excavation Dewatering	1	LS	$75,000.00	$75,000	Pump, Temporary Storage, and Disposal. Dewatering expected to be required for AST and sediment removal
9	Excavate and stockpile Soil (0'-6' bgs) TP-08 area	3,840	CY	$10.00	$38,400	Total of all soil excavated. Assume 20% expansion above in-place volume. Cost includes excavation and stockpile. Unit cost for excavation based on average of two bids (Wyser and Clean Harbor).
10	Excavate and stockpile Soil (0'-11' bgs) AST area	1,626	CY	$10.00	$16,300	
11	Excavate and stockpile sediment (0'-5' bgs) Intertidal area	1,556	CY	$10.00	$15,600	
12	Contaminated Soil (non-haz) Transport and Disposal at approved off-site facility	11,234	TON	$81.67	$917,500	All contaminated soil transport and disposal. Assume 1.6 ton/CY. Cost includes loading and hauling to a non-haz landfill. Average of Wyser and Clean Harbor estimates.
13	Purchase, Place and Compact General Backfill Material	10,715	TON	$10.00	$107,200	Assume 1.6 ton/CY. Assume tonnage equal to that of off-site disposal soil minus 2-foot lift of granular marine backfill. Cost includes purchase, filling and compaction. Unit cost based on Clean Harbor estimate.
14	Purchase, Place and Compact Granular Marine Backfill Material	519	CY	$32.00	$16,600	2-foot lift of granular backfill to be placed below MHHW over general backfill.
				Subtotal	**$1,298,800**	
	Groundwater Monitoring					
15	Perform 4 quarterly monitoring events, monitor for TPH, cPAHs and metals only	4	Ea	$2,200.00	$8,800	Based on recent groundwater sampling costs at the site.
				Subtotal	**$8,800**	
	Contractor Overhead (Based on total of Tasks 1-22)	10.00%	%		$132,960	
	Sales Tax	8.2%	%		$119,930	Sales Tax applied to sum of construction items and construction overhead.
	Total Purchase and Installation Subtotal				**$1,582,490**	
	Construction Management and Field Monitoring	10.0%	%		$158,249	
	Contingency (Concept design level)	20.0%	%		$348,148	Higher contingency relative to Alternative 2 due to uncertainties associated with contaminant extent along shoreline.
Construction Total					**$2,088,887**	
OVERALL PROJECT TOTAL COSTS					**$2,230,000**	Costs for removing slag outcrop material associated with shoreline restoration activities are not included in overall project costs.

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TABLE 28
COST ESTIMATE - REMEDIAL ALTERNATIVE 4 (EXCAVATION + CAPPING)
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON

ITEM No.	DESCRIPTION	PLAN QUANT	UNIT	UNIT PRICE	AMOUNT (2009$)	NOTE
	Design, Permitting, and Administrative Costs					
1	Design and Permitting	1	LS	$120,000.00	$120,000	Prepare design, contracting documents, permit applications for in-water work. Increased complexity of design relative to Alternative 3.
2	Institutional Controls	1	LS	$30,000.00	$30,000	Develop restrictive covenants for contamination left in place, implement signage and other notifications. Reduced scope of covenants for upland areas.
				Subtotal	**$150,000**	
Pre-Construction Total					**$150,000**	
	Mobilization and Site Preparation					
1	Mobilization/Site Controls/Demobilization	1	LS	$4,500.00	$4,500	Wyser Construction cost estimate, April 2009
2	Erosion control	1	LS	$2,500.00	$2,500	
3	Demolition	1	LS	$5,000.00	$5,000	
4	Site Restoration	1	LS	$10,000.00	$10,000	
				Subtotal	**$22,000**	
	Soil and Sediment Removal, Backfill, and Pavement Restoration					
5	Installation of Sheet Pile Wall (near-shore sediment area)	6,000	SF	$18.70	$112,200	Assume temporary sheet pile along shoreline and adjacent to the AST TPH areas requiring remedial action (See Fig. 14). Assumed sheet pile wall 300 feet long and 20 feet deep. Unit cost based on Means 2005 estimates (20 feet deep excavation, 27 psf, drive, extract, & salvage).
6	Excavation Dewatering	1	LS	$50,000.00	$50,000	Pump, Temporary Storage, and Disposal. Dewatering expected to be required for AST and sediment removal
7	Excavate and stockpile Soil (0'-6' bgs) TP-08 area	3,840	CY	$10.00	$38,400	Total of all soil excavated. Assume 20% expansion above in-place volume. Cost includes excavation and stockpile. Unit cost for excavation based on average of two bids (Wyser and Clean Harbor).
8	Excavate and stockpile Soil (0'-11' bgs) AST area	1,626	CY	$10.00	$16,300	
9	Excavate and stockpile sediment (0'-5' bgs) Intertidal area	1,556	CY	$10.00	$15,600	
10	Contaminated Soil (non-haz) Transport and Disposal at approved off-site facility	11,234	TON	$81.67	$917,500	All contaminated soil transport and disposal. Assume 1.6 ton/CY. Cost includes loading and hauling to a non-haz landfill. Average of Wyser and Clean Harbor estimates.
11	Purchase, Place and Compact General Backfill Material	10,715	TON	$10.00	$107,200	Assume 1.6 ton/CY. Assume tonnage equal to that of off-site disposal soil minus 2-foot lift of granular marine backfill. Cost includes purchase, filling and compaction. Unit cost based on Clean Harbor estimate.
12	Purchase, Place and Compact Granular Marine Backfill Material	519	CY	$32.00	$16,600	2-foot lift of granular backfill to be placed below MHHW over general backfill.
				Subtotal	**$1,273,800**	
	Soil Capping					
13	Clearing and Grubbing upland cap area	1.0	Acre	$7,500.00	$7,800	Unit cost based on bid costs for similar project in NW Washington. Higher unit cost for cap fill, relative to Aternative 2 due to the cap areas are limited to restricted upland areas only.
14	Install upland geotextile	5,044	SY	$2.25	$11,400	
15	Place 2-foot lift of fill in Upland cap areas	3,363	CY	$20.00	$67,300	
				Subtotal	**$86,500**	
	Groundwater Monitoring					
16	Perform 4 quarterly monitoring events, monitor for TPH, cPAHs and metals only	4	Ea	$2,200.00	$8,800	Based on recent groundwater sampling costs at the site.
				Subtotal	**$8,800**	
	Contractor Overhead (Based on total of Tasks 1-22)	10.00%	%		$139,110	
	Sales Tax	8.2%	%		$125,477	Sales Tax applied to sum of construction items and construction overhead.
	Total Purchase and Installation Subtotal				**$1,655,687**	
	Construction Management and Field Monitoring	10.0%	%		$165,569	
	Contingency (Concept design level)	20.0%	%		$364,251	Higher contingency relative to Alternative 2 due to uncertainties associated with contaminant extent along shoreline.
Construction Total					**$2,185,507**	
OVERALL PROJECT TOTAL COSTS					**$2,340,000**	Costs for removing slag outcrop material associated with shoreline restoration activities are not included in overall project costs.

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TABLE 29
COST ESTIMATE - REMEDIAL ALTERNATIVE 5 (EXCAVATION)
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON

ITEM No.	DESCRIPTION	PLAN QUANT	UNIT	UNIT PRICE	AMOUNT (2009$)	NOTE
	Design, Permitting, and Administrative Costs					
1	Design and Permitting	1	LS	$130,000.00	$130,000	Prepare design, contracting documents, permit applications for in-water work. Increased complexity of design relative to Alternative 4.
2	Institutional Controls	1	LS	$10,000.00	$10,000	Develop minimal documentation to account for contamination not removed during excavation.
				Subtotal	**$140,000**	
Pre-Construction Total					**$140,000**	
	Mobilization and Site Preparation					
3	Mobilization/Site Controls/Demobilization	1	LS	$4,500.00	$4,500	Wyser Construction cost estimate, April 2009
4	Erosion control	1	LS	$2,500.00	$2,500	
5	Demolition	1	LS	$5,000.00	$5,000	
6	Site Restoration	1	LS	$10,000.00	$10,000	
	Subtotal				**$22,000**	
	Soil and Sediment Removal, Backfill, and Pavement Restoration					
7	Installation of Sheet Pile Wall	6,000	SF	$18.70	$112,200	Assume temporary sheet pile along shoreline and adjacent to the AST TPH areas requiring remedial action (See Fig. 14). Assumed sheet pile wall 300 feet long and 20 feet deep. Unit cost based on Means 2005 estimates (20 feet deep excavation, 27 psf, drive).
8	Excavation Dewatering	1	LS	$75,000.00	$75,000	Pump, Temporary Storage, and Disposal. Dewatering expected to be required for AST and sediment removal
9	Excavate and stockpile Soil (0'-3' bgs) steel production building	5,653	CY	$10.00	$56,500	Total of all soil excavated. Assume 20% expansion above in-place volume. Cost includes excavation and stockpile. Unit cost for excavation based on average of two bids (Wyser and Clean Harbor).
10	Excavate and stockpile Soil (0'-6' bgs) power house complex	800	CY	$10.00	$8,000	
11	Excavate and stockpile Soil (0'-6' bgs) TP-08 area	3,840	CY	$10.00	$38,400	
12	Excavate and stockpile Soil (0'-11' bgs) AST area	1,626	CY	$10.00	$16,300	
13	Excavate and stockpile sediment (0'-5' bgs) Intertidal area	1,556	CY	$10.00	$15,600	
14	Contaminated Soil (non-haz) Transport and Disposal at approved off-site facility	21,559	TON	$81.67	$1,760,700	All contaminated soil transport and disposal. Assume 1.6 ton/CY. Cost includes loading and hauling to a non-haz landfill. Average of Wyser and Clean Harbor estimates.
15	Purchase, Place and Compact General Backfill Material	21,041	TON	$10.00	$210,400	Assume 1.6 ton/CY. Assume tonnage equal to that of off-site disposal soil minus 2-foot lift of granular marine backfill. Cost includes purchase, filling and compaction. Unit cost based on Clean Harbor estimate.
16	Purchase, Place and Compact Granular Marine Backfill Material	519	CY	$32.00	$16,600	2-foot lift of granular backfill to be placed below MHHW over general backfill.
	Subtotal				**$2,309,700**	
	Groundwater Monitoring					
17	Perform 4 quarterly monitoring events, monitor for TPH, cPAHs and metals only	4	Ea	$2,200.00	$8,800	Based on recent groundwater sampling costs at the site.
	Subtotal				**$8,800**	
	Contractor Overhead (Based on total of Tasks 1-22)	10.00%	%		$234,050	
	Sales Tax	8.2%	%		$211,113	Sales Tax applied to sum of construction items 1-22 and construction overhead.
	Total Purchase and Installation Subtotal				**$2,785,663**	
	Construction Management and Field Monitoring	10.0%	%		$278,566	
	Contingency (Concept design level)	30.0%	%		$919,269	Higher 30% contingency used to account for uncertainties associated with shoreline excavation and excavation of upland area.
Construction Total					**$3,983,498**	
OVERALL PROJECT TOTAL COSTS					**$4,120,000**	Costs for removing slag outcrop material associated with shoreline restoration activities are not included in overall project costs.

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TABLE 30
SUMMARY OF MTCA EVALUATION AND RANKING OF CLEANUP ACTION ALTERNATIVES
DRAFT RI/FS
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON

Alternative Number	**ALTERNATIVE 1 (Instititional Controls)**	**ALTERNATIVE 2 (Capping - All Sub-Units)**	**ALTERNATIVE 3 (Excavation + Institutional Controls)**	**ALTERNATIVE 4 (Excavation + Capping)**	**ALTERNATIVE 5 (Excavation - All Sub-Units)**
Alternative Ranking Under MTCA					
1. Compliance with MTCA Threshold Criteria (1)	NO	YES	YES	YES	YES
2. Restoration Time Frame	Less than one year	Two to three years	Two to three years	Two to three years	Two to three years
3. DCA Relative Benefits Ranking	--	4th	3rd	2nd	1st
Protectiveness	--	2	3	4	5
Permanence	--	2	3	4	5
Long-Term Effectiveness	--	2	3	4	5
Management of Short-Term Risks	--	4	3	3	3
Technical and Administrative Implementability	--	4	3	3	2
Consideration of Public Concerns	--	3	4	4	4
Total of Scores	--	**17**	**19**	**22**	**24**
4. Disproportionate Cost Analysis (DCA)					
Probable Remedy Cost (+50%/-30%, rounded) (4)	--	$789,000	$2,230,000	$2,340,000	$4,120,000
Costs Disproportionate to Incremental Benefits	--	NA (2)	NO	NO	YES
Practicability of Remedy	--	Practicable	Practicable	Practicable	Practicable
Remedy Permanent to Maximum Extent Practicable	--	Yes (3)	Yes	Yes (3)	Yes
Overall Alternative Ranking	**Does not meet threshold requirements; not ranked**	**3rd**	**2nd**	**1st**	**Costs disproportionate; not ranked**

Notes:
1 Noncompliant alternatives were not considered in the DCA (items 3 and 4 in this table).
2 Not applicable since this is the lowest cost alternative.
3 May require modification due to future land use or development.
4 Costs associated with removal of slag outcrop material associated with shoreline restoration activities are not included in Probable Remedy Costs.

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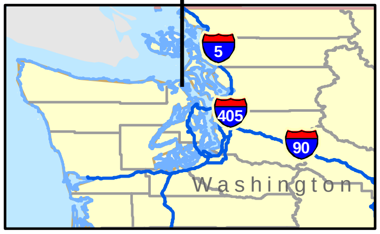

Data Sources: ESRI Data & Maps, Street Maps 2005.
Chimacum Creek Tidelands location obtained from "Health Consultation. Evaluation of Selected Metals in Irondale Beach Park and Chimacum Creek Tidelands Shell Fish." Irondale, Jefferson County, Washington. Agency for Toxic Substances and Disease Registry. July 28, 2008.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
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Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

Vicinity Map

Irondale Iron and Steel Plant
Irondale, Washington

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Figure 1

Map Revised: July 16, 2009

Office: SEA Path: P:\0\0504042\00\GIS\050404200 FIG-1.mxd

Map Revised: May 18, 2009

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007).
Former structures from Hart Crowser (1996).

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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Office:SEA

Site Plan

Irondale Iron and Steel Plant
Irondale, Washington

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Figure 2

Previous Sampling Locations

Irondale Iron and Steel Plant
Irondale, Washington

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Figure 3

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007).
Former structures and Hart Crowser sample locations from Hart Crowser (1996).
Jefferson County sample locations from Jefferson County (2001 and 2007).

Notes:
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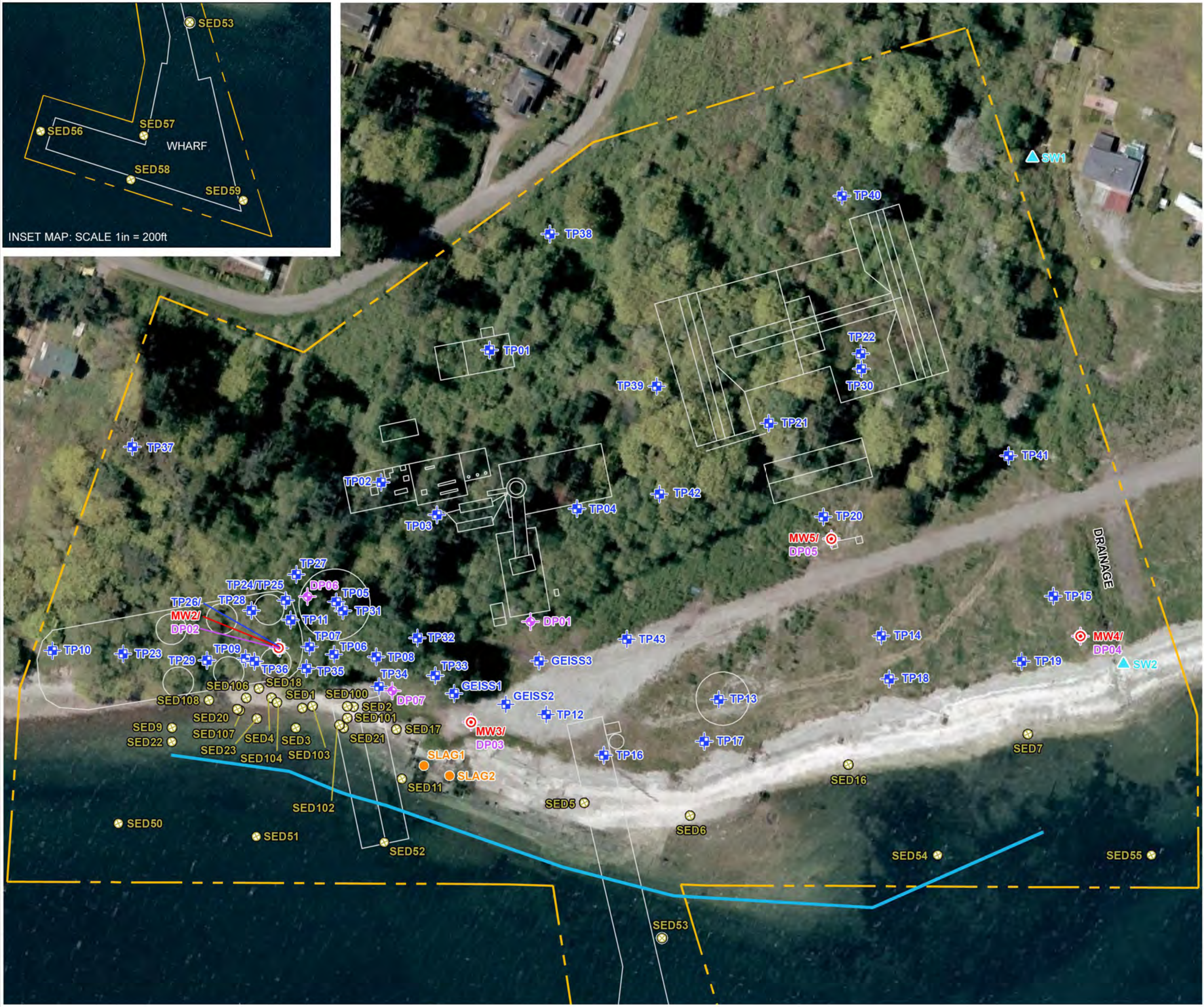
Map Revised: May 18, 2009

Path: P:\0\0504042\00\GIS\050404200_FIG-3-051809.mxd

Office:SEA



Legend

DP01	Direct-Push Boring Location and ID
TP40	Soil Sample Location and ID
SLAG1 ●	Slag Sample Location and ID
SED104	Sediment Sample Location and ID
SW1 ▲	Surface Water Sample Location and ID
MW3	Monitoring Well Location and ID
	Approximate mean Lower Lower Water (MLLW)
	Site Boundary
	Former Structures

100 0 100
FEET

Notes

1. The locations of all features shown are approximate.
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3. Monitoring well was not constructed at DD01 PC Draft RI/FS Work Plan (GeoEngineers, 2007A; i.e. MW01 does not exist).

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

RI Sample Locations

Irondale Iron and Steel Plant
Irondale, Washington

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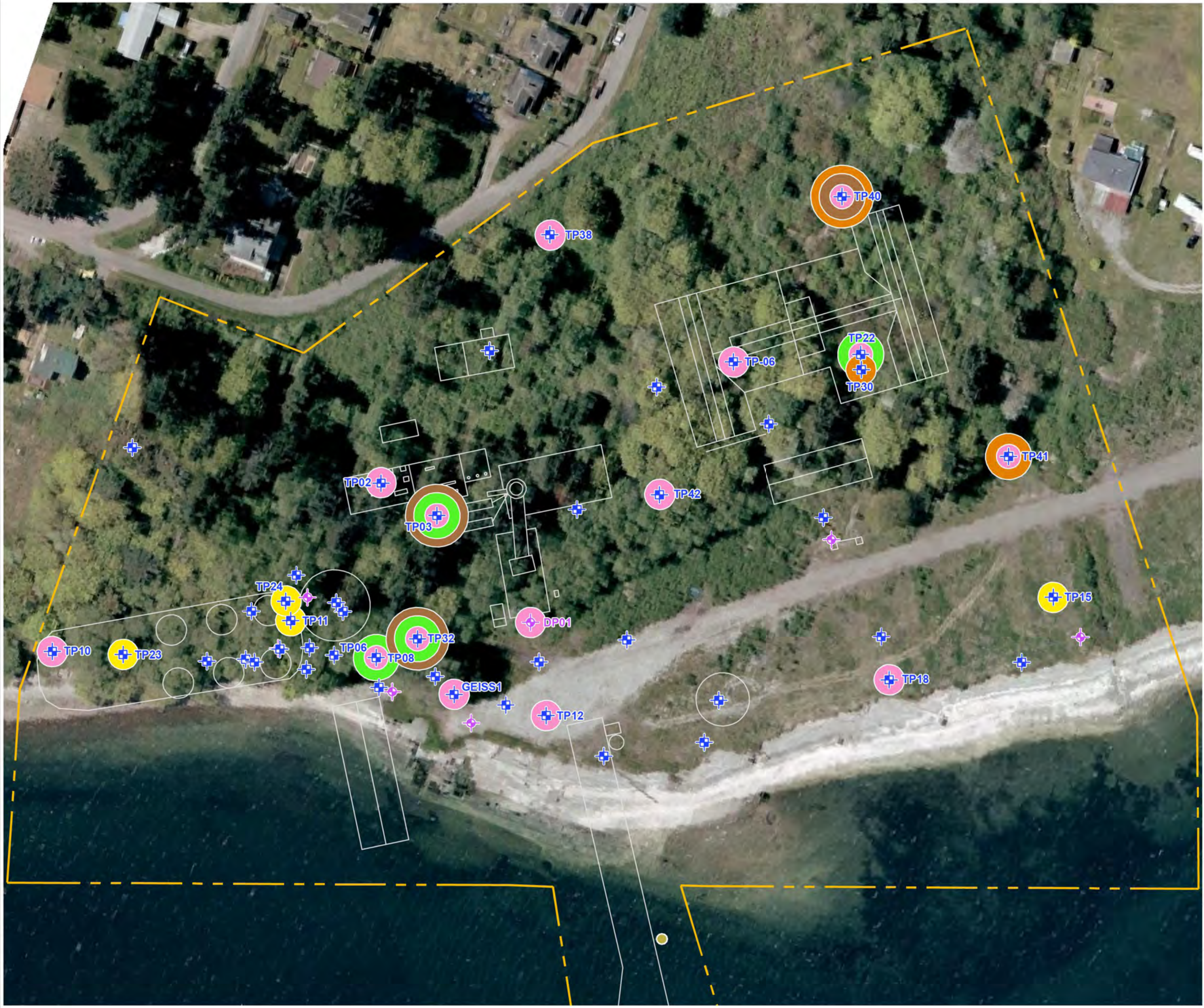
Figure 4

P:\0\0504042\00\CADD\T04\SITE PLAN FIGURES\SHEET\050404200 FIG 4.DWG\TAB:FIG 4 MODIFIED BY TMICHAUD ON JUL 17, 2009 - 13:10



Legend

● Soil Biota Bioassay (TPH) Soil Sample Location

● Plant and Soil Biota Bioassay (Metals) Soil Sample Location

● Arsenic (III/V) Speciation Soil Sample Location

● Co-located Soil / Plant Sample Location

● Co-located Soil / Earthworm Sample Location

DP01 ⌖ Direct-Push Boring Location and ID

TP40 ⌖ Soil Sample Location and ID

Site Boundary

Former Structures

100 0 100
FEET

Notes

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

Terrestrial Ecological Evaluation
Sample Locations

Irondale Iron and Steel Plant
Irondale, Washington

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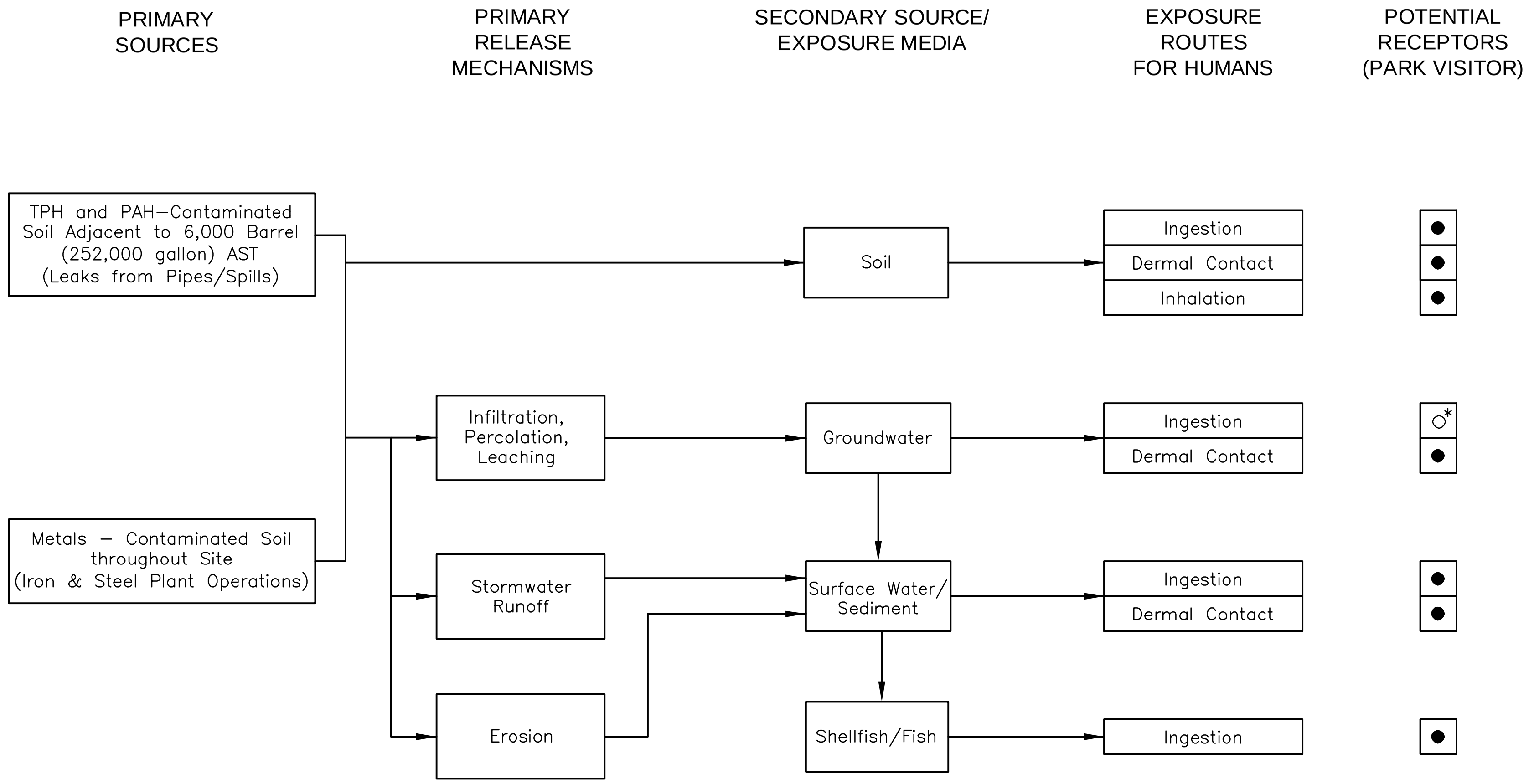
Figure 5

P:\0504042\00\CADD\T04\SITE PLAN FIGURES\SHEET\050404200 FIG 5.DWG\TAB:FIG 5 MODIFIED BY TMICHAUD ON APR 24, 2009 - 14:00



EXPLANATION:

● COMPLETE EXPOSURE PATHWAY

○* COMPLETE BUT INSIGNIFICANT EXPOSURE PATHWAY

Notes:
1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Human Health Conceptual Site Exposure Model

Irondale Iron & Steel Plant
Irondale, Washington

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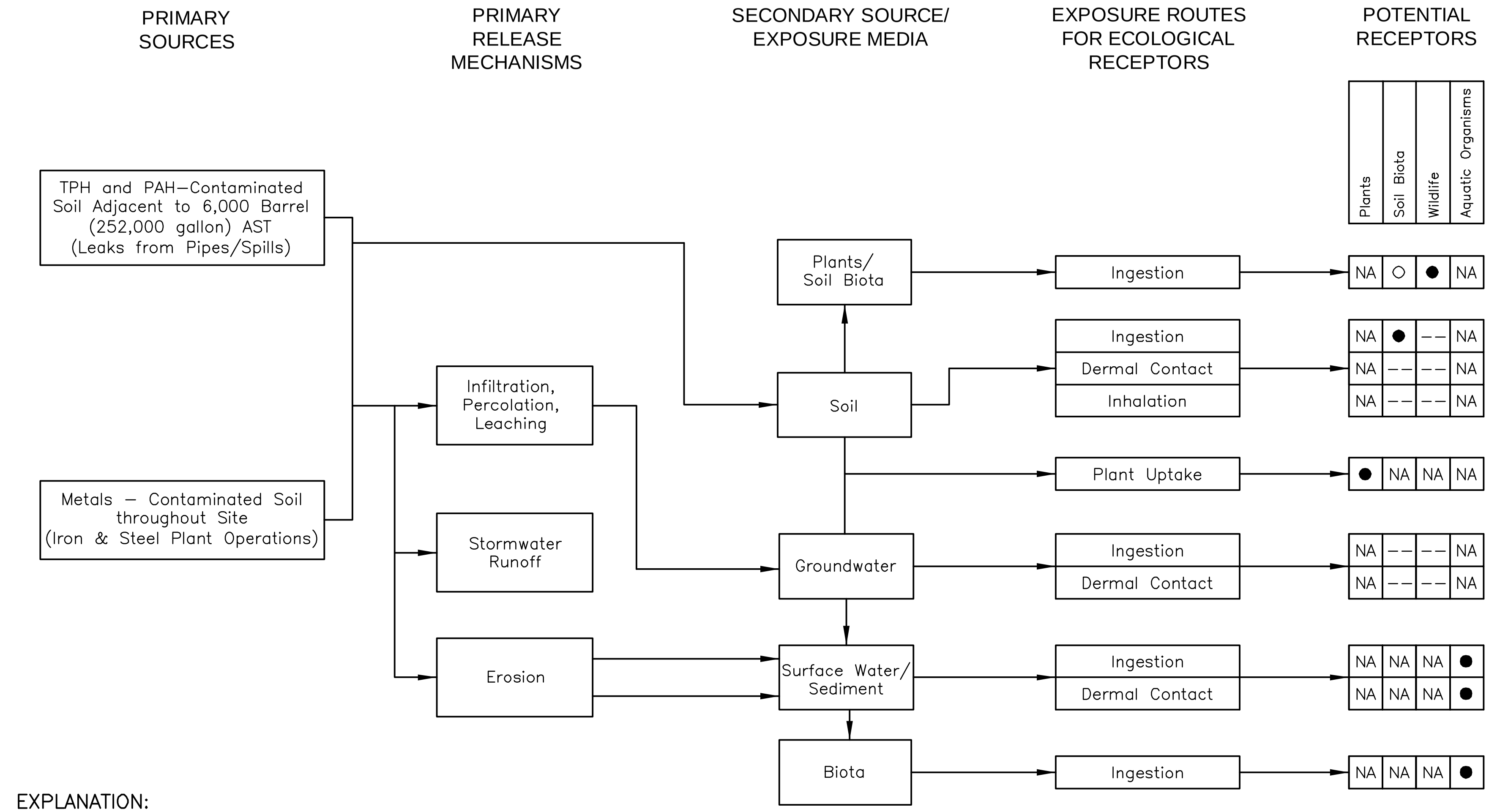
Figure 6

P:\0\0504042\00\CADD\T05\050404200T04-Fig 3 and 4.dwg\TAB:Fig 7 modified on Aug 28, 2009 - 3:33pm

JCL : TJM



EXPLANATION:

● COMPLETE EXPOSURE PATHWAY

○ INCOMPLETE EXPOSURE PATHWAY

–– POTENTIALLY COMPLETE INSIGNIFICANT EXPOSURE PATHWAY

NA NOT APPLICABLE

Notes:

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Ecological Conceptual Site Exposure Model

Irondale Iron & Steel Plant
Irondale, Washington

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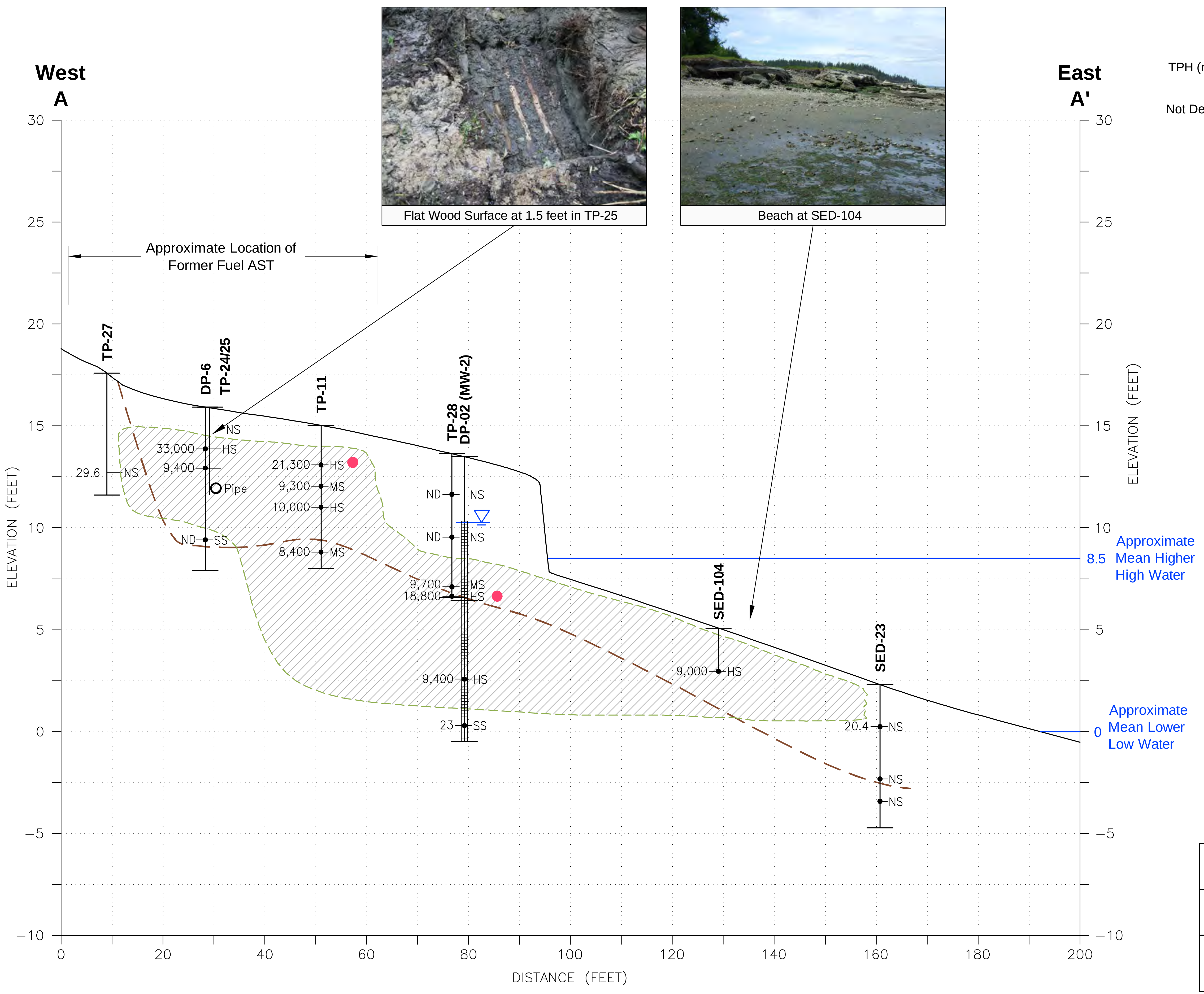
Figure 7


Flat Wood Surface at 1.5 feet in TP-25

Beach at SED-104

Legend

TP-27 = Boring

Field Screen Result

TPH (mg/kg)* = 3,000 HS = Heavy Sheen
MS = Moderate Sheen
SS = Slight Sheen
Not Dectected = ND NS = No Sheen

= Water Level (1/8/09)

= Well Screen

● = Oil seep from side of excavation

= Fill (sand, brick, slag) above this line
= Native sand below this line

▨ = Interpreted extent of Total Petroleum Hydrocarbon concentrations greater than the cleanup level

* TPH is sum of diesel and oil-range hydrocarbon concentrations

HORIZONTAL SCALE: 1"= 20'
VERTICAL SCALE: 1"= 5'
VERTICAL EXAGGERATION: 4X

20 0 20
FEET

Notes

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

3. MLLW Tidal Datum, MLLW=0' Converted from NGVD 29.

Cross Section from AST through Beach

State of Washington Department of Ecology
Irondale, Washington

GEOENGINEERS

Figure 8

P:\0\0504042\00\CADD\T04\050404200T04-F8.DWG\TAB:FX MODIFIED BY TMICHAUD ON APR 24, 2009 - 13:09

P:\0\0504042\00\CADD\T04\SITE PLAN FIGURES\SHEET\050404200 FIG 9.DWG\TAB:FIG 9 MODIFIED BY TMICHAUD ON APR 10, 2009 - 10:35

TP03

DEPTH	As	Fe	Pb
0.5'	**28.1**	**156,000**	**370**
1'	**58**	**419,000**	**720**
2'	6	24,300	27
2'	10.9	--	--
2'	**29.1**	**130,000**	**280**

TP02

DEPTH	Fe
2'	**99,000**
2.5'	16,100
3'	18,500

TP32

DEPTH	As	Cu	Fe
0.5'	**50.4**	1,150	**95,700**
1.5'	**51**	**5,810**	**119,000**
2'	**31.1**	--	--
3'	**38.5**	883	**106,000**
5'	8.5	122	25,900

TP28

DEPTH	Cu	Ni
5	**97.1**	**57**

TP08

DEPTH	As	Fe
1.5'	14	39,800
2'	4.19	--
4'	**180**	**143,000**
4'	8.4	26,700
6'	**27**	**171,000**

TP34

DEPTH	As
1.5'	5
5'	**22**

SLAG1

DEPTH	As	Cu	Fe
surface	**36**	**3,060**	**363,000**

TP-11

DEPTH	As	Fe
2.5' - 4.5'	**68**	**110,000**

TP-06

DEPTH	Fe
0.5' - 2'	**66,000**
1'	24,800

DP01

DEPTH	As	Fe
4'	4.8	31,700
5'	**32**	**93,800**

SS-3

DEPTH	Fe	Pb
0.2 - 0.25	**320,000**	**2,200**

SS7

DEPTH	Pb
unknown	**1,910**

TP40

DEPTH	As	Fe
0.5'	**47**	**269,000**
0.5'	**56**	**243,000**
0.5'	**44**	**260,000**
1'	**43.6**	**202,000**
5'	3.7	19,800

TP22

DEPTH	As	Fe
2'	**64**	**371,000**
2'	1	--
3'	2.0	15,300

TP30

DEPTH	As	Fe
0.5'	**41**	**208,000**
3.5'	5 U	14,800

Legend

✚	RI Soil Sample Location
●	Slag Sample Location
🟩	Previous Soil Sample Location
— · —	Site Boundary
—	Former Structures
🔴	Sample location with one or more sample result(s) greater than human health soil screening levels

Soil Results in mg/Kg

Metal (Human Health Soil Screening Level)

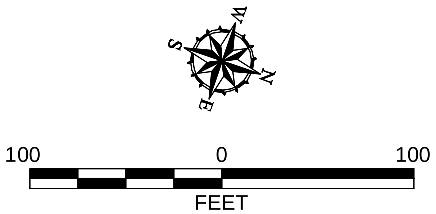
As = Arsenic (20)

Cu = Copper (3,000)

Fe = Iron (58,700)

Pb = Lead (250)

Red/Bold Values exceed Human Health Soil Screening Levels



Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

Metals: Upland Sample Locations with Exceedances of Human Health Soil Screening Levels

Irondale Iron and Steel Plant
Irondale, Washington

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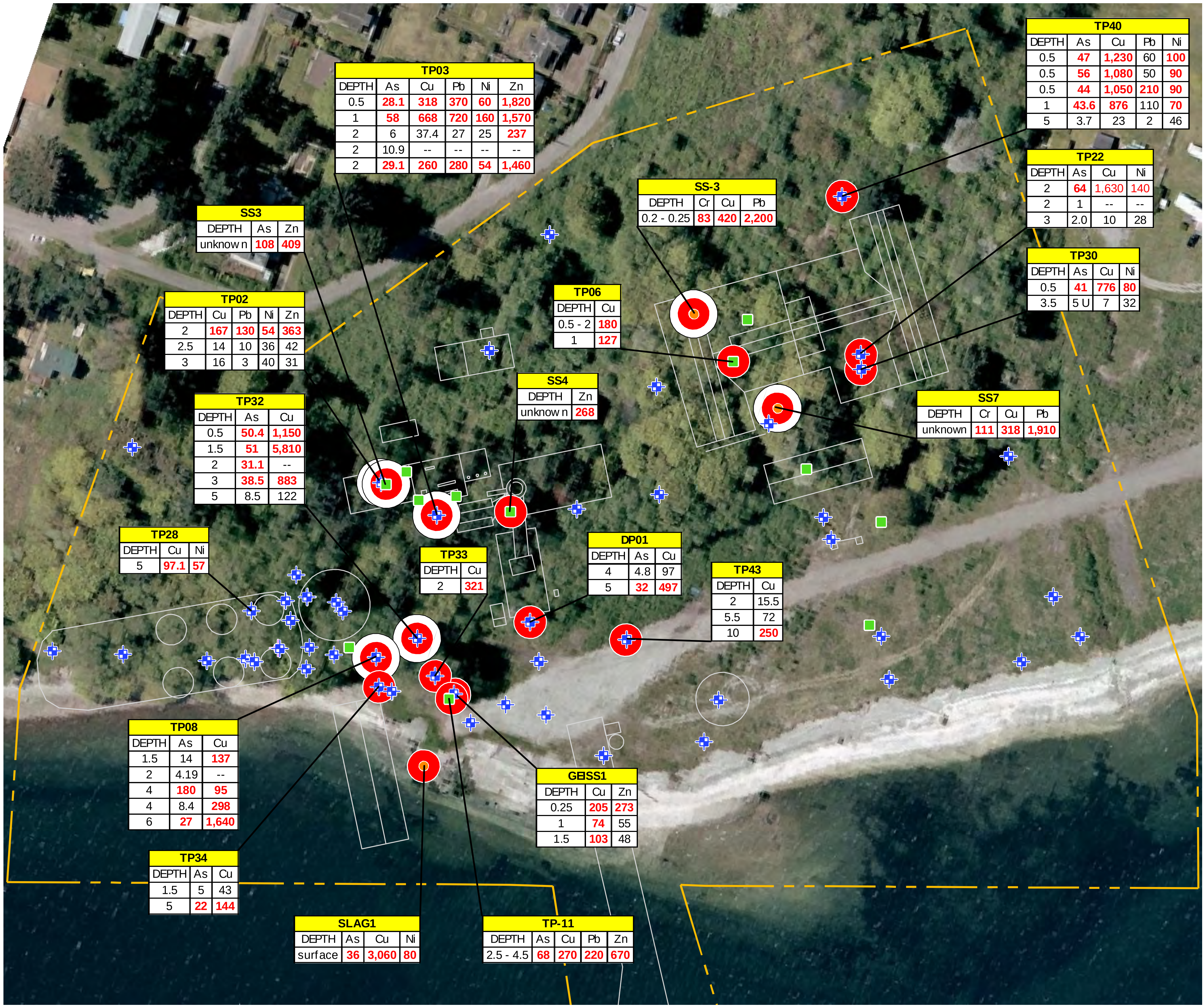
Figure 9

P:\0\0504042\00\CADD\T04\Site Plan Figures\SHEET\050404200 Fig 10.dwg\TAB:Fig 10 modified by tmichaud on Apr 10, 2009 - 10:40



TP03

DEPTH	As	Cu	Pb	Ni	Zn
0.5	**28.1**	**318**	**370**	**60**	**1,820**
1	**58**	**668**	**720**	**160**	**1,570**
2	6	37.4	27	25	**237**
2	10.9	--	--	--	--
2	**29.1**	**260**	**280**	**54**	**1,460**

SS3

DEPTH	As	Zn
unknown	**108**	**409**

TP02

DEPTH	Cu	Pb	Ni	Zn
2	**167**	**130**	**54**	**363**
2.5	14	10	36	42
3	16	3	40	31

TP32

DEPTH	As	Cu
0.5	**50.4**	**1,150**
1.5	**51**	**5,810**
2	**31.1**	--
3	**38.5**	**883**
5	8.5	122

TP28

DEPTH	Cu	Ni
5	**97.1**	**57**

TP08

DEPTH	As	Cu
1.5	14	**137**
2	4.19	--
4	**180**	**95**
4	8.4	**298**
6	**27**	**1,640**

TP34

DEPTH	As	Cu
1.5	5	43
5	**22**	**144**

SLAG1

DEPTH	As	Cu	Ni
surface	**36**	**3,060**	**80**

TP-11

DEPTH	As	Cu	Pb	Zn
2.5 - 4.5	**68**	**270**	**220**	**670**

GBSS1

DEPTH	Cu	Zn
0.25	**205**	**273**
1	**74**	55
1.5	**103**	48

TP33

DEPTH	Cu
2	**321**

SS4

DEPTH	Zn
unknown	**268**

TP06

DEPTH	Cu
0.5 - 2	**180**
1	**127**

DP01

DEPTH	As	Cu
4	4.8	97
5	**32**	**497**

TP43

DEPTH	Cu
2	15.5
5.5	72
10	**250**

SS-3

DEPTH	Cr	Cu	Pb
0.2 - 0.25	**83**	**420**	**2,200**

SS7

DEPTH	Cr	Cu	Pb
unknown	**111**	**318**	**1,910**

TP40

DEPTH	As	Cu	Pb	Ni
0.5	**47**	**1,230**	60	**100**
0.5	**56**	**1,080**	50	**90**
0.5	**44**	**1,050**	**210**	**90**
1	**43.6**	**876**	110	**70**
5	3.7	23	2	46

TP22

DEPTH	As	Cu	Ni
2	**64**	1,630	**140**
2	1	--	--
3	2.0	10	28

TP30

DEPTH	As	Cu	Ni
0.5	**41**	**776**	**80**
3.5	5 U	7	32

Legend

✚ RI Soil Sample Location

● Slag Sample Location

🟩 Previous Soil Sample Location

- - Site Boundary

— Former Structures

● Sample location with one or more sample result(s) greater than plant TEE soil screening levels

○ Sample location with one or more sample result(s) greater than wildlife TEE soil screening levels

Soil Results in mg/Kg

Metal (Plant / Wildlife Soil Screening Level)

As = Arsenic (18 / 386)

Cu = Copper (70 / 1,340)

Pb = Lead (120 / 285)

Ni = Nickel (48 / 3,870)

Zn = Zinc (160 / 360)

Red/Bold Values exceed TEE Soil Screening Levels

Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

Metals: Upland Sample Locations
with Exceedances of TEE
Soil Screening Levels

Irondale Iron and Steel Plant
Irondale, Washington

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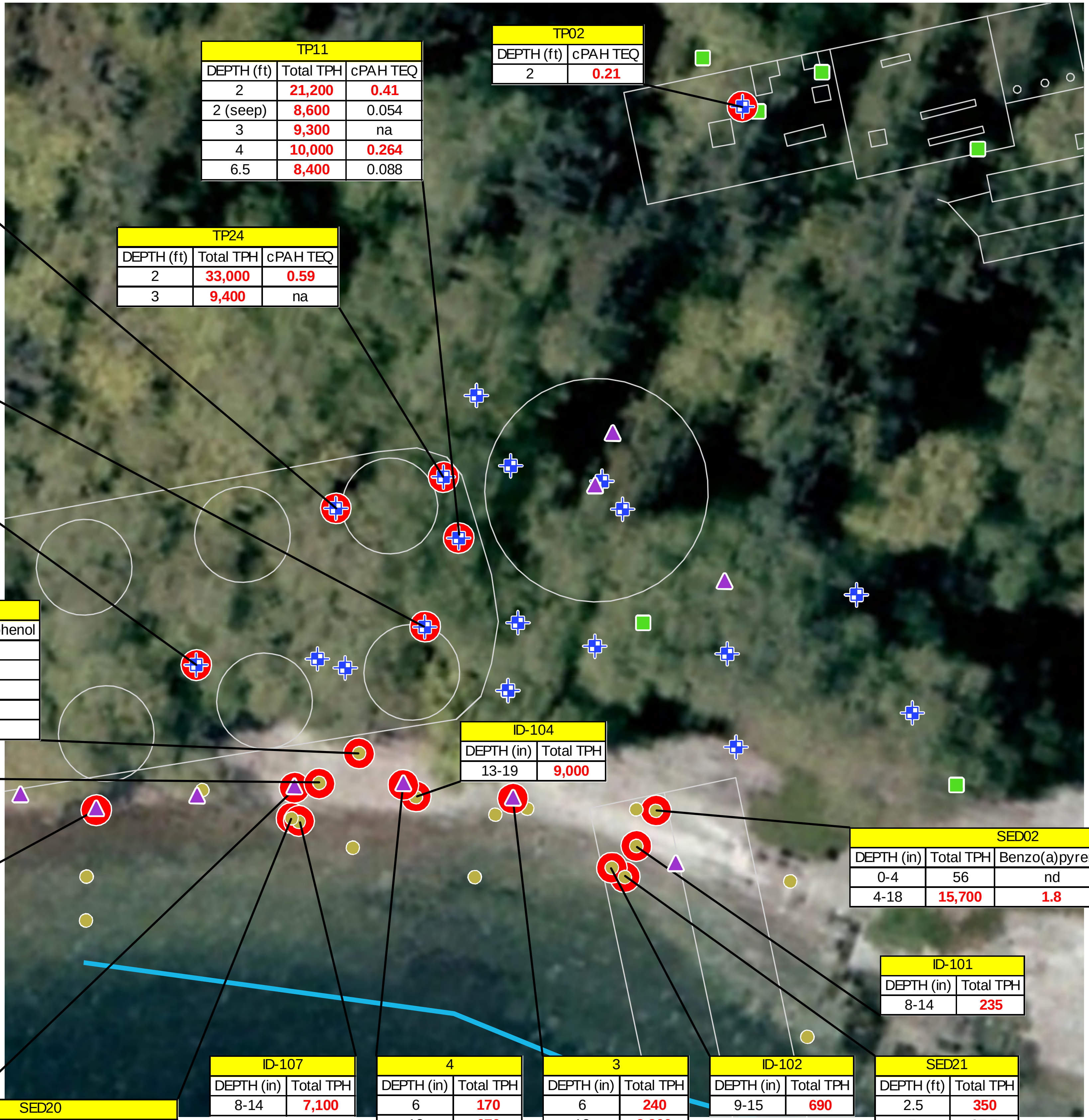
Figure 10



TP02

DEPTH (ft)	cPAH TEQ
2	**0.21**

TP11

DEPTH (ft)	Total TPH	cPAH TEQ
2	**21,200**	**0.41**
2 (seep)	**8,600**	0.054
3	**9,300**	na
4	**10,000**	**0.264**
6.5	**8,400**	0.088

TP28

DEPTH (ft)	Total TPH
3	nd
5	**350**
6.5	nd

TP26/DP02

DEPTH (ft)	Total TPH	cPAH TEQ
2	na	na
4	na	na
6.5	**9,700**	**0.191**
7	**18,800**	0.13
11	**9,400**	na
13	23	na

TP24

DEPTH (ft)	Total TPH	cPAH TEQ
2	**33,000**	**0.59**
3	**9,400**	na

TP29

DEPTH (ft)	Total TPH
3	**183**
6	55
7	15

SED18

DEPTH (ft)	Total TPH	2,4-Dimethylphenol
2.5	na	na
5	**6,100**	**0.14**
7.5	**1,290**	na
10	**950**	na
12.5	57	na

ID-104

DEPTH (in)	Total TPH
13-19	**9,000**

ID-106

DEPTH (in)	Total TPH
13-19	**6,200**

SED02

DEPTH (in)	Total TPH	Benzo(a)pyrene	Chrysene
0-4	56	nd	nd
4-18	**15,700**	**1.8**	**3.3**

7

DEPTH (in)	Total TPH
6	**180**
12	nd
18	**745**

ID-101

DEPTH (in)	Total TPH
8-14	**235**

5

DEPTH (in)	Total TPH
6	110
12	**230**
18	**450**

ID-107

DEPTH (in)	Total TPH
8-14	**7,100**

4

DEPTH (in)	Total TPH
6	**170**
12	**670**
18	104

3

DEPTH (in)	Total TPH
6	**240**
12	**2,300**
18	**610**

ID-102

DEPTH (in)	Total TPH
9-15	**690**

SED21

DEPTH (ft)	Total TPH
2.5	**350**
5	27.7
7.5	na

SED20

DEPTH (ft)	Total TPH	2,4-Dimethylphenol
1.5	**2,000**	**0.088**
3.5	**230**	na
5	**950**	na
6.5	7.9	na

Legend

✚	RI Soil Sample Location
●	RI Sediment Sample Location
🟩	Previous Soil Sample Location
▲	Previous Sediment Sample Location
—	Approximate Mean Lower Low Water (MLLW)
- - -	Site Boundary
—	Former Structures
🔴	Sample location with one or more sample result(s) greater than human health or benthic screening levels

TPH and cPAH (Soil and Sediment Screening Levels)

Soil - cPAHs (0.137; Human Health)
Soil - TPH (2,000; Human Health)
Sediment - TPH (2,000; Human Health)
Soil / Sediment - TPH (136; Benthic)
Sediment - Benzo(a)Pyrene (1.6; 1988 Puget Sound AET)
Sediment - Chrysene (1.4; 1988 Puget Sound AET)
Sediment - Dimethylphenol (0.029; SMS)

Soil and Sediment Results in mg/Kg

Red/Bold Values exceed at least one screening level

SMS = Sediment Management Standards
AET = Apparent Effects Threshold
NA = Not Analyzed
ND = Not Detected

40 0 40
FEET

Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

TPH and SVOCs: Soil and Sediment Locations with Exceedances of Screening Levels

Irondale Iron and Steel Plant
Irondale, Washington

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Figure 11

P:\0\0504042\00\CADD\T05\0504042000T04-Fig 8.DWG\TAB:Fig 11 MODIFIED BY TMICHAUD ON AUG 28, 2009 - 16:20

Legend

🟫 Old Growth

🟨 Groundwater Seeps

🟦 Open Water

🟩 Shrub Scrub

🟥 Herbaceous

🟩 Second Growth Forest

🟪 Immature Forest

— Former Structures

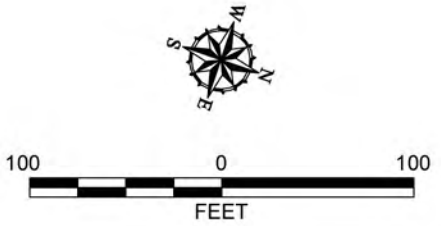
✚ RI Soil Sample Location

● Slag Sample Location

■ Previous Soil Sample Location

● Sample location with one or more sample result(s) greater than plant TEE soil screening levels

○ Sample location with one or more sample result(s) greater than wildlife TEE soil screening levels



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Habitat Map

Irondale Iron and Steel Plant
Irondale, Washington

GeoEngineers

Figure 12

P:\0\0504042\00\CADD\T04\SITE PLAN FIGURES\SHEET\050404200 FIG 12.DWG\TAB:FIG 12 MODIFIED BY TMICHAUD ON JUL 17, 2009 - 13:39

P:\0\0504042\00\CADD\T04\Site Plan Figures\SHEET\050404200 Fig 13.dwg\TAB:Fig 13 modified by tmichaud on Apr 24, 2009 - 15:55

Legend

✚	RI Soil Sample Location
●	Slag Sample Location
🟩	Previous Soil Sample Location
— · —	Site Boundary
—	Former Structures
●	Sample location with one or more sample result(s) greater than human health or TEE soil screening levels
▬ ▬	Upland Area Requiring Remedial Action (dashes indicate extent is inferred)

Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

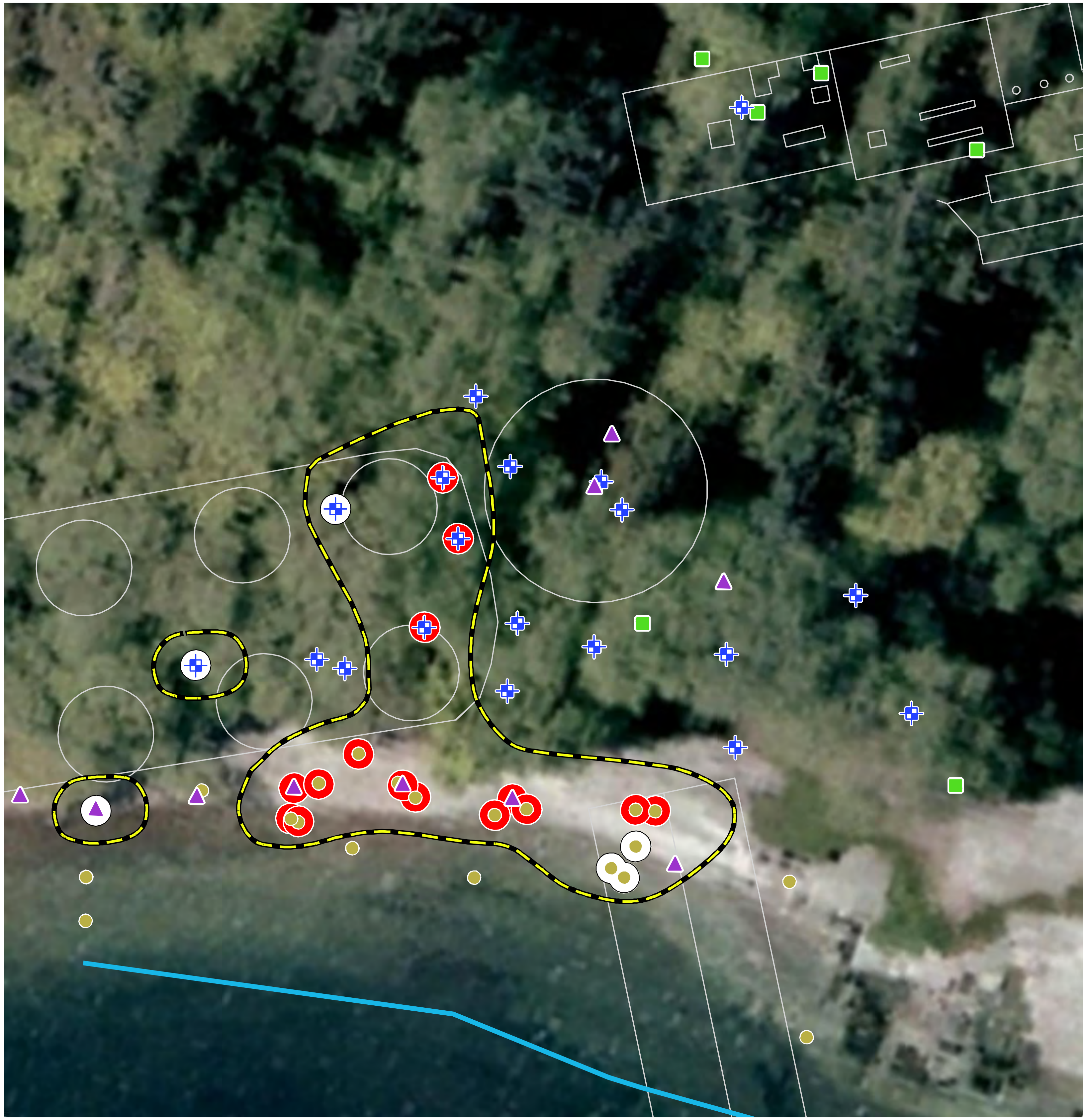
Upland Areas Requiring Remedial Action

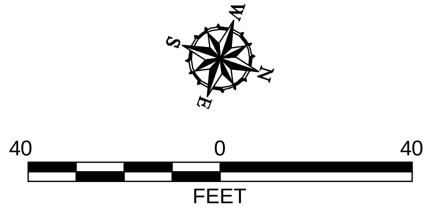
Irondale Iron and Steel Plant
Irondale, Washington

GeoEngineers

Figure 13

P:\0\0504042\00\CADD\T04\Site Plan Figures\SHEET\050404200 Fig 14.dwg\TAB:Fig 14 modified by tmichaud on Apr 24, 2009 - 16:07





Legend

- ✚ RI Soil Sample Location
- ● RI Sediment Sample Location
- 🟩 Previous Soil Sample Location
- ▲ Previous Sediment Sample Location
- Approximate mean Lower Lower Water (MLLW)
- Site Boundary
- Former Structures
- 🔴 Sample location with one or more sample result(s) greater than soil/sediment screening level of 2,000 mg/Kg
- ○ Sample location with one or more sample result(s) greater than sediment screening level of 136 mg/Kg, but less than 2,000 mg/Kg
- Sediment Areas Requiring Remedial Action (Total TPH >136 mg/Kg) - (dashes indicate extent is inferred)

Notes

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Former AST TPH Areas
Requiring Remedial Action

Irondale Iron and Steel Plant
Irondale, Washington

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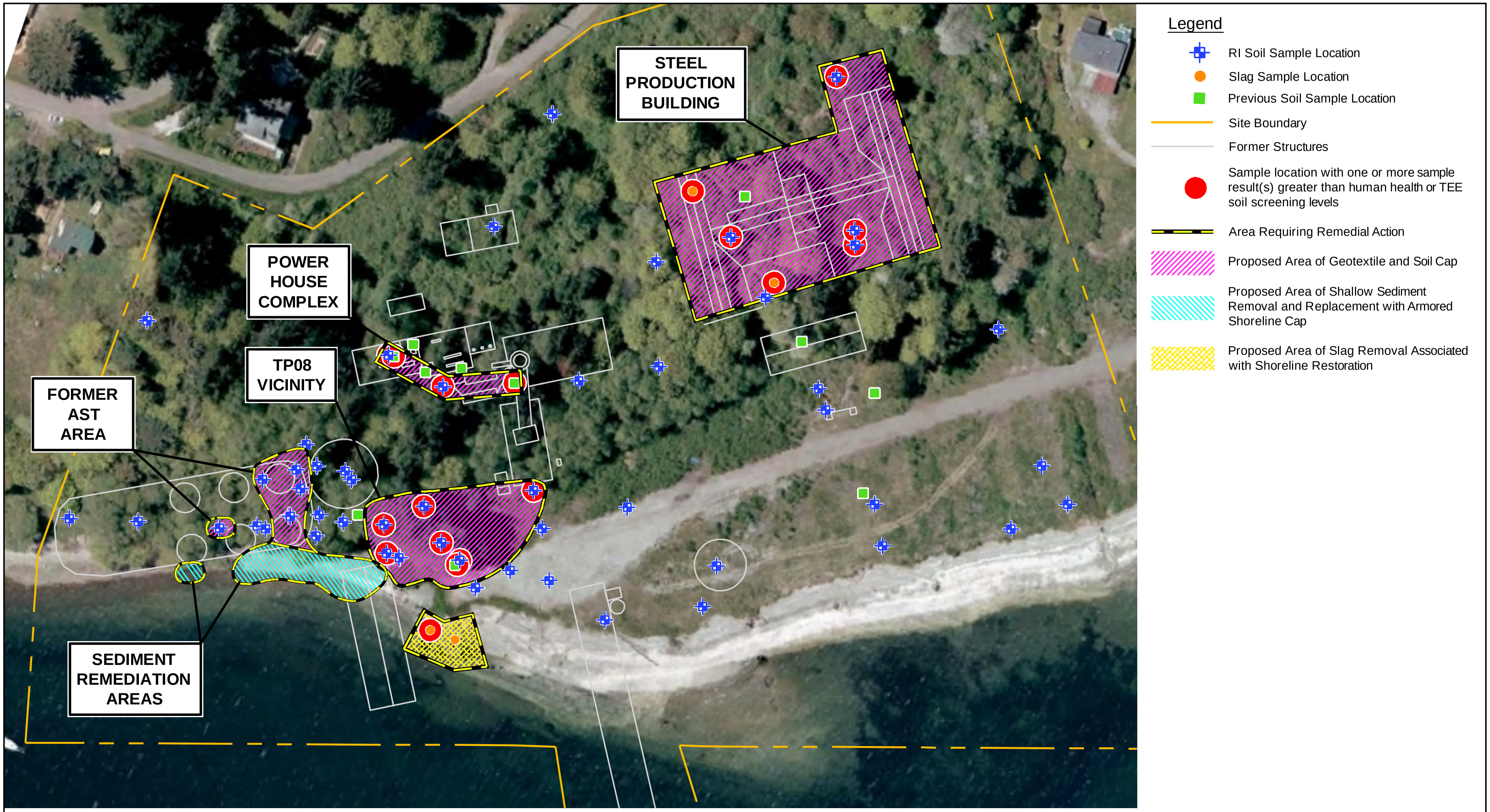
Figure 14

P:\0\0504042\00\CADD\T04\SITE PLAN FIGURES\SHEET\050404200 FIG 15.DWG\TAB:F 15 MODIFIED BY TMICHAUD ON JUL 17, 2009 - 14:33



Notes

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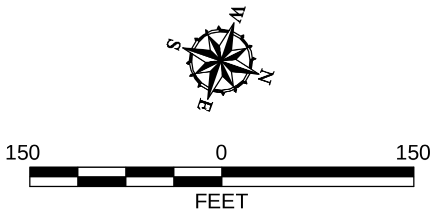

Proposed Layout of Remedial Alternative 2 (Capping All Sub-Units)

Irondale Iron and Steel Plant
Irondale, Washington

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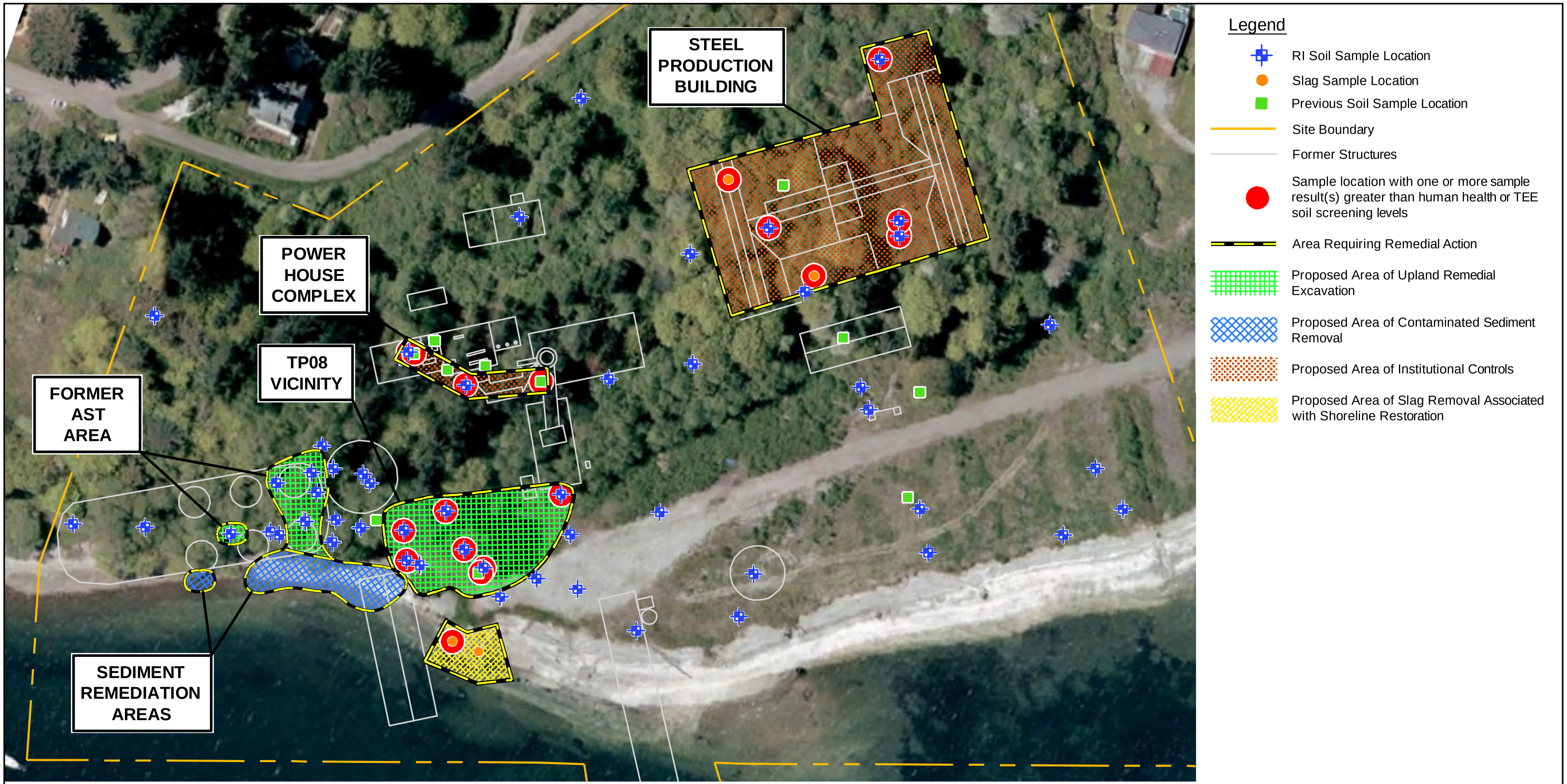
Figure 15



Notes

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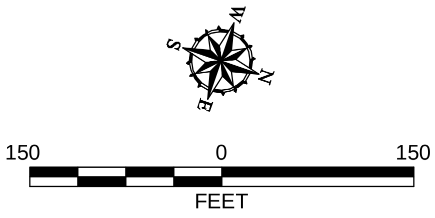

Proposed Layout of Remedial Alternative 3
Excavation/Removal: Sediment Remediation Areas, Former AST Area, TP08 Vicinity
Institutional Controls: Power House Complex, Steel Production Building

Irondale Iron and Steel Plant
Irondale, Washington

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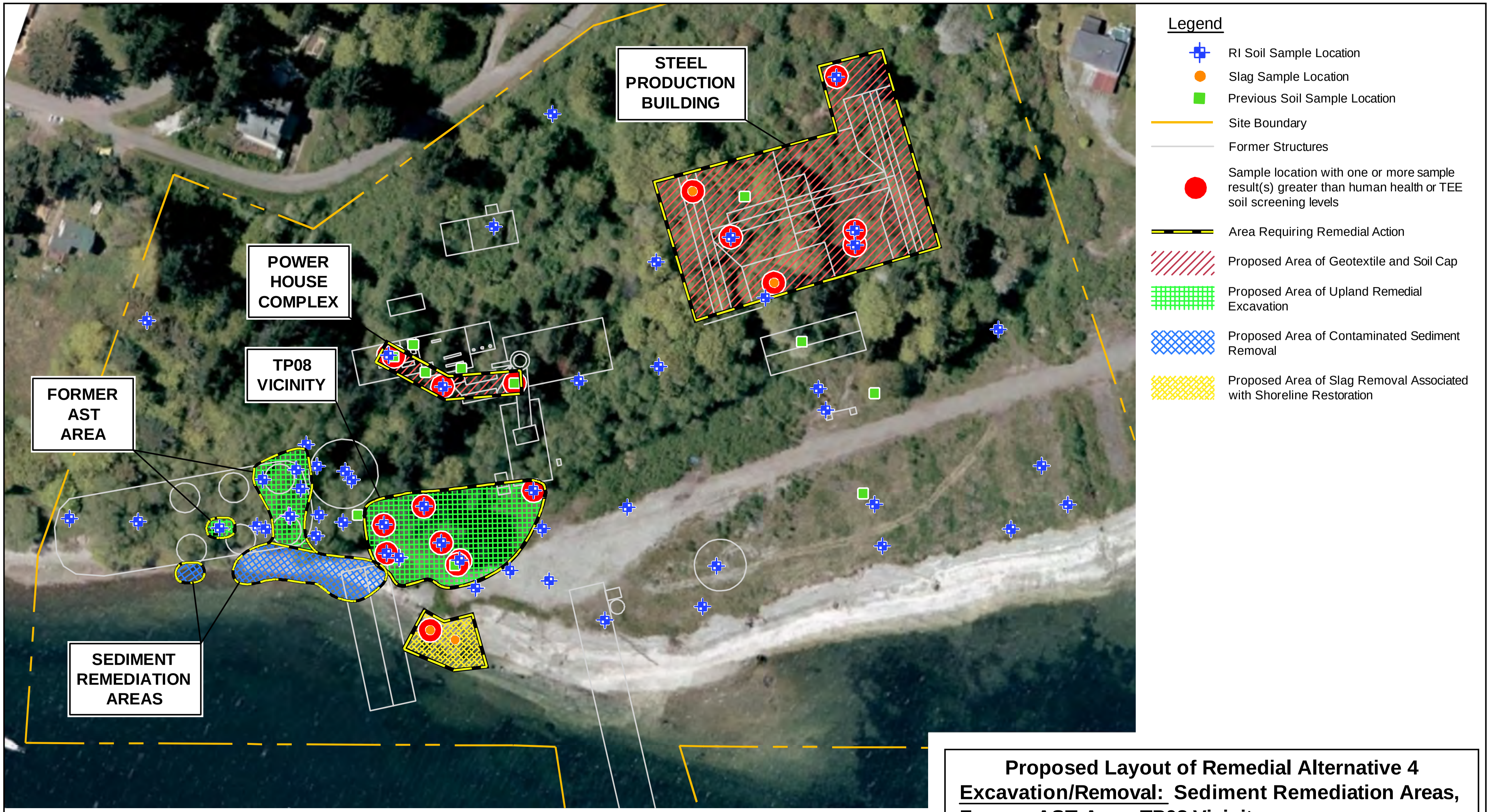
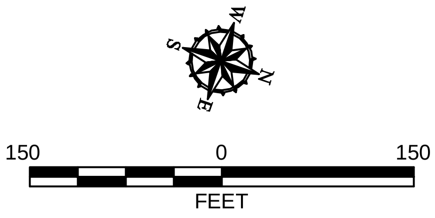
Figure 16

P:\0\0504042\00\CADD\T04\SITE PLAN FIGURES\SHEET\050404200 FIG 17.DWG\TAB:F 15 MODIFIED BY TMICHAUD ON AUG 12, 2009 - 12:35





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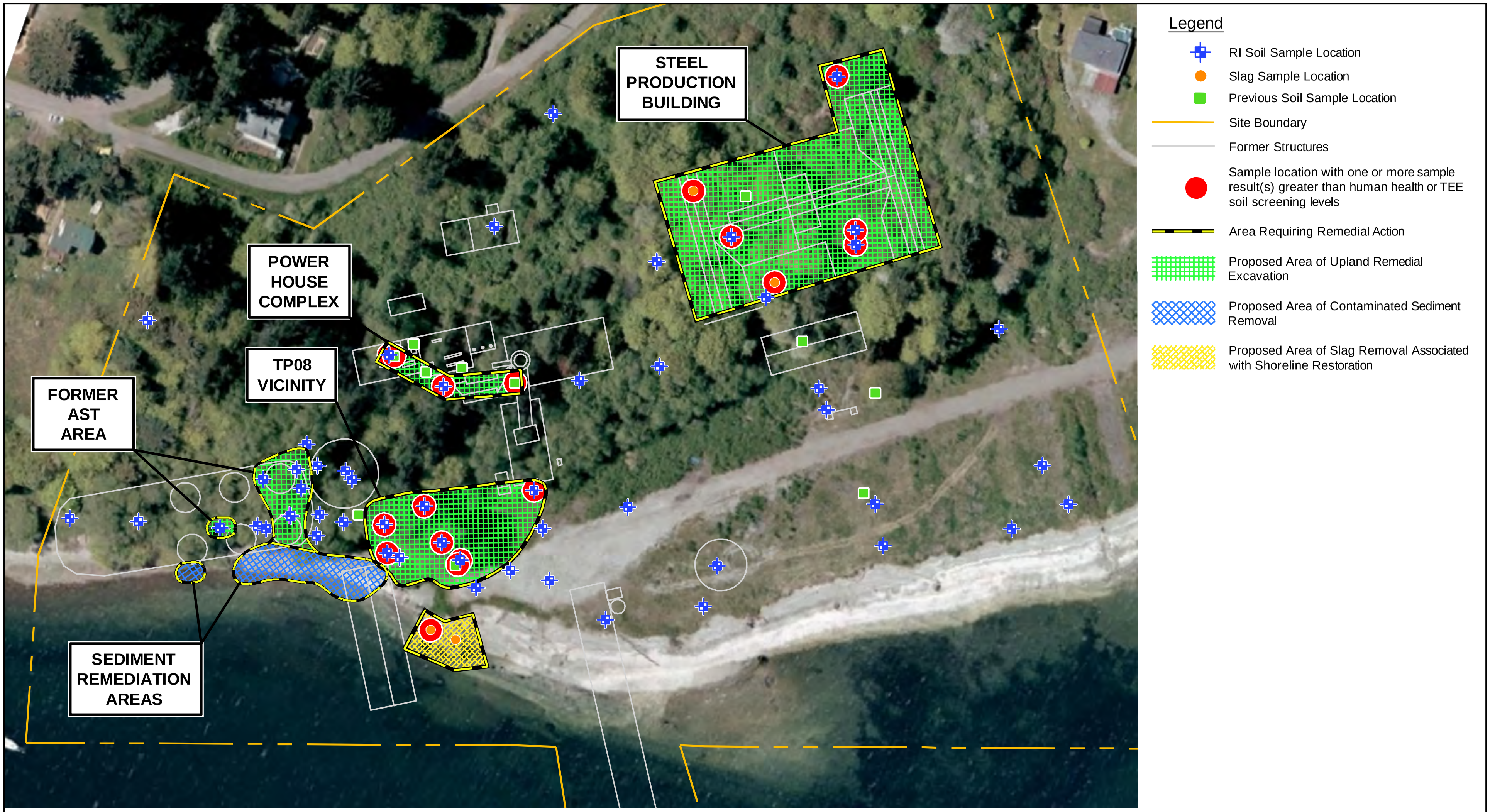
Proposed Layout of Remedial Alternative 4
Excavation/Removal: Sediment Remediation Areas, Former AST Area, TP08 Vicinity
Capping: Power House Complex, Steel Production Building

Irondale Iron and Steel Plant
Irondale, Washington

GEOENGINEERS

Figure 17

P:\0\0504042\00\CADD\T04\SITE PLAN FIGURES\SHEET\050404200 FIG 18.DWG\TAB:F 15 MODIFIED BY TMICHAUD ON JUL 17, 2009 - 14:39



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Proposed Layout of Remedial Alternative 5 (Excavation All Sub-Units)

Irondale Iron and Steel Plant
Irondale, Washington

GEOENGINEERS

Figure 18

APPENDIX A

FIELD PROCEDURES AND SOIL BORING LOGS

APPENDIX A
FIELD PROCEDURES AND SOIL BORING LOGS

1.0 GENERAL SAMPLING PROCEDURES

This section specifies the field procedures implemented during the RI.

1.1 UNDERGROUND UTILITY LOCATE

Prior to drilling and test pit activities, an underground utility locate was conducted in the area of the proposed boring and test pit locations in the near shore area of the site to identify any subsurface utilities and/or potential underground physical hazards.

1.2 SURVEYING

Prior to drilling and test pit activities, a Washington State licensed professional land surveyor established temporary benchmarks to delineate the MLLW in the area of the proposed sediment sample locations. During the investigation, these benchmarks were used to determine the elevation of explorations.

1.2.1 Vertical Controls

Each monitoring well casing rim and ground surface elevation was surveyed by GeoEngineers field personnel relative to the temporary benchmarks. Elevations were surveyed using a laser level, which has an accuracy of 0.01 feet.

1.2.2 Horizontal Controls

GeoEngineers field personnel recorded the boring/monitoring well, test pit and surface water and sediment sampling locations, and other pertinent information, using hand-held Trimble GeoXT GPS units during sampling activities whenever possible. GPS data collected in the field was processed in the office using measurements from the nearest reference station to each collection point. Many of the sample locations within the wooded portion of the Site could not be located using the GPS units. At these locations, sample locations were measured from existing landmarks.

1.3 SOIL SAMPLING

1.3.1 Test Pits

The test pits were excavated using a rubber-tire backhoe and a mini-excavator. A member of GeoEngineers' staff observed subsurface conditions in the test pits and classify soil in general accordance with ASTM Standard D-2488. Exploration logs were prepared for each test pit exploration. The logs included a summary of the soil and groundwater conditions observed, and field screening results. After completion of the test pits, the spoils were returned to the pit in the order they were excavated and compacted using the backhoe or excavator bucket.

Soil samples obtained at depths shallower than 3 feet bgs were obtained directly from the test pit sidewalls using newly gloved nitrile hands. Soil in the exposed test pit sidewalls was not sampled because it was contacted by the excavator bucket. This "surficial" soil was removed using newly gloved nitrile hands. The "fresh" soil exposed during this process was then sampled using the procedures described above.

Test pit soil samples from depths greater than 3 feet bgs were obtained directly from the backhoe/excavator bucket. These samples were obtained from the center of the bucket using the procedures described above.

The samples were placed into laboratory-supplied containers, lightly packed and capped with a plastic lid. The sand-sized and finer fractions of the soil were targeted for collection. Sample containers were labeled in the field and stored in an iced cooler prior to and during shipment to the chemical analytical laboratory.

1.3.2 Hand Dug Explorations

Hand-dug explorations were required in areas inaccessible to mechanized equipment. Prior to advancing the explorations, surface duff and debris was removed. The explorations were advanced using a shovel or hand auger. The samples were placed in a container provided by the analytical laboratory and submitted for chemical analysis based on field screening results. Each sample container was securely capped, labeled and placed in a cooler with ice upon collection.

1.3.3 Direct Push and Hollow-Stem Auger Borings

Soil samples were obtained from borings installed for collection of groundwater samples and installation of groundwater monitoring wells using direct-push methods. In addition, soil and sediment samples were obtained from borings using hollow-stem auger methods.

Boring activities were monitored continuously by a technical representative from GeoEngineers who observed and classified the soil encountered and prepare detailed field notes. Soil samples obtained from the borings were visually classified in general accordance with ASTM Standard D-2488. The samples were also evaluated for the potential presence of hydrocarbon contamination and iron slag using field screening techniques. Observations of soil and groundwater conditions and soil field screening results for each exploration are included in the boring logs.

Soil samples were obtained from the direct-push borings using a hydraulically advanced 4-foot long sampler with a disposable liner or a 3-foot-long split spoon sampler. Soil and sediment samples were obtained from the hollow-stem auger borings at approximately 2.5-foot intervals using a standard penetration test (SPT) sampler. The sampler was driven by a 140-pound hammer falling a vertical distance of approximately 30 inches. The number of blows required to advance the sampler the final 18 inches was recorded on the boring logs. Soil cuttings (unused soil core) from the borings were placed in a labeled 55-gallon drum.

At the target interval for the sample, the required volume of soil was removed from the sampler placed into laboratory-supplied containers, lightly packed and capped with a plastic lid. The sand-sized and finer fractions of the soil were targeted for collection. Samples were selected for analysis based on field screening results and/or sample depth relative to groundwater depth.

Sample containers were labeled in the field and stored in an iced cooler prior to and during shipment to the chemical analytical laboratory. Section 2.0 addresses the disposition of investigation-derived waste such as soil cuttings.

1.3.4 Composite Surface Slag/fill Samples

Two composite samples from the exposed slag headland were obtained. Each composite was composed of four discrete subsamples obtained approximately 10 feet apart along the exposed face of the headland.

Subsamples were composited in a stainless steel bowl and processed in the same manner as other soil samples.

1.4 FIELD SCREENING

Soil samples were field screened for evidence of possible contamination. Field screening results were recorded on the field logs and the results were used as a general guideline to delineate areas of possible contamination. Screening results were used to aid in the selection of soil samples to be submitted for chemical analysis. The following screening methods were used: (1) visual screening; (2) water sheen screening; (3) headspace vapor screening; and (4) magnet and acid. Field screening results are site- and location-specific. The results may vary with temperature, moisture content, soil type and chemical constituent.

1.4.1 Visual Screening

The soil was observed for unusual color and stains and/or odor indicative of possible contamination.

1.4.2 Water Sheen Screening

This is a qualitative field screening method that can help identify the presence or absence of petroleum hydrocarbons. A portion of the soil sample was placed in a pan containing distilled water and the water surface was observed for signs of sheen. The following sheen classifications were used:

Classification	Identifier	Description
No Sheen	(NS)	No visible sheen on the water surface
Slight Sheen	(SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly
Moderate Sheen	(MS)	Light to heavy sheen; may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on the water surface
Heavy Sheen	(HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen

1.4.3 Headspace Vapor Screening

This is a semi-quantitative field screening method that can help identify the presence or absence of volatile chemicals. Volatile chemicals at this site were only anticipated in conjunction with residual oil. A portion of the soil sample was placed into a plastic bag for headspace vapor screening. Ambient air was captured in the bag; the bag was sealed and then shaken gently to expose the soil to the air trapped in the bag. The bag remained closed for approximately 1 minute at ambient temperature before the headspace vapors were measured. Vapors present within the sample bag's headspace were measured by inserting the probe of a photoionization detector (PID) through a small opening in the bag. A PID measures the concentration of organic vapors ionizable by a 10.6 electron volt (eV) lamp in parts per million (ppm) and quantifies organic vapor concentrations in the range between 0.1 ppm and 2,000 ppm (isobutylene equivalent) with an accuracy of 1 ppm between 0 ppm and 100 ppm. The maximum value on the instrument and the ambient air temperature was recorded on the field log for each sample. The PID was calibrated to 100 ppm isobutylene at least twice per day.

1.4.4 Magnet

This is a qualitative screening method that can help determine the presence or absence of iron particles (slag). A portion of the soil sample was massaged to break up larger particles. The magnet was placed in the soil and the presence or absence of iron on the magnet was visually assessed.

1.4.5 Acid

This is a qualitative screening method that can help identify if lime from the steel process is present in the sample. A weak hydrochloric acid solution discharged from an eye dropper style container was placed on the sample and the absence or presence of a reaction was noted. A reaction indicates that lime is present in the sample. A positive reaction was caused by seashells present in the dredge sand fill and native sediments.

1.5 MONITORING WELL CONSTRUCTION AND DEVELOPMENT

Monitoring wells were constructed by a Washington State licensed driller in compliance with State standards. Installation of the monitoring wells was observed by a GeoEngineers field technician, who maintained a detailed log of the materials and depths of the wells. Monitoring wells were installed to depths ranging from approximately 8 to 12 feet below the groundwater table. The total depth of the monitoring wells is approximately 13 to 19 feet bgs.

The wells were constructed with 3/4-inch diameter schedule 40 PVC with pre-pack 20-slot well screen. The top of the well screens are located at depths ranging from approximately 3 to 5 feet above measured groundwater level. Medium sand was placed in the borehole annulus surrounding the slotted portion of the well. A bentonite seal was placed from the top of the sand to the bottom of the concrete surface completion. The surface completion for the groundwater monitoring wells was a 2-foot by 2-foot concrete box that extends above the ground approximately 3 inches. A lockable "Thermos"-type cap was installed in the top of the PVC well casing.

Each monitoring well was developed using a peristaltic pump with disposable polyethylene tubing to remove water introduced into the well during drilling (if any), stabilize the filter pack and formation materials surrounding the well screen, and restore the hydraulic connection between the well screen and the surrounding soil. The volume of groundwater removed was recorded during well development procedures. Well development water is stored temporarily on-site in a 55-gallon drum. The depth to water in the monitoring well was measured prior to development.

1.6 GROUNDWATER SAMPLING

1.6.1 Monitoring wells

Groundwater levels were measured in each monitoring well to the nearest 0.01 foot using an electric water level indicator. The water levels were measured relative to the casing rim elevations.

Groundwater samples were obtained using low-flow/low-turbidity sampling techniques to minimize the suspension of sediment in groundwater samples. Groundwater samples were obtained from monitoring wells using a peristaltic pump and disposable polyethylene tubing. Groundwater was pumped at approximately 0.5 liter per minute using a peristaltic pump through tubing placed within the screened interval. A YSI 556 multi parameter water quality meter (with flow-through-cell) was used to monitor the following water quality parameters during purging: electrical conductivity, dissolved oxygen, pH, oxidation-reduction potential, conductivity, and temperature. Ambient groundwater conditions were reached once these parameters varied by less than 10 percent on three consecutive measurements. The stabilized field measurements were documented in the field log book (for subsequent use in the RI), and then groundwater samples were obtained. Purge water was stored in a labeled 55-gallon drum for subsequent characterization. Section 2.0 addresses the disposition of investigation-derived waste such as purge water.

1.6.2 One-Time (Direct Push) Samples

At selected borings, an approximately 1.25-inch-diameter steel rod was pushed about 4 feet below the water table and then pulled back to expose a temporary 4-foot-long stainless steel screen. Groundwater samples were obtained from these borings using low flow sampling methods described above. After collection of the water sample, the screen and rod will be removed and the boring abandoned. New tubing was at each boring, and all rods and well screens were decontaminated between borings.

Groundwater samples were obtained after the wells were purged. Samples were obtained by pumping water directly from the tubing into sample containers provided by the analytical laboratory. The samples were free of bubbles, and headspace was not present in the containers. Each sample container was securely capped, labeled and placed in a cooler with ice upon collection. The well casing plugs and monument cover lids were secured after each sampling event.

1.7 SURFACE WATER SAMPLING

Surface water samples were obtained by placing a clean, capped, laboratory-provided sample collection container as close as possible to the drainage stream bottom, minimizing introduction of foreign objects or turbidity. The sample containers were then uncapped, allowing the water to enter, and then recapped prior to removal from the sampling location. When preservative was required in the sample containers, the samples were obtained using a laboratory-provided non-preserved container and then transferred to a laboratory provided container with preservative. Samples placed in a cooler with ice and delivered to the analytical laboratory within laboratory-specified holding times. Standard chain-of-custody procedures were observed during transport of the samples to the laboratory.

1.8 SEDIMENT SAMPLING

Sediment samples were obtained from the exposed intertidal area of the Site during low tide using a hand shovel as part of the June 2007 sampling event. Armoring (cobbles and boulders) was removed from the surface at each location, and the underlying substrate was excavated for chemical analyses. Approximately 2 quarts of sediment material was obtained at each sampling location. Sample material was obtained using a stainless steel spoon and placed in a stainless steel bowl for mixing prior to placement into laboratory-supplied sample containers.

The samples were obtained as close to MLLW as possible and located using the Trimble GeoXT GPS unit.

The depth of each sample interval was measured with a steel measuring tape. The general character of sediment (size distribution, angularity), presence/absence of brick or slag, field screening results, and location of residual oil, if any, was recorded for each sample interval.

As discussed in Section 1.3, sediment samples were also obtained (during the December 2007 sampling event) using a hollow-stem auger drill rig.

1.9 EARTHWORM SAMPLING

Earthworm samples were obtained at three sample locations during the December 2007 sampling event. Each earthworm sample was collocated with a surface soil sample. The earthworms were obtained using a shovel and hand sorting; clean nitrile gloves were used at each sample location. One to five earthworms were obtained at the three sample locations. Each sample was stored in a 4-ounce glass jars. Sampling equipment will be decontaminated after each sampling location.

Chain of custody procedures outlined in the QAPP (Appendix A; Draft Final Remedial Investigation/Feasibility Study Work Plan; GeoEngineers, 2007a) were followed and samples were stored the samples at 4 degrees C (as specified in EPA method 200.8 solid sample preparation).

To the extent practicable, soil was removed from the gut of the earthworms by ARI laboratory prior to chemical analyses. The earthworms from each sample were placed in a clean sample jar with 2 milliliters of distilled/deionized water for 24 hours and then transferred to a second clean sample jar containing 2 milliliters of distilled/deionized water for an additional 24 hours. Placing the earthworms in water allowed them to purge their gut contents naturally. During purging, the jars containing the earthworms were be labeled with the appropriate sample number and stored in a cooler over the ice or coolant (e.g., blue ice).

Following the 48-hour purging period, the earthworms were rinsed in distilled/deionized water to remove any adhering soil, placed in clean sample jars and allowed to air-dry in the opened sample jar to a level where free water is not observed.

1.10 PLANT SAMPLING

Plant samples were obtained at three sampling locations during the June 2008 sampling event. Each plant sample was collocated with a surface soil sample. Plant samples were obtained using clean nitrile gloves at each sample location. Sufficient plant material was collected to fill an 8-ounce glass jar. Plant material consisted of above ground plant parts only (shoots, stalks, leaves, etc).

Chain of custody procedures outlined in the QAPP (Appendix A; Draft Final Remedial Investigation/Feasibility Study Work Plan) will be followed and samples will be stored the samples at 4 degrees Celsius (as specified in EPA method 200.8 solid sample preparation).

Plant material obtained included the following: trialing blackberry (*Rubus ursinus*), Douglas fir seedlings (*Pseudotsuga menziesii*), snowberry (*Symphoricarpos*), thimbleberry (*Rubus parviflorus*), and Himalayan blackberry (*Rubus discolor*).

1.11 DECONTAMINATION

The drilling equipment was decontaminated before beginning each boring using a pressure washer. Reusable sampling/monitoring equipment (trowels, split spoons, bowls, etc.) that came in contact with soil or groundwater was decontaminated before each use. Decontamination procedures for the equipment consisted of the following: (1) wash with nonphosphate detergent solution (Liqui-Nox and distilled water); (2) rinse with distilled water; and (3) place the decontaminated equipment on clean plastic sheeting or in a plastic bag. Wash water used to decontaminate the sampling equipment is stored on-site in a labeled 55-gallon drum for subsequent characterization and disposal.

1.12 SAMPLE HANDLING

Sample handling procedures, including labeling, container and preservation requirements, and holding times are described in the Draft Final Remedial Investigation/Feasibility Study Work Plan QAPP (Appendix A; GeoEngineers, 2007a). Archived samples were be kept frozen by the laboratory.

1.13 FIELD EQUIPMENT CALIBRATION PROCEDURES

Field equipment requiring calibration was calibrated to known standards in accordance with manufacturers' recommended schedules and procedures for each instrument. Calibration checks of the vapor measurement equipment were conducted daily, and the instruments were recalibrated as required. Calibration measurements were recorded in the daily field logs.

2.0 DISPOSITION OF INVESTIGATION-DERIVED MATERIALS

2.1 SOIL

Soil removed from the test pit excavations was replaced in the excavations. Soil cuttings from borings completed during the June and December 2007 sampling events were placed in labeled and sealed 55-gallon drums. Following receipt of chemical analytical results, the drums were removed from the Site and the materials properly disposed of by Envirotech Systems.

2.2 GROUNDWATER AND DECONTAMINATION WATER

Purge water removed from the monitoring wells and decontamination water generated during the June and December 2007 sampling events were placed in labeled and sealed 55-gallon drums. Following receipt of chemical analytical results, the drums were removed from the Site and the materials properly disposed of by Envirotech Systems.

Purge water from the January 2009 sampling event was disposed of at GeoEngineers Redmond, Washington office under the GeoEngineers' Purge Water Disposal Program (King County Permit No. 393-04). The chemical analytical results from groundwater samples obtained during the January 2009 sampling event met the criteria outlined in Permit 393-04.

2.3 DISPOSITION OF INCIDENTAL WASTE

Incidental waste generated during sampling activities includes items such as gloves, plastic sheeting, paper towels and similar expended and discarded field supplies. These materials are considered de minimis and were disposed of at local trash receptacle.

Table A-1
June 2008 Soil & Plant Sample Descriptions
Draft RI/FS

Irondale Iron & Steel Plant
Irondale, Washington

Location ID	Sample ID	Collection Date	Approximate Sample Depth (feet bgs)	Field Screening Results[2]		Sample Description
				Sheen	Headspace Vapors (ppm)	
DP01	DP01-BA-080605-4	6/5/2008	4	--	--	Brown fine to medium sand with slag
GEISS1	GEI-SS1-BA-080605-1	6/5/2008	1	--	--	Brown coarse sand with slag
TP02	TP02-BA-080605-2.5	6/5/2008	2.5	--	--	Light brown fine to medium sand
TP03	TP03-ASP-080606-2	6/6/2008	2	--	--	Dark brown fine to medium sand with organics and bricks; trailing blackberry and douglas fir sprout
	TP03-BA-080606-2	6/6/2008	2	--	--	
	TP03-CP-080606	6/6/2008	Plant	--	--	
	TP03-CS-080606	6/6/2008	Surface	--	--	
TP06	TP06-BA-080605-1	6/5/2008	1	--	--	Dark brown fine to medium sand with organics and bricks
TP08	TP08-BA-080606-4	6/6/2008	4	--	--	Brown coarse sand with bricks
	TP08-ASP-080606-4	6/6/2008	4	--	--	
TP10	TP10-BA-080605-1	6/5/2008	1	--	--	Brown fine to medium sand
TP11	TP11-BA-080606-3	6/6/2008	3	Heavy	0	Brown to black fine to medium sand
TP12	TP12-BA-080605-2	6/5/2008	2	--	--	Grey fine to medium sand with silt and gravel
TP15	TP15-BA-080606-2	6/6/2008	2	None	0	Brown fine to medium sand with organics and shells
TP18	TP18-BA-080605-2	6/5/2008	2	--	--	Brown fine to medium sand with organics and occasional gravel
TP22	TP22-ASP-080606-3	6/6/2008	3	--	--	Light brown fine to medium sand with organics
	TP22-BA-080606-3	6/6/2008	3	--	--	
TP23	TP23-BA-080606-2	6/6/2008	2	None	0	Brown fine to medium sand with occasional gravel
TP24	TP24-BA-080606-3	6/6/2008	3	Heavy	0	Brown to black fine to medium sand (wet, groundwater at 2.5 feet bgs)
TP32	TP32-ASP-080606-3	6/6/2008	3	--	--	Brown medium to coarse sand; trailing blackberry
	TP32-BA-080606-3	6/6/2008	3	--	--	
	TP32-CP-080606	6/6/2008	Plant	--	--	
	TP32-CS-080606	6/6/2008	Surface	--	--	
TP38	TP38-BA-080605-2	6/5/2008	2	--	--	Brown fine to medium sand
TP40	TP40-BA-080605-1	6/5/2008	1	--	--	Dark brown fine to medium sand with organics; trailing blackberry, himalayan blackberry, snowberry, thimbleberry
	TP40-CP-080605	6/5/2008	Plant	--	--	
	TP40-CS-080605	6/5/2008	Surface	--	--	
TP41	TP41-BA-080605-2	6/5/2008	2	--	--	Brown silty fine to medium sand with organics
TP42	TP42-BA-080605-2.5	6/5/2008	2.5	--	--	Brown silty fine to medium sand with organics

SEAT:\0\0504042\00\Working\Draft RI-FS Report\Draft Tables\June 2008 samples.xls

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	⁘	GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
			∘	GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	⁘	GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)	∴	SW	WELL-GRADED SANDS, GRAVELLY SANDS
			⁚	SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	⁞	SM	SILTY SANDS, SAND - SILT MIXTURES
			▨	SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	‖	ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			⌣	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	¦	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
			▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY
			⌣	OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			≡	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
▨	CC	Cement Concrete
■	AC	Asphalt Concrete
▩	CR	Crushed Rock/ Quarry Spalls
▒	TS	Topsoil/ Forest Duff/Sod

▼	**Measured groundwater level in exploration, well, or piezometer**
▽	**Groundwater observed at time of exploration**
▽	**Perched water observed at time of exploration**
▼	**Measured free product in well or piezometer**

Graphic Log Contact

———	**Distinct contact between soil strata or geologic units**
╱	**Approximate location of soil strata change within a geologic soil unit**

Material Description Contact

———	**Distinct contact between soil strata or geologic units**
– – – –	**Approximate location of soil strata change within a geologic soil unit**

Sampler Symbol Descriptions

◫	**2.4-inch I.D. split barrel**
◨	**Standard Penetration Test (SPT)**
■	**Shelby tube**
▤	**Piston**
◧	**Direct-Push**
☒	**Bulk or grab**

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	**Percent fines**
AL	**Atterberg limits**
CA	**Chemical analysis**
CP	**Laboratory compaction test**
CS	**Consolidation test**
DS	**Direct shear**
HA	**Hydrometer analysis**
MC	**Moisture content**
MD	**Moisture content and dry density**
OC	**Organic content**
PM	**Permeability or hydraulic conductivity**
PP	**Pocket penetrometer**
SA	**Sieve analysis**
TX	**Triaxial compression**
UC	**Unconfined compression**
VS	**Vane shear**

Sheen Classification

NS	**No Visible Sheen**
SS	**Slight Sheen**
MS	**Moderate Sheen**
HS	**Heavy Sheen**
NT	**Not Tested**

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE A-1

Drilled — Start: 6/26/2007 — End:	Total Depth (ft): 12	Logged By: AJS Checked By: RMB	Driller: ESN Northwest	Drilling Method: Direct Push
Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data:		Drilling Equipment: AMS Powerprobe 9630	
Latitude / Longitude:	System / Datum: N/A		Groundwater — Date Measured: 6/26/2007	Depth to Water (ft): 5.0 — Elevation (ft): Undetermined
Notes:				

Elevation (feet)	Depth (feet)	Recovered %	Blows/foot	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0	67		1		SM	Dark brown silty fine to coarse sand (moist) (topsoil)	NS	0	
						SP	Brown coarse sand with slag fragments (moist) (fill)			
		50				SW-SM	Dark brown fine to coarse sand with silt, trace red grains (moist)			
	5			2 CA	▼	SP	Red medium to coarse sand (wet)	HS	0	
							Red brick			
		67				SP	Brown coarse sand, trace silt (wet)			
							Red brick			
		67				SW	Black fine to coarse sand with trace silt; occasional gravel			
	10									
				3 CA		SP-SM	Gray fine sand with silt, trace shell fragments (wet) (native sediment)	NS	0	

Note: See Figure A-1 for explanation of symbols.

Log of Boring DP01

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A2
Sheet 1 of 1

Drilled Start 6/25/2007 End	Total Depth (ft) 8	Logged By AJS Checked By RMB	Driller ESN Northwest	Drilling Method Direct Push
Surface Elevation (ft) Vertical Datum Undetermined	Hammer Data		Drilling Equipment AMS Powerprobe 9630	
Latitude Longitude	System Datum N/A		**Groundwater**	
Notes:			Date Measured / Depth to Water (ft) / Elevation (ft) Undetermined	

		FIELD DATA											
Elevation (feet)	Depth (feet)	Interval	Recovered %	Blows/foot	**Collected Sample**	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0		83						SP	Brown fine to medium sand, trace silt (wet) (fill)			
			100										
	5												
									SP	Brown coarse sand with gravel (wet, loose) (native sediment)			
						1 CA			ML	Gray silt (moist)	SS	19	

Note: See Figure A-1 for explanation of symbols.

Log of Boring DP06

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A3
Sheet 1 of 1

Drilled: Start 6/26/2007, End	Total Depth (ft): 12	Logged By: AJS Checked By: RMB	Driller: ESN Northwest	Drilling Method: Direct Push
Surface Elevation (ft) Vertical Datum: 13.6	Hammer Data:		Drilling Equipment: AMS Powerprobe 9630	
Latitude Longitude:	System Datum: N/A		Groundwater	
Notes:				

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
6/26/2007	7.0	6.6

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered %	FIELD DATA: Blows/foot	FIELD DATA: **Collected Sample**	FIELD DATA: Sample Name	FIELD DATA: Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SP-SM	No samples obtained - boring completed for groundwater grab sampling only			
10													
	5												
							▼						
5												
	10												

Note: See Figure A-1 for explanation of symbols.

Log of Boring DP07

GeoEngineers

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A4
Sheet 1 of 1

Date Excavated:	12/13/2007	Logged By:	RMB
Equipment:	Shovel	Total Depth (ft)	2.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
				▨	TS		Dark brown silty fine to medium sand with occasional gravel (loose, moist) (fill)			
		☒	1 CA	▨	RBL		White-gray sand-sized coke with slag fragments (dense, moist) (fill)	NS	0	
	1			▨						
		☒	2 CA	▨				NS	0	
	2									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit GEISS1

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A5
Sheet 1 of 1

Date Excavated: 12/13/2007
Equipment: Shovel

Logged By: RMB
Total Depth (ft) 1.5

Elevation (feet)	Depth (feet)	SAMPLE		Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		Testing Sample	Sample Name Testing							
					SM		Brown fine to medium sand with occasional gravel and brick fragments (medium dense, moist) (fill)			
	1	☒	1 CA		Coal Fragments		Black charcoal with sand and occasional metal fragments (medium dense, moist) (fill)	NS		

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit GEISS2

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Date Excavated: 12/13/2007
Equipment: Shovel

Logged By: RMB
Total Depth (ft) 1.0

Elevation (feet)	Depth (feet)	SAMPLE		Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		Testing Sample	Sample Name Testing							
				▨	TS		Topsoil			
				▨	RBL		White coke (very dense, moist) (fill)			
		☒	1 CA	▨				NS		
	1									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit GEISS3

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A7
Sheet 1 of 1

Drilled Start 6/25/2007 End	Total Depth (ft) 14	Logged By AJS Checked By RMB	Driller ESN Northwest	Drilling Method Direct Push
Hammer Data	Drilling Equipment AMS Powerprobe 9630			
Surface Elevation (ft) Vertical Datum 13.6	Top of Casing Elevation (ft)			
Latitude Longitude	System Datum N/A			
Notes:				

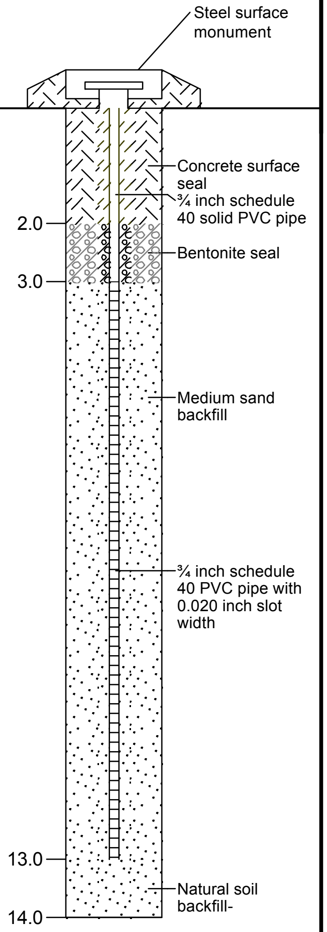
A (in) well was installed on to a depth of 14 (ft).
Well was developed on 6/25/2007.

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
6/25/2007	6.0	7.55

Elevation (feet)	Depth (feet)	Interval	Recovered %	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	0		92						SM	Dark brown silty fine to medium sand with occasional brick fragments (moist) (fill)		
	1								SP-SM	Brown fine to medium sand with silt and occasional brick fragments (moist)		
10												
	4		92									
	5											
	6						▼		SP-SM	Gray fine to medium sand with silt (wet) (native soil)		
	7					1					HS	31
	8		100									
5												
	10											
	11					2 CA			SP	Brown coarse sand with gravel (wet)	HS	15.9
	12		83			3 CA			ML	Dark gray silt (moist)	SS	14.6
0												
	14											

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of MONITORING WELL MW02 (DP02)

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Drilled	Start 6/26/2007	End	Total Depth (ft) 19	Logged By AJS Checked By RMB	Driller ESN Northwest	Drilling Method Direct Push

Hammer Data	Drilling Equipment AMS Powerprobe 9630	A (in) well was installed on to a depth of 19 (ft). Well was developed on 6/26/2007.
Surface Elevation (ft) Vertical Datum 13.1	Top of Casing Elevation (ft)	
Latitude Longitude	System Datum N/A	

Groundwater

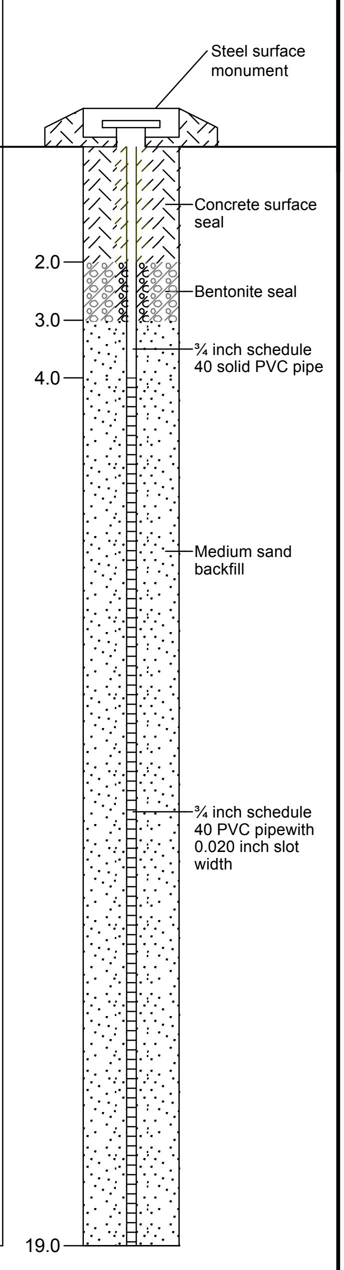
Date Measured	Depth to Water (ft)	Elevation (ft)
6/26/2007	6.5	6.59

Notes:

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered %	Blows/foot	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	0	75		1		SP	Light brown and white medium to coarse sand (moist) (fill)	NS	0
10									
		92							
	5								
					▼				
				2 CA		SP	Brown coarse sand (wet)	NS	
5		83						NS	0
	10					SP	Dark brown fine to medium sand (wet)		
				3 CA		SM	Gray brown and green silty fine sand (wet) Large piece of wood	NS	0
		100				SP	Dark brown fine to medium sand, trace silt (wet) (native soil)		
0									
	15					SM	Dark gray silty fine sand with occasional shell fragments (wet)		
		100							
-5									

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Seattle: Date:4/22/09 Path:P:\0\0504042\GINT\050404200.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of MONITORING WELL MW03 (DP03)

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A9
Sheet 1 of 1

Drilled	Start 6/25/2007	End	Total Depth (ft) 18	Logged By AJS Checked By RMB	Driller ESN Northwest	Drilling Method Direct Push

Hammer Data		Drilling Equipment	AMS Powerprobe 9630
Surface Elevation (ft) Vertical Datum	14.6	Top of Casing Elevation (ft)	
Latitude Longitude		System Datum	N/A

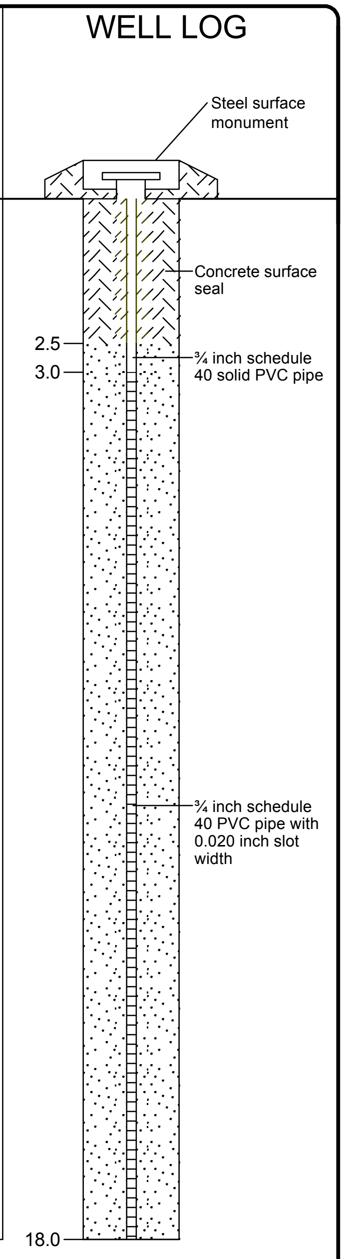
A (in) well was installed on to a depth of 18 (ft).
Well was developed on 6/25/2007.

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
6/25/2007	8.0	6.57

Notes:

Elevation (feet)	Depth (feet)	Recovered %	Blows/foot	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	0	83				TS	Dark brown organic silty fine to coarse sand (topsoil)		
						GP	Gray rock fragments (fill)		
						SP	Dark brown wood layer with fine to medium sand, trace silt (moist)		
				1		SW	Light brown/gray fine to coarse sand with shell fragments (moist)	SS	30
		100							
10									
	5			2				SS	
		100		3 CA	▼	SP	Gray fine to medium sand with shell fragments (wet) (native soil)	MS	
5						SP	Gray fine sand with silt and shell fragments (wet)		
	10	100		4				MS	50
						ML	Gray silt (wet)		
						SP	Gray fine sand with silt and shell fragments (wet)		
		100							
0									
	15								
						ML	Gray silt with sand (wet)		



Note: See Figure A-1 for explanation of symbols.

Log of MONITORING WELL MW04 (DP04)

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A10
Sheet 1 of 1

Seattle: Date:4/22/09 Path:P:\0\0504042\GINT\050404200.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Drilled Start 6/26/2007 End	Total Depth (ft) 20	Logged By AJS Checked By RMB	Driller ESN Northwest	Drilling Method Direct Push

Hammer Data	Drilling Equipment AMS Powerprobe 9630	A (in) well was installed on to a depth of 20 (ft). Well was developed on 6/26/2007.
Surface Elevation (ft) Vertical Datum 14.6	Top of Casing Elevation (ft)	
Latitude Longitude	System Datum N/A	

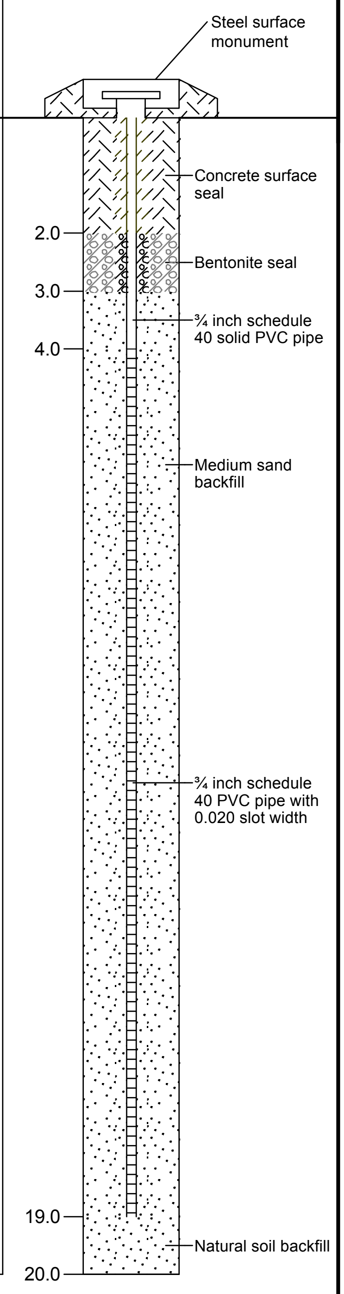
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
6/26/2007	7.0	7.57

Notes:

Elevation (feet)	Depth (feet)	Recovered %	Blows/foot	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	0	92		1		TS	Brown silty fine to coarse sand (moist) (topsoil)	NS	
						SP	Light brown fine to medium sand with trace silt (moist) (fill)		
						SP	Light brown fine to medium sand with occasional shell fragments (moist)		
		92						NS	
10	5								
				2 CA	▼	SP	Dark gray/brown fine to medium sand with occasional shell fragments (wet) (native sediment)		
		92							
5	10					SW	Gray/brown fine to coarse sand with trace silt and occasional shell fragments (wet)		
				3				SS	
						SP-SM	Brown/gray fine sand with silt and occasional shell fragments (wet)		
		92							
0	15								
		92							
						SM	Gray silty fine sand (wet)		
-5	20								

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of MONITORING WELL MW05 (DP05)

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A11
Sheet 1 of 1

Date Excavated: 6/28/2007
Equipment:
Logged By: RMB
Total Depth (ft) 2.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		☒	1 CA		SP		Brown medium to coarse sand with shell fragments	NS	0	
		☒	2 CA		SP		Gray and brown medium to coarse sand with occasional shell fragments and slag cobbles	NS	0	
	1									
						▼	- grades to wet			
	2									

Rapid groundwater seepage observed at 1.5 feet
Severe caving observed from 1.5 to 2 feet

Note: See Figure A-1 for explanation of symbols.

Log of TEST PIT SED01

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Date Excavated: 6/28/2007
Equipment:
Logged By: RMB
Total Depth (ft) 1.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
			1 CA		RBL		Black and brown coarse-grained slag fragments with sand	NS	0	
			2 CA		RBL		Black and brown coarse-grained slag fragments with sand and tar-like-coated slag cobbles.	MS	1	
	1									
5										
						▼	Floating product observed at 1.5 feet, grades to wet			

Rapid groundwater seepage observed at 1.5 feet
Severe caving observed at 1.5 feet

Note: See Figure A-1 for explanation of symbols.

Log of TEST PIT SED02

GEOENGINEERS

Project:	Irondale Iron and Steel Plant
Project Location:	Irondale, Washington
Project Number:	0504-042-00

Figure A13
Sheet 1 of 1

Date Excavated:	6/29/2007	Logged By:	RMB
Equipment:		Total Depth (ft)	1.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		☒	1 CA		SP		Brown sand	NS	0	
		☒	2		SP		Black fine to medium grained charcoal (?) with sand, occasional shell fragments, and slag cobbles	NS	0	
						▼	Grades to wet			
	1									

Rapid groundwater seepage observed at 8 inches
Severe caving observed from 8 to 12 inches

Note: See Figure A-1 for explanation of symbols.

Log of TEST PIT SED03

GeoEngineers

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A14
Sheet 1 of 1

Date Excavated:	6/28/2007	Logged By:	RMB
Equipment:		Total Depth (ft)	3.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		☒	1 CA	▨	SP		Gray medium sand with shell fragments	NS	0	
		☒	2	▨	SP-SM		Gray fine to medium sand with silt and occasional shell and slag fragments	NS	0	
	1									
	2	☒	3	▨	SP-SM		Gray fine to medium sand with occasional shell fragments	NS	0	
5										
						▼	Grades to wet			
	3									

Rapid groundwater seepage observed at 3 feet
Severe caving observed from 2 to 3 feet

Note: See Figure A-1 for explanation of symbols.

Log of TEST PIT SED05

GeoEngineers

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A15
Sheet 1 of 1

Date Excavated: 6/28/2007

Equipment:

Logged By: RMB

Total Depth (ft) 3.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		☒	1 CA		SP		Gray medium to coarse sand with shell fragments and occasional slag	NS	0	
5		☒	2		SP-SM		Brown fine to medium sand with silt and occasional shell fragments	NS	0	
	1									
	2	☒	3		SP-SM		Gray medium sand with silt and occasional shell fragments	NS	0	
						▼	Grades to wet			
	3									

Rapid groundwater seepage observed at 3 feet
Severe caving obwerved at 3 feet

Note: See Figure A-1 for explanation of symbols.

Log of TEST PIT SED06

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A16
Sheet 1 of 1

Date Excavated: 6/28/2007

Equipment:

Logged By: RMB

Total Depth (ft) 2.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0	☒	1 CA		SM		Gray silty fine to medium sand with occasional shell fragments	NS	0	
		☒	2					NS	0	
	1									
	2					▼	Grades to wet			

Rapid groundwater seepage observed at 2 feet
Severe caving observed at 2 feet

Note: See Figure A-1 for explanation of symbols.

Log of TEST PIT SED07

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A17
Sheet 1 of 1

Date Excavated: 6/29/2007
Logged By: RMB
Equipment:
Total Depth (ft) 2.3

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
			1 CA		RBL		Bricks and slag cobbles with medium to coarse sand with shell fragments	NS	0	
			2					NS	0	
	1					▼	Grades to wet			
	2									
							Practical refusal at 27 inches			

Moderate water seepage observed at 1 foot
No caving observed

Note: See Figure A-1 for explanation of symbols.

Seattle: Date:4/22/09 Path:P:\0504042\GINT\050404200.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Log of TEST PIT SED09

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A18
Sheet 1 of 1

Date Excavated: 6/28/2007

Equipment:

Logged By: RMB

Total Depth (ft) 2.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		☒	1 CA		SP-SM		Brown medium to coarse sand with silt and shell fragments	NS	0	
		☒	2		SP-SM		Brown, black and white coarse-grained slag with sand	NS	0	
	1									
0										
	2					▼	Grades to wet			
							Refusal on hard surface at 2.5 feet			

Rapid graoundwater seepage observed at 2 feet
Severe caving observed at 2 feet

Note: See Figure A-1 for explanation of symbols.

Log of TEST PIT SED11

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A19
Sheet 1 of 1

Date Excavated: 6/28/2007
Equipment:
Logged By: RMB
Total Depth (ft) 2.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		☒	1 CA		SP		Gray silty fine to medium sand with shell fragments and slag	NS	0	
		☒	2		SP-SM		Gray fine to medium sand with silt and occasional shell fragments	NS	0	
	1									
	2					▼	Grades to wet			

No groundwater seepage observed
Severe caving observed at 2 feet

Note: See Figure A-1 for explanation of symbols.

Log of TEST PIT SED16

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Date Excavated: 6/29/2007
Equipment:
Logged By: RMB
Total Depth (ft) 2.3

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
			1 CA		SP		Brown medium to coarse sand with shell fragments and occasional slag fragments	NS	0	
5	1 2		2		RBL		Black and brown gravel and cobble-sized slag debris with coarse sand and shell fragments Practical refusal at 29 inches	NS	0	

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of TEST PIT SED17

GeoEngineers

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A21
Sheet 1 of 1

Drilled Start 12/10/2007 End	Total Depth (ft) 13.5	Logged By RMB Checked By RMB	Driller Cascade Drilling	Drilling Method Hollow Stem Auger

Surface Elevation (ft) Vertical Datum Undetermined	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment
Latitude Longitude	System Datum N/A	Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
12/10/2007	3.0	Undetermined

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered %	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								GM	Brown silty gravel with brick fragments and sand (wet) (fill)			
			17			1					VSS		
							▼						
									SM	Black-gray silty fine to medium sand (native sediment)			
			100			2 CA					MS		
	5												
			100			3 CA					MS		
			67			4 CA					MS		
	10												
			67			5 CA					MS		
						CA					NS		
									ML	Gray silt with sand (very stiff, moist) (native soil)			

Note: See Figure A-1 for explanation of symbols.

Log of BORING SED18

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A22
Sheet 1 of 1

Drilled	Start 12/10/2007	End	Total Depth (ft) 7.5	Logged By RMB Checked By RMB	Driller Cascade Drilling
Drilling Method	Hollow Stem Auger				
Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	
Latitude Longitude		System Datum	N/A		
Notes:					

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
12/10/2007	2.0	Undetermined

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered %	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SM	Gray silty fine to medium sand (medium dense,wet) (native sediment)			
			67	14									
						1 CA	▼				MS		Oil liberated when digging
						2 CA					MS		
			67	14									
			67	21									
	5					3 CA					MS		
			67	22									
						4 CA					MS		

Note: See Figure A-1 for explanation of symbols.

Log of BORING SED20

GEOENGINEERS

Project:	Irondale Iron and Steel Plant
Project Location:	Irondale, Washington
Project Number:	0504-042-00

Figure A23
Sheet 1 of 1

Drilled Start 12/10/2007 End	Total Depth (ft) 8.5	Logged By RMB Checked By RMB	Driller Cascade Drilling	Drilling Method Hollow Stem Auger

Surface Elevation (ft) Vertical Datum: Undetermined	Hammer Data: 140 (lbs) / 30 (in) Drop	Drilling Equipment
Latitude Longitude	System Datum: N/A	Groundwater
Notes:		

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
12/10/2007	2.5	Undetermined

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered %	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SM	Gray silty fine to medium sand with occasional shell and brick fragments (wet) (fill)			
			22			1 CA	▼				SS		
	5		100			2 CA				- grades to gray-black	NS		
			100			3 CA					NS		
									SP	Gray fine to medium sand with occasional shell fragments (native sediment)			

Note: See Figure A-1 for explanation of symbols.

Log of BORING SED21

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A24
Sheet 1 of 1

Drilled Start 12/10/2007 End	Total Depth (ft) 8.5	Logged By RMB Checked By RMB	Driller Cascade Drilling	Drilling Method Hollow Stem Auger
Surface Elevation (ft) Vertical Datum Undetermined	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment		
Latitude Longitude	System Datum N/A	Groundwater Date Measured 12/10/2007	Depth to Water (ft) 2.5	Elevation (ft) Undetermined
Notes:				

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered %	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SP	Brown medium to coarse sand with brick fragments (loose, wet) (fill)			
			56	5		1	▼				NS		
	5		56			2					NS		
			56			3			GM	Gray silty gravel with sand and shell fragments (native sediment)	NS		

Note: See Figure A-1 for explanation of symbols.

Log of BORING SED22

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A25
Sheet 1 of 1

Drilled	Start 12/10/2007	End	Total Depth (ft) 8.5	Logged By RMB Checked By RMB	Driller Cascade Drilling
Drilling Method	Hollow Stem Auger				
Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	
Latitude Longitude		System Datum	N/A		
Notes:					

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
12/10/2007	3.0	Undetermined

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered %	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SM	Gray silty fine to medium sand with occasional shell and brick fragments (loose, wet) (fill)			
			100	10		1 CA					NS		
							▼						
			100			2			SP	Gray fine to medium sand with silt and shell fragments (native sediment)	NS		
	5												
			75			3					NS		

Note: See Figure A-1 for explanation of symbols.

Log of BORING SED23

GeoEngineers

Project:	Irondale Iron and Steel Plant
Project Location:	Irondale, Washington
Project Number:	0504-042-00

Figure A26
Sheet 1 of 1

Date Excavated: 6/25/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 4.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Duff and topsoil			
	1	☒	1 CA		SP-SM		Tan-brown fine to medium sand (loose, moist) (native soil)	NS	0	
	2									
		☒	2 CA					NS	0	
	3									
	4									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP01

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A27
Sheet 1 of 1

Date Excavated: 6/25/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 4.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Duff and topsoil			
	1						3-inch-diameter steel pipe observed			
					SM		Dark brown silty fine to medium sand with occasional bricks (loose, moist) (fill)			
	2	☒	1 CA					NS	0	
					SP-SM		Tan-brown fine to medium sand with silt (loose, moist) (native soil)			
	3	☒	2 CA					NS	0	
	4									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP02

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A28
Sheet 1 of 1

Date Excavated: 6/26/2007
Equipment: Shovel

Logged By: RMB
Total Depth (ft) 4.0

		SAMPLE								
Elevation (feet)	Depth (feet)	Testing Sample	Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Duff and topsoil			
					RBL		Medium grained slag fragments with sand (medium dense, moist) (fill)			
	1	☒	1 CA		RBL		Red brick fragments with white material and sand (medium dense, moist) (fill)	NS	0	
	2	☒	2 CA					NS	0	
							Slag cobble encountered			
	3				SM		Reddish brown silty fine sand with occasional gravel (loose, moist) (fill)			
	4	☒	3 CA					NS	0	

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP03

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A29
Sheet 1 of 1

Date Excavated: 12/12/2007
Equipment: Shovel

Logged By: SHL
Total Depth (ft) 3.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Topsoil			
					SP		Brown fine to medium sand with organic matter and metal debris (moist) (fill)	NS		
	1									
								NS		
	2									
								NS		
	3									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP03 (UBSS3)

GeoEngineers

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A30
Sheet 1 of 1

Date Excavated: 6/27/2007
Equipment:
Logged By:
Total Depth (ft) 4.0

Elevation (feet)	Depth (feet)	SAMPLE		Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		Testing Sample	Sample Name Testing							
					TS		Duff and topsoil			
		☒	1		SM		Dark brown silty fine to medium sand with occasional gravel and cobbles (loose, moist) (fill)	NS	0	
	1									
	2	☒	2 CA					NS	0	
		☒	3 CA					NS	0	
	3									
	4									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP04

GEOENGINEERS

Project:	Irondale Iron and Steel Plant
Project Location:	Irondale, Washington
Project Number:	0504-042-00

Figure A31
Sheet 1 of 1

Date Excavated: 6/27/2007

Equipment: Excavator

Logged By: HS

Total Depth (ft) 4.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
15	0				CC		Concrete slab			
	1				SP		Brown fine to medium sand with occasional fine gravel (loose, moist) (fill)			
	2	☒	1 CA		SP		Gray fine to medium sand with occasional fine gravel (medium dense, wet)	NS	0	
		☒	2 CA					NS	0	
	3					▼				
	4									

Slow groundwater seepage observed at 3 feet
Moderate caving observed from 3 to 4 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP05

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A32
Sheet 1 of 1

Date Excavated:	6/21/2007	Logged By:	RMB
Equipment:	Excavator	Total Depth (ft)	8.0

Elevation (feet)	Depth (feet)	Testing Sample	Sample Name Testing	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0			TS		Topsoil with brick fragments and burned organics (loose, moist) (fill)			
15									
	1			SP-SM		Tan-brown fine to medium sand with silt and occasional brick fragments, charcoal fragments (loose, moist) (fill)			
	2	☒	1 CA				NS	0	
	3								
	4	☒	2 CA				NS	0	
	5			SP-SM		Light brown fine to medium sand with orange brown lamination (loose, moist to wet) (native soil)			
10									
	6								
		☒	3 CA		▼		NS	0	
	7			SP		Gray fine to medium sand with silt (loose, wet)			
	8								

Moderate groundwater seepage observed at 6.5 feet
Moderate caving observed from 6.5 to 8 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP06

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A33
Sheet 1 of 1

Date Excavated: 6/21/2007
Equipment: Excavator

Logged By: RMB
Total Depth (ft) 7.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Topsoil and duff with rootlets			
	1				SP-SM		Tan brown fine to medium sand with occasional bricks (loose, moist) (fill)			
	2	☒	1 CA					NS	0	
	3									
	3.5				SP-SM		Tan brown fine to medium sand with lamination (loose, moist) (native soil)			
	4	☒	2 CA					NS	0	
10	5									
	6									
	6.5	☒	3 CA			▼	Grades to gray, wet	NS	0	
	7									

Rapid groundwater seepage observed at 6.5 feet
Moderate caving observed from 6 to 7 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP07

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A34
Sheet 1 of 1

Date Excavated: 6/21/2007
Equipment: Excavator

Logged By: RMB
Total Depth (ft) 7.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Topsoil and Duff			
	1				SM		Dark brown and black silty fine to medium sand with occasional rock fragments (loose, moist) (fill)			
		☒	1 CA					NS	0	
	2				SM		6 to 8 inch lenses of purple-orange silty fine to medium sand and black charcoal-stained silty fine to medium sand with occasional charcoal; brick fragments and yellow-white silty sand pods (medium dense, moist)			
	3									
10	4	☒	2 CA					NS	0	
	5				RBL		Bricks encountered Brown to medium coarse angular slag and brick fragments (loose, wet) (fill)			
	6	☒	3 CA					NS	0	
	7					▼				

Rapid groundwater seepage observed at 7 feet
Severe caving observed from 6 to 7 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP08

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A35
Sheet 1 of 1

Date Excavated: 6/22/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 8.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Duff and topsoil			
	1.5				SP-SM		Tan fine to medium sand with silt (loose, moist) (native soil)			
	2	☒	1 CA					NS	0	
	4	☒	2 CA					NS	0	
	6	☒	3					NS	0	
	7.5					▼	Grades to wet			
	8	☒	4 CA				Slow groundwater seepage observed at 7.5 feet Moderate caving observed from 7.5 to 8.5 feet	NS	0	

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP09

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A36
Sheet 1 of 1

Date Excavated:	6/22/2007	Logged By:	RMB
Equipment:	Excavator	Total Depth (ft)	8.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Topsoil and duff			
					SM		Tan-brown silty fine to medium sand with occasional gravel and brick fragments (loose to medium dense, moist) (fill)			
	1									
	2	☒	1 CA					NS	0	
	3									
10	4	☒	2					NS	0	
	5				SP-SM		Tan-brown fine to medium sand with silt (loose, moist) (native soil)			
	6	☒	3 CA					NS	0	
	7									
		☒	4 CA		SP-SM	▼	Gray medium sand with gravel and silt (loose, wet)	NS	0	
	8									

Rapid groundwater seepage observed at 7.5 feet
Severe caving observed from 7.5 to 8.5 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP10

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Date Excavated: 6/21/2007
Equipment: Excavator

Logged By: RMB
Total Depth (ft) 7.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Topsoil and duff			
	1				SM		Dark gray silty fine to medium sand with silt lenses (loose, moist) (fill)			
15										
	2	☒	1, 2 CA					HS	0.5	Product seep
	3									
	4	☒	3 CA				Brick rubble encountered - lumber and steel beam encountered	HS	.5	
	5									
					SP-SM		Gray fine to medium sand with silt (native soil)			
	6									
10										
		☒	4 CA					MS	1.5	
							Excavation refusal on tree roots			
	7									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP11

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Date Excavated:	6/22/2007	Logged By:	RMB
Equipment:	Excavator	Total Depth (ft)	8.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					GP		Crushed rock			
					SM		Black fine to medium silty sand with gravel and occasional cobbles (medium dense, moist) (fill)			
	1	☒	1		SM		Brown and rust brown silty fine to medium sand with occasional slag, yellow-white bricks, and gravel (medium dense, moist)	NS	0	
		☒	2 CA					NS	0	
	2									
10					SP-SM		Brown-tan fine to medium sand with occasional shell fragments (loose, moist)			
	3	☒	3 CA					NS	0	
	4									
	5						Large woody debris encountered			
	6						Grades to gray, wooden pile encountered			
	7	☒	4 CA				Sulfur odor, grades to wet	NS	0	
5										
	8									

No groundwater seepage observed
Severe caving observed from 7 to 8 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP12

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Date Excavated: 6/25/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 8.5

Elevation (feet)	Depth (feet)	SAMPLE		Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
		Testing Sample	Sample Name Testing							
	0				TS		Grass and topsoil			
	0.5				SM		Tan-gray silty fine to medium sand with shell fragments (loose, moist) (fill)			
	1				WD		Wood chips with sand and gravel (loose, moist) (fill)			
	2				SP-SM		Brown and gray fine to medium sand with silt and shell fragments (loose, moist)			
	2.5	☒	1 CA					NS	0	
	3									
10	4									
	5	☒	2 CA					NS	0	
	6									
	7									
	7.5				SP-SM		Gray medium sand with silt and shell fragments (loose, moist to wet) (native soil)			
	8	☒	3 CA					NS	0	
	8.5					▼	Grades to wet			

Moderate groundwater seepage observed at 8.5 feet
Minor caving observed from 7.5 to 8.5 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP13

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A40
Sheet 1 of 1

Date Excavated:	6/26/2007
Equipment:	Excavator
Logged By:	RMB
Total Depth (ft)	8.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Grass and Topsoil			
	0.5				WD		Wood chips with sand and occasional gravel (loose, moist) (fill)			
	1									
	1.5				SP-SM		Tan and gray fine to medium sand with silt and shell fragments (loose, moist) (fill)			
	2	☒	1 / CA					NS	0	
	3									
	4	☒	2					NS	0	
10	5									
	6	☒	3 / CA					NS	0	
	7				SP-SM	▼	Gray fine to medium sand with silt and shell fragments (loose, wet) (native soil)			
	8	☒	4 / CA					NS	0	

Slow groundwater seepage observed at 7 feet
Moderate caving observed from 7 to 8 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP14

GEOENGINEERS

Project:	Irondale Iron and Steel Plant
Project Location:	Irondale, Washington
Project Number:	0504-042-00

Figure A41
Sheet 1 of 1

Date Excavated: 6/21/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 8.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				WD		Wood chips with rootlets and fine to medium silty sand (loose, moist) (fill)			
	1									
	1.5				SP-SM		Brown and gray fine to medium sand with silt and occasional shell fragments (loose, moist)			
	2	☒	1 CA					NS	0	
	3									
10	4	☒	2 CA					NS	0	
	5									
	6									
	6.5	☒	3 CA		SP-SM	▼	Gray fine to medium sand with silt and occasional shell fragments (loose, wet) (native soil)	NS	0	
	7									
	8									

Rapid groundwater seepage observed at 6.5 feet
Moderate caving observed from 7 to 8 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP15

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A42
Sheet 1 of 1

Date Excavated:	6/22/2007	Logged By:	RMB
Equipment:	Excavator	Total Depth (ft)	8.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0			▨	TS		Grass and topsoil			
	0.5			░	SP-SM		Brown fine to medium sand with silt and occasional shell fragments (loose, moist) (fill)			
	1									
10										
	2	☒	1 CA					NS	0	
	3									
	4	☒	2 CA					NS	0	
	5									
	5.5			░	SP-SM		Gray fine to medium sand with silt and occasional shell fragments (loose, wet) (native soil)			
	6	☒	3					NS	0	
5										
	7	☒	4 CA			▼		NS	0	
	8									

Rapid groundwater seepage observed at 7 feet
Moderate caving observed from 6.5 to 7.5 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP16

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Date Excavated: 6/26/2007
Logged By: RMB
Equipment: Excavator
Total Depth (ft) 8.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Grass and topsoil			
					WD		Wood chips with occasional gravel (loose, moist) (fill)			
	1									
					SP-SM		Tan-brown sand with silt and occasional shell and coke fragments (loose, moist) (fill)			
	2	☒	1 CA					SS	0	
	3									
10	4	☒	2					NS	0	
	5									
					SP-SM		Gray fine to medium sand with silt and occasional shell fragments (loose, moist to wet)			
	6	☒	3 CA					NS	0	
	7									
					SP-SM		Gray medium sand with silt and occasional shell fragments (loose, wet) (native soil)			
	8	☒	4 CA			▼		NS	0	

Moderate groundwater seepage observed at 8 feet
Minor caving observed from 7.5 to 8.5 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP17

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A44
Sheet 1 of 1

Date Excavated: 6/26/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 8.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
15	0			TS		Grass and topsoil			
	0.5			SM		Dark brown silty fine to medium sand with wood chips, white coke fragments, rip rap, shell fragments,occasional red slag, and bricks (loose, moist) (fill)			
	1.5	☒	1 CA				NS	0	
	2			SP-SM		Brown and gray fine to medium sand with silt and occasional shell fragments (loose, moist) (fill)			
	3	☒	2 CA				NS	0	
10	5								
	6	☒	3				NS	0	
	7				▼				
	7.5			SP-SM		Gray fine to medium sand with occasional shell fragments and silt (loose, wet) (native soil)			
	8	☒	4 CA				NS	0	

Moderate groundwater seepage observed at 7 feet
Moderate caving observed from 7 to 8.5 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP18

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A45
Sheet 1 of 1

Date Excavated: 6/21/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 8.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				WD		Wood chips with rootlets (loose, moist) (fill)			
	1									
	2	☒	1 CA		SP-SM		Brown and gray fine to medium sand with silt; occasional shell fragments (loose, moist)	NS	0	
	3									
	4									
10										
	5									
		☒	2 CA				Grades to gray	NS	0	
	6									
	7	☒	3 CA		SP-SM	▼	Gray fine sand with occasional shells and sandy silt lenses (loose, wet) (native soil)	NS	0	
	8									

Rapid groundwater seepage observed at 7 feet
Moderate caving observed from 7 to 8 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP19

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A46
Sheet 1 of 1

Date Excavated: 6/25/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 9.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					SM		Dark brown silty fine to medium sand with occasional cobbles (loose, moist) (fill)			
	1									
15										
					SP-SM		Tan-brown fine to medium sand with silt (loose, moist)			
	2	☒	1 CA					SS	0	
	3									
	4	☒	2 CA					NS	0	
	5									
	6	☒	3 CA		SP-SM		Gray fine to medium sand with shell fragments (loose, moist)	SS	0	
10										
	7									
	8	☒	4					NS	0	
					SM		Black and brown fine silty sand with charcoal fragments, bricks, and occasional white coke fragments (medium dense, wet)			
	9									

No groundwater seepage observed
Severe caving observed from 6 to 9.5 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP20

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A47
Sheet 1 of 1

Date Excavated: 6/25/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 4.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Topsoil and duff			
	0.5				SM		Dark brown silty fine to medium sand with red and yellow-white brick fragments and occasional slag debris (loose, moist) (fill)			
	1									
	2	☒	1 CA							
	3				SM		Tan-brown silty fine to medium sand with occasional brick fragments (loose, moist)			
	4	☒	2 CA							

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP21

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A48
Sheet 1 of 1

Date Excavated: 6/27/2007
Logged By: RMB
Equipment: Shovel
Total Depth (ft) 2.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Topsoil and duff			
					RBL		Black coarse grained metal flakes with occasional slag cobbles and white debris (loose, moist) (fill)			
	1	☒	1					NS	0	
							Brick rubble encountered in sand-sized matrix			
	2									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP22

GeoEngineers

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A49
Sheet 1 of 1

Date Excavated:	6/22/2007
Equipment:	Excavator
Logged By:	RMB
Total Depth (ft)	8.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Topsoil and duff (loose, moist) (fill)			
		☒	1 CA					NS	0	
	1				SP-SM		Tan-brown fine to medium sand with silt and trace brick fragments (loose, moist)			
	2	☒	2 CA					NS	0	
	3									
	4	☒	3		SP-SM		Brown fine to medium sand with silt (loose, moist) (native soil)	NS	0	
10										
	5									
	6									
	7	☒	4 CA		GM	▼	Gray silty gravel with sand (loose, wet)	NS	0	
	8									

Rapid groundwater seepage observed at 7 feet
Severe caving observed from 6 and 8 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP23

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A50
Sheet 1 of 1

Date Excavated: 6/22/2007

Equipment: Excavator

Logged By: RMB

Total Depth (ft) 4.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Duff and topsoil			
15	1				SP-SM		Tan-brown fine to medium sand with silt (loose, moist) (fill)			
	2	☒	1 CA		SM		Gray-black silty fine to medium sand with occasional bricks (loose, moist)	HS	<1	
	3						2-inch-diameter steel pipe encountered			
	4									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP24

GeoEngineers

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A51
Sheet 1 of 1

Date Excavated: 6/22/2007

Logged By: RMB

Equipment: Excavator

Total Depth (ft) 1.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
				▩	TS		Duff and topsoil			
15	1			▨	SM		Gray silty fine to medium sand (loose, moist) (fill) Refusal on flat lumber surface			

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP25

GeoEngineers

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A52
Sheet 1 of 1

Date Excavated:	6/22/2007	Logged By:	RMB
Equipment:	Excavator	Total Depth (ft)	7.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Topsoil and duff			
	1				SP-SM		Brown-tan fine to medium sand with occasional brick fragments (loose, moist) (fill)			
	2	☒	1 CA					NS	0	
	3									
10										
	4	☒	2 CA					NS	0	
	5									
	6				SP-SM		Gray fine to medium sand with silt (loose, moist) (native soil)			
		☒	3 CA					MS	0	
	7					▼				
		☒	4 CA					HS	<1	

Moderate groundwater seepage observed at 7 feet
Severe caving observed from 6 to 7.5 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP26

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A53
Sheet 1 of 1

Date Excavated: 6/25/2007
Equipment: Excavator
Logged By: RMB
Total Depth (ft) 6.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Duff and topsoil			
	1				SM		Brown silty fine to medium sand (loose, wet) (native soil)			
20										
	2					▽				
	3									
	4									
	5	☒	1 CA					NS	0	
	6									

Slow groundwater seepage observed from 2 to 6 feet
Severe caving observed from 2 to 6 feet

Note: See Figure A-1 for explanation of symbols.

Seattle: Date:4/22/09 Path:P:\0\0504042\GINT\050404200.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Log of Test Pit TP27

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A54
Sheet 1 of 1

Date Excavated:	6/25/2007	Logged By:	RMB
Equipment:	Excavator	Total Depth (ft)	6.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Duff and topsoil			
	1				SM		Brown and gray silty fine to medium sand with silt lenses (loose, wet) (fill)			
	2									
	3	☒	1 CA			▽		NS	0	
					SM		Gray silty fine to medium sand with occasional brick fragments (loose, wet)			
	4									
15										
	5	☒	2 CA					SS	0	Slight odor
	6				SM		Gray silty fine to medium sand with occasional gravel (dense, moist)			
		☒	3 CA					NS	0	

Moderate groundwater seepage observed at 3.5 feet
Minor caving observed from 3.5 to 6.5 feet

Note: See Figure A-1 for explanation of symbols.

Seattle: Date:4/22/09 Path:P:\0504042\GINT\050404200.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Log of Test Pit TP28

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A55
Sheet 1 of 1

Date Excavated: 6/25/2007
Logged By: RMB
Equipment: Excavator
Total Depth (ft) 7.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Duff and topsoil			
	1									
					SP-SM		Tan-brown fine to medium sand with silt and occasional brick fragments (loose, moist) (fill)			
	2									
	3	☒	1 CA					NS	0	
	4									
10										
	5									
	6	☒	2 CA				Grades to moist to wet	NS	0	
					SP-SM		Gray medium to coarse sand with silt and gravel (loose, wet) (native soil)			
	7	☒	3 CA			▼		NS	0	

Moderate groundwater seepage observed at 7 feet
Minor caving observed from 6 to 7.5 feet

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP29

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Date Excavated: 6/26/2007
Equipment: Shovel

Logged By: RMB
Total Depth (ft) 4.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Topsoil and duff			
					SP-SM		Tan-brown fine sand with occasional cobbles (loose, moist) (fill)			
	1									
	2									
	3									
		☒	1 CA					SS	0	
	4									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Seattle: Date:4/22/09 Path:P:\0504042\GINT\050404200.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Log of Test Pit TP30

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A57
Sheet 1 of 1

Date Excavated: 12/12/2007

Equipment: Shovel

Logged By: SHL

Total Depth (ft) 1.5

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					S		Brown fine to medium sand with organic matter and metal debris (moist) (fill)			
		☒	1 CA							
	1									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP30 (UBSS2)

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A58
Sheet 1 of 1

Date Excavated: 6/27/2007
Equipment: Shovel
Logged By: RMB
Total Depth (ft) 1.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
				▨	CC		Rubble			
	1									

Refusal at 1 foot on brick rubble
No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP31

GEOENGINEERS

Project:	Irondale Iron and Steel Plant
Project Location:	Irondale, Washington
Project Number:	0504-042-00

Figure A59
Sheet 1 of 1

Drilled Start 12/10/2007 End	Total Depth (ft) 11	Logged By RMB Checked By RMB	Driller Cascade Drilling	Drilling Method Hollow Stem Auger
Surface Elevation (ft) Vertical Datum 14.6	Hammer Data 140 (lbs) / 30 (in) Drop		Drilling Equipment	
Latitude Longitude	System Datum N/A		Groundwater	
Notes:			Date Measured 12/10/2007	Depth to Water (ft) 6.8 Elevation (ft) 7.8

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered %	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SM	Dark brown silty fine to medium sand with brick and slag fragments (medium dense, moist) (fill)			
			100	14		1 CA					NS	0	
10			17	11		2 CA					NS	0	
	5								SM	Brown fine to medium silty sand with slag fragments (loose, moist)			
							▼						
			67	17		3 CA				- becomes wet	SS	0	
										- grades to gray and black with occasional brick fragments	SS	0	
									SP	Gray fine to medium sand with occasional gravel and trace brick fragments (medium dense, moist)			
5	10		100			4					NS	0	
									ML	Gray silt with sand (very stiff, moist) (native soil)			

Note: See Figure A-1 for explanation of symbols.

Log of BORING TP32

GeoEngineers

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A60
Sheet 1 of 1

Drilled	Start 12/11/2007	End	Total Depth (ft) 9.5	Logged By RMB Checked By RMB	Driller Cascade Drilling
Drilling Method	Hollow Stem Auger				

Surface Elevation (ft) Vertical Datum 13.3	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment
Latitude Longitude	System Datum N/A	
Notes:		

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
12/11/2007	7.5	5.8

Elevation (feet)	Depth (feet)	Interval	Recovered %	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SP	Brown and black sand with occasional slag and brick fragments (loose, moist) (fill)			
			67	14		1 CA					NS	0	
10													
									WD	Wood			
	5		100			2				Drilling refusal, moved drill rig 3 feet	NS	0	
							▼						
5													
			100	50/6"		3							

Note: See Figure A-1 for explanation of symbols.

Log of BORING TP33

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A61
Sheet 1 of 1

Drilled	Start 12/10/2007	End	Total Depth (ft) 16	Logged By RMB Checked By RMB	Driller Cascade Drilling
Drilling Method	Hollow Stem Auger				
Surface Elevation (ft) Vertical Datum	13.4	Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	
Latitude Longitude		System Datum	N/A		
Notes:					

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
12/10/2007	7.0	6.4

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered %	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SP	Brown fine to medium sand with silt (medium dense, moist) (fill)			
			100	17		1 CA					NS	0	
10													
			44			2 CA					NS	0	
	5									- brick and slag fragments encountered			
			100	30		3	▼			- becomes wet	NS	0	
5													
			100	50/6"		4					NS	0	
	10								SP	Brown fine to medium sand with brick and slag fragments (dense, wet)			
0													
			61	50/6"		5a			SP	Gray fine to medium sand with occasional shell, brick and metal fragments (dense, wet)	NS	0	
	15												
						5b			ML	Gray silt with sand (very stiff, moist) (native soil)	NS	0	

Note: See Figure A-1 for explanation of symbols.

Log of BORING TP34

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A62
Sheet 1 of 1

Drilled Start 12/10/2007 End	Total Depth (ft) 8.5	Logged By RMB Checked By RMB	Driller Cascade Drilling	Drilling Method Hollow Stem Auger
Surface Elevation (ft) Vertical Datum 14.2	Hammer Data 140 (lbs) / 30 (in) Drop		Drilling Equipment	
Latitude Longitude	System Datum N/A		Groundwater	
Notes:			Date Measured 12/10/2007	Depth to Water (ft) 5.0 Elevation (ft) 9.2

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered %	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SP	Brown fine to medium sand with silt and occasional brick fragments (loose, moist) (fill)			
			100	11		1 CA					SS	0	
10			67	5		2 CA					NS	0	
	5						▼			Becomes wet, grades to gray			
			100	10		3 CA			SP	Gray fine to medium sand (loose, wet) (native soil)	NS	0	

Note: See Figure A-1 for explanation of symbols.

Log of BORING TP35

GEOENGINEERS

Project:	Irondale Iron and Steel Plant
Project Location:	Irondale, Washington
Project Number:	0504-042-00

Figure A63
Sheet 1 of 1

Drilled Start 12/11/2007 End	Total Depth (ft) 13.5	Logged By RMB Checked By RMB	Driller Cascade Drilling	Drilling Method Hollow Stem Auger
Surface Elevation (ft) Vertical Datum 14.2	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment		
Latitude Longitude	System Datum N/A	Groundwater: Date Measured / Depth to Water (ft) / Elevation (ft)	Undetermined	
Notes:				

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered %	FIELD DATA: Blows/foot	FIELD DATA: **Collected Sample**	FIELD DATA: Sample Name	FIELD DATA: Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0									No samples to 9.5 feet			
10													
	5												
5													
			100	50/6"		1			SP	Gray fine to medium sand with occasional gravel (medium dense, moist) (native soil)	NS	0	
	10												
			50	50/6"		2			ML	Gray sandy silt (very stiff, moist)	NS	0	

Note: See Figure A-1 for explanation of symbols.

Log of BORING TP35A

GEOENGINEERS

Project:	Irondale Iron and Steel Plant
Project Location:	Irondale, Washington
Project Number:	0504-042-00

Figure A64
Sheet 1 of 1

Seattle: Date:4/22/09 Path:P:\0504042\GINT\050404200.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start 12/10/2007 End	Total Depth (ft) 8.5	Logged By RMB Checked By RMB	Driller Cascade Drilling	Drilling Method Hollow Stem Auger
Surface Elevation (ft) Vertical Datum 14.5	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment		
Latitude Longitude	System Datum N/A	Groundwater		
Notes:		Date Measured 12/10/2007	Depth to Water (ft) 4.5	Elevation (ft) 10.0

		FIELD DATA									
Elevation (feet)	Depth (feet)	Interval Recovered %	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0							SP	Brown fine to medium sand with silt (medium dense, moist) (fill)			
		100	13		1					NS	0	
10						▼						
	5	100	12		2				Becomes wet	NS	0	
		100	8		3					NS	0	
								SP	Gray fine to medium sand (loose, wet) (native soil)			

Note: See Figure A-1 for explanation of symbols.

Log of BORING TP36

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A65
Sheet 1 of 1

Drilled Start 12/11/2007 End	Total Depth (ft) 13.5	Logged By RMB Checked By RMB	Driller Cascade Drilling	Drilling Method Hollow Stem Auger
Surface Elevation (ft) Vertical Datum 14.5	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment		
Latitude Longitude	System Datum N/A	Groundwater		
Notes:		Date Measured	Depth to Water (ft)	Elevation (ft) Undetermined

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered %	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0									Auger to 9.5 feet			
10													
	5												
5			100	50/6"		1 CA			SP	Brown fine to medium sand with occasional gravel (medium dense, wet) (native soil)	SS	0	
	10												
			100	50/4"		2			ML	Gray sandy silt (very stiff, moist)	NS	0	

Note: See Figure A-1 for explanation of symbols.

Log of BORING TP36A

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A66
Sheet 1 of 1

Date Excavated: 12/12/2007
Equipment: Shovel
Logged By: SHL
Total Depth (ft) 6.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0			TS		Brown fine to medium sand with organic matter (moist)			
	0.5			SP		Brown fine to medium sand (moist) (native soil)			
	1								
	1.5	☒	1 CA				NS		
	2								
	3								
	4								
	5					Brown medium to coarse sand (moist)			
	5.5	☒	2 CA				NS		
	6								

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP37

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A67
Sheet 1 of 1

Date Excavated: 12/12/2007
Equipment: Shovel
Logged By: SHL
Total Depth (ft) 6.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Brown fine to medium sand with organic matter (moist) (topsoil)			
					SP		Brown fine to medium sand (moist) (native soil)			
	1	☒	1 CA					NS		
	2									
	3									
	4									
	5	☒	2 cA					NS		
	6									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP38

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A68
Sheet 1 of 1

Date Excavated: 12/12/2007
Equipment: Shovel

Logged By: SHL
Total Depth (ft) 5.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				SP		Brown fine to medium sand with organic matter and occasional gravel (moist) (fill)			
	1	☒	1 / CA					NS		
	2									
	3									
	4				SP		Light brown fine to medium sand (moist) (native soil)			
	5	☒	2 / CA					NS		

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP39

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A69
Sheet 1 of 1

Date Excavated: 12/12/2007
Equipment: Shovel
Logged By: SHL
Total Depth (ft) 5.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
					TS		Brown fine to medium sand with organic matter and slag (moist) (fill)			
		☒	1 CA		SP		Brown fine sand (moist)	NS		
	1									
	2									
	3									
	4									
	5	☒	2 CA					NS		

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP40 (UBSS1)

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Date Excavated: 12/12/2007
Equipment: Shovel
Logged By: RMB
Total Depth (ft) 3.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
				▨	TS		Dark brown silty fine to medium sand with occasional gravel and rootlets (loose, moist) (topsoil)			
	1	☒	1 CA	▨				NS		
				▒	SM		Brown silty fine to medium sand with occasional gravel and shell fragments (loose, moist) (fill)			
	2			▒						
				▒		▼				
	3	☒	2 CA	▒				NS		

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Seattle: Date:4/22/09 Path:P:\0504042\GINT\050404200.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Log of Test Pit TP41

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A71
Sheet 1 of 1

Date Excavated: 12/12/2007
Equipment: Shovel
Logged By: RMB
Total Depth (ft) 6.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				TS		Topsoil			
	0.5				SP		Brown fine to medium sand with organic matter and occasional gravel (moist) (fill)			
	1									
	2	☒	1 CA					NS		
	3									
	4									
	5	☒	2 CA					NS		
	6									

No groundwater seepage observed
No caving observed

Note: See Figure A-1 for explanation of symbols.

Log of Test Pit TP42

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A72
Sheet 1 of 1

Drilled Start 12/11/2007 End	Total Depth (ft) 16	Logged By RMB Checked By RMB	Driller Cascade Drilling	Drilling Method Hollow Stem Auger
Surface Elevation (ft) Vertical Datum 13.7	Hammer Data 140 (lbs) / 30 (in) Drop		Drilling Equipment Hollow Stem Auger	
Latitude Longitude	System Datum N/A		Groundwater	
Notes:			Date Measured 12/11/2007	Depth to Water (ft) 5.0 Elevation (ft) 8.7

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered %	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	REMARKS
	0								SP	Brown fine to medium sand with occasional gravel (medium dense, moist) (fill)			
			100	50/6"		1 CA					NS	0	
10													
	5		100	50/6"		2 CA	▼		SP	Black and brown sand with occasional gravel and slag (medium dense, wet) (fill)	NS	0	Y/N
5													
	10		100	50/6"		3 CA			SM	Light gray fine sand with occasional charcoal and laminated organic lenses (very dense, moist) (native soil)	NS	0	
0													
	15		100	25		4			ML	Gray sandy silt with occasional gravel and shell fragments (very stiff, wet)	NS	0	

Note: See Figure A-1 for explanation of symbols.

Log of BORING TP43

GEOENGINEERS

Project: Irondale Iron and Steel Plant
Project Location: Irondale, Washington
Project Number: 0504-042-00

Figure A73
Sheet 1 of 1

APPENDIX B

ANALYTICAL REPORTS (CD) AND DATA VALIDATION REPORTS

EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

WASHINGTON DOE TOXICS CLEANUP PROGRAM
REMEDIAL INVESTIGATION FEASIBLITY STUDY
IRONDALE, WASHINGTON

Prepared for:

SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

GeoEngineers, Inc.
600 Stewart Street, Suite 1700
Seattle, WA 98101

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C4122-7

April 2, 2009

Approved for Release

Christine Ransom
Project Manager
EcoChem, INC.

INTRODUCTION

Basis for the Data Validation

This report summarizes the results of the summary (Level III) data validation performed on groundwater and quality control (QC) sample data for the Washington Department of Ecology – Remedial Investigation Feasibility Study at Irondale, Washington. A complete list of samples is provided in the **Sample Index**. Analytical Resources, Inc., Tukwila, Washington performed all analyses. The analytical methods and EcoChem project chemists are listed below.

Analysis	Method of Analysis	Primary Review	Secondary Review
SVOC-SIM	SW8270D-SIM	Jennifer Newkirk	Eric Strout
Diesel and Residual Range Hydrocarbons	NWTPH-Dx	Linda Holz	Eric Strout
Metals	SW6010B & EPA 200.8	Linda Holz	Christine Ransom

The data validation is based on QC criteria documented in the above listed methods, the *Quality Assurance Project Plan (QAPP) - Investigation/Feasibility Study, Irondale, Washington (2007)*; and *USEPA National Functional Guidelines for Organic* (1999) *and Inorganic (2004) Data Review*.

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

Data qualifier definitions, reason codes, and validation criteria are included as **Appendix A**. **Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem.

SAMPLE INDEX
Irondale - Groundwaters

SDG	Sample ID	Laboratory ID	SVOC-SIM	TPH-Dx	Metals
OH58	MW04-090109	09-1271-OH58A	✓	✓	✓
	MW05-090109	09-1272-OH58B	✓	✓	✓
	MW03-090109	09-1273-OH58C	✓	✓	✓
	MW02-090109	09-1274-OH58D	✓	✓	✓
	MW02-090109-DUPE	09-1275-OH58E	✓	✓	✓
	MW04-090109	09-1276-OH58F			✓
	MW05-090109	09-1277-OH58G			✓
	MW03-090109	09-1278-OH58H			✓
	MW02-090109	09-1279-OH58I			✓
	MW02-090109-DUPE	09-1280-OH58J			✓

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Metals by Methods SW6010B and E200.8

This report documents the review of analytical data from the analyses of groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH58	5 Groundwater	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table:

1 Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
CRDL Standards
Laboratory Blanks
Laboratory Control Samples (LCS)
Matrix Spikes (MS)
Laboratory Duplicates
2 Field Duplicates
Interference Check Samples
Serial Dilutions
1 Reported Results

---

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Field Duplicates

The relative percent difference (RPD) value is used to assess precision only if both sample results are greater than 5x the RL for a given analyte; otherwise, the difference between the two results is used to evaluate precision. For water matrices, the RPD control limit is 35% or the difference must be less than the RL.

Data for one set of field duplicates were submitted: MW02-090109 and MW02-090109-DUPE. The RPD values for total iron (67.3%) and dissolved copper (52.6%) were greater than the 35% control limit. The total iron and dissolved copper results for these two samples were estimated (J-9).

Reported Results

Some results for dissolved arsenic and nickel were slightly higher than for the total fraction. The results fell within normal analytical precision and no action was necessary.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory and field replicate RPD values indicated acceptable precision, except as noted above. Accuracy was also acceptable, as demonstrated by the matrix spike and laboratory control sample recoveries.

Data were estimated based on a field duplicate precision outlier.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Selected Semivolatiles by EPA Method 8270D-SIM

This report documents the review of analytical data from the analyses of groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH58	5 Groundwater	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

SDG OH58: There was a calibration calculation error in the data submitted by the laboratory. Results were recalculated correctly and a revised hardcopy and electronic data deliverable were submitted.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table:

1 Holding Times and Sample Preservation
GC/MS Instrument Performance Check
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
2 Laboratory Blanks
Field Blanks
Surrogate Compounds
Laboratory Control Samples (LCS)
Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Internal Standards
2 Field Duplicates
Target Analyte List
Reporting Limits
Reported Results

---

[1] ***Quality control results are discussed below, but no data were qualified***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Laboratory Blanks

To assess the impact of each blank contaminant on the reported sample results, an action level is established at five times the concentration reported in the blank. If a contaminant is reported in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-7). If the result is also less than the reporting limit, then the result is elevated to the reporting limit. No action is taken if the sample result is greater than the action level, or for non-detected results.

Method blanks were analyzed at the appropriate frequency. Various target analytes were detected in the method blanks, however, only the following analytes were qualified as not detected in one or more samples.

A total of three naphthalene results were qualified as not-detected (U-7).

Field Duplicates

The relative percent difference (RPD) value is used to assess precision only if both sample results are greater than 5x the RL for a given analyte; otherwise, the difference between the two results is used to evaluate precision. For water matrices, the RPD control limit is 35% or the difference must be less than the RL.

One set of field duplicates (MW02-090109 and MW02-090109-DUPE) were submitted. The benzo(a)pyrene difference value was greater than the reporting limit. The benzo(a)pyrene results were estimated (J/UJ-9) in the parent and duplicate samples.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD), and laboratory control sample recoveries. Precision was also acceptable as demonstrated by the MS/MSD and field duplicate RPD values, with the exception noted above.

Data were estimated based on a field duplicate precision outlier. Data were qualified as not detected based on contamination in the associated method blank.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Diesel and Residual Range Hydrocarbons by Method NWTPH-Dx

This report documents the review of analytical data from the analyses of groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH58	5 Groundwater	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Preservation
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Blanks (Method)
Field Blanks
Surrogate Compounds
Matrix Spike/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Samples (LCS/LCSD)
2 Field Duplicates
Target Analyte List
Reporting Limits
Reported Results
Compound Identification and Quantification

---

[1] ***Quality control results are discussed below, but no data were qualified.***

[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Field Duplicates

The relative percent difference (RPD) value is used to assess precision only if both sample results are greater than 5x the reporting limit (RL) for a given analyte; otherwise, the difference between the two results is used to evaluate precision. For water matrices, the RPD value control limit is 35% or the difference must be less than the RL.

One set of field duplicates, MW02-090109 and MW02-090109-DUPE, was submitted. The difference of the diesel range hydrocarbon results was greater than the RL. The diesel results were estimated (J/UJ-9) in these two samples.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample percent recovery (%R) values. Precision was also acceptable, as demonstrated by the field duplicate and MS/MSD RPD values, with the exception noted above.

Data were estimated based on a field duplicate precision outlier.

All data, as qualified, are acceptable for use.

EcoChem, INC.
Environmental Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS
REASON CODES
AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with “R” and “DNR” only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives
22	Elevated Detection Limit Due to Interference (i.e., laboratory, chemical and/or matrix)

DATA VALIDATION CRITERIA

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	Water: J(+)/UJ(-) if ext. > 7 and < 21 days J(+)/R(-) if ext > 21 days (EcoChem PJ) Solids/Wastes: J(+)/UJ(-) if ext. > 14 and < 42 days J(+)/R(-) if ext. > 42 days (EcoChem PJ) J(+)/UJ(-) if analysis >40 days	1
Tuning	DFTPP Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	(EcoChem PJ, see TM-06) J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	(EcoChem PJ, see TM-06) If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Field Blanks (Not Required)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS low conc. H2O SVOA	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS regular SVOA (H2O & solid)	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R <LCL J(+)/R(-) if %R < 10% (EcoChem PJ)	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Minimum of 3 acid and 3 base/neutral compounds Use method acceptance criteria	Do not qualify if only 1 acid and/or 1 B/N surrogate is out unless <10% J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10%	13
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT>30 seconds, narrate and Notify PM	19
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants See Technical Director for ID issues	4
Quantitation/ Identification	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	See Technical Director if outliers	14 21 (false +)

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X (EcoChem PJ)	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors $\leq$20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if R^2 <0.990 J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 85% to 115%	Narrate if frequency not met. J(+)/UJ(-) if %R < 85% J(+) if %R >115%	5B
Method Blank	At least one per batch ($\leq$10 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is $\geq$ RL and < 5X blank result	7
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. Use PJ if only one %R outlier	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch ($\leq$10 samples) RPD $\leq$ lab control limit	J(+) if RPD > lab control limits	9
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% (EcoChem PJ)	10

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. (EcoChem PJ)	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP EcoChem default: water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. (See TM-04)	11

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration Tissues: Frozen	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r > 0.995	J(+)/UJ(-) if r < 0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		(Refer to TM-02 for additional information)
			7

Reporting Limit Standard	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+) < 2x RL if %R <50% (< 30% Sb, Pb, Tl) J(+) < 2x RL, UJ(-) if %R 50-69% (30-49% Sb, Pb,Tl) J(+) < 2x RL if %R 130-180% (150-200% Sb, Pb, Tl) R(+) < 2x RL if %R > 180% (200% Sb, Pb, Tl)	14
Interference Check Samples (ICSA/ICSAB)	ICSAB %R 80 - 120% for all spiked elements | ICSA | < MDL for all unspiked elements except: K, Na	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R= 50 to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spikes	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R > 125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R < 30% or J(+)/UJ(-) if Post Spike %R 75-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples >RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2x RL for solids) qualify all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample conc. > 50x MDL	J(+)/UJ(-) if %D >10% qualify all samples in batch	16
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Tune	Prior to ICAL monitoring compounds analyzed 5 times wih Std Dev. ≤ 5% mass calibration <0.1 amu from True Value Resolution < 0.9 AMU @ 10% peak height or <0.75 amu @ 5% peak height	Use Professional Judgment to evaluate tune J(+)/UJ(-) if tune criteria not met	5A
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r>0.995	J(+)/UJ(-) if r<0.995 (for multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Reporting Limit Standard (CRI)	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Co,Mn, Zn)	R(-),(+) < 2x RL if %R < 50% (< 30% Co,Mn, Zn) J(+) < 2x RL, UJ(-) if %R 50-69% (30%-49% Co,Mn, Zn) J(+) < 2x RL if %R 130%-180% (150%-200% Co,Mn, Zn) R(+) < 2x RL if %R > 180% (200% Co, Mn, Zn)	14
Interference Check Samples (ICSA/ICSAB)	Required by SW 6020, but not 200.8 ICSAB %R 80% - 120% for all spiked elements | ICSA | < IDL (MDL) for all unspiked elements	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R = 50% to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch Blank Spike: %R within 80%-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 75-125% for samples where results do not exceed 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% or J(+)/UJ(-) if Post Spike %R 75%-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, Spike parent sample at 2x the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5 x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample values > 50x MDL	J(+)/UJ(-) if %D >10% All samples in batch	16
Internal Standards	Every sample SW6020: 60%-125% of cal blank IS 200.8: 30%-120% of cal blank IS	J (+)/UJ (-) all analytes associated with IS outlier	19
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem, INC.
Environmental Data Quality

APPENDIX B
QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary
Irondale - Groundwaters

SDG	SAMPLE ID	LAB ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
OH58	MW02-090109	09-1274-OH58D	Diesel Range Hydrocarbons	0.72	mg/L		J	9
OH58	MW02-090109-DUPE	09-1275-OH58E	Diesel Range Hydrocarbons		mg/L	U	UJ	9
OH58	MW02-090109	09-1274-OH58D	Iron	1430	ug/l		J	9
OH58	MW02-090109-DUPE	09-1275-OH58E	Iron	710	ug/l		J	9
OH58	MW02-090109	09-1279-OH58I	Copper	12	ug/l		J	9
OH58	MW02-090109-DUPE	09-1280-OH58J	Copper	7	ug/l		J	9
OH58	MW04-090109	09-1271-OH58A	Naphthalene	0.012	ug/L	B	U	7
OH58	MW05-090109	09-1272-OH58B	Naphthalene	0.012	ug/L	B	U	7
OH58	MW03-090109	09-1273-OH58C	Naphthalene	0.010	ug/L	B	U	7
OH58	MW02-090109	09-1274-OH58D	Benzo(a)pyrene		ug/L	U	UJ	9
OH58	MW02-090109-DUPE	09-1275-OH58E	Benzo(a)pyrene	0.032	ug/L		J	9

EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

WASHINGTON DOE TOXICS CLEANUP PROGRAM
REMEDIAL INVESTIGATION FEASIBLITY STUDY
IRONDALE, WASHINGTON

Prepared for:

SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C4122-6

September 10, 2008

Approved for Release

Linda [illegible] for
Christine Ransom
Project Manager
EcoChem, INC.

INTRODUCTION

Basis for the Data Validation

This report summarizes the results of the summary (Level III) data validation performed on sediment, soil, tissue, and quality control (QC) sample data for the Washington Department of Ecology – Remedial Investigation Feasibility Study at Irondale, Washington. A complete list of samples is provided in the **Sample Index**. Analytical Resources, Inc., Tukwila, Washington performed all analyses. The analytical methods and EcoChem project chemists are listed below.

Analysis	Method of Analysis	Primary Review	Secondary Review
Diesel and Residual Range Hydrocarbons	NWTPH-Dx	Mark Brindle	Christine Ransom
Metals	SW6010B & EPA 200.8	Linda Holz	
Arsenic Speciation	EPA 6800		
Total Solids	E160.3		

The data validation is based on QC criteria documented in the above listed methods, the *Quality Assurance Project Plan (QAPP) - Investigation/Feasibility Study, Irondale, Washington (2007)*; and *USEPA National Functional Guidelines for Organic* (1999) *and Inorganic (2004) Data Review*.

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

Data qualifier definitions, reason codes, and validation criteria are included as **Appendix A**. **Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem.

SAMPLE INDEX
SAIC - Irondale

SDG	Sample ID	Laboratory ID	TPH-Dx	Metals	Arsenic Speciation	Total Solids
MZ93	TP22-ASP-080606-3	08-12045-MZ93A			✓	
MZ93	TP03-ASP-080606-2	08-12046-MZ93B			✓	
MZ93	TP32-ASP-080606-3	08-12047-MZ93C			✓	
MZ93	TP08-ASP-080606-4	08-12048-MZ93D			✓	
MZ93	TP12-BA-080605-2	08-12049-MZ93E		✓		✓
MZ93	TP18-BA-080605-2	08-12050-MZ93F		✓		✓
MZ93	GEI-SS1-BA-080605-1	08-12051-MZ93G		✓		✓
MZ93	TP10-BA-080605-1	08-12052-MZ93H		✓		✓
MZ93	TP41-BA-080605-2	08-12053-MZ93I		✓		✓
MZ93	TP42-BA-080605-2.5	08-12054-MZ93J		✓		✓
MZ93	DP01-BA-080605-4	08-12055-MZ93K		✓		✓
MZ93	DP06-BA-080605-1	08-12056-MZ93L		✓		✓
MZ93	TP02-BA-080605-2.5	08-12057-MZ93M		✓		✓
MZ93	TP38-BA-080605-2	08-12058-MZ93N		✓		✓
MZ93	TP40-BA-080605-1	08-12059-MZ93O		✓		✓
MZ93	TP40-CP-080605	08-12060-MZ93P		✓		✓
MZ93	TP40-CS-080605	08-12061-MZ93Q		✓		✓
MZ93	TP15-CS-080606-2	08-12062-MZ93R	✓			
MZ93	TP22-BS-080606-3	08-12063-MZ93S		✓		✓
MZ93	TP03-BS-080606-2	08-12064-MZ93T		✓		✓
MZ93	TP03-CP-080606	08-12065-MZ93U		✓		✓
MZ93	TP03-CS-080606	08-12066-MZ93V		✓		✓
MZ93	TP32-BA-080606-3	08-12067-MZ93W		✓		✓
MZ93	TP32-CP-080606	08-12068-MZ93X		✓		✓
MZ93	TP32-CS-080606	08-12069-MZ93Y		✓		✓
MZ93	TP24-BA-080606-3	08-12070-MZ93Z	✓			
MZ93	TP11-BA-080606-3	08-12071-MZ93AA	✓			
MZ93	TP08-BA-080606-4	08-12072-MZ93AB		✓		✓
MZ93	TP23-BA-080606-2	08-12073-MZ93AC	✓			
NC19	CONTROL	08-13380-NC19A	✓			
NC19	TP-23	08-13381-NC19B	✓			
NC19	TP-11 100%	08-13382-NC19C	✓			
NC19	TP-11 50%	08-13383-NC19D	✓			
NC19	TP-11 25%	08-13384-NC19E	✓			
NC19	TP-11 12%	08-13385-NC19F	✓			
NC19	TP-11 6%	08-13386-NC19G	✓			
NC19	TP-11 3%	08-13387-NC19H	✓			
NC90	TP40-CP-080605	08-13811-NC90A				✓
NC90	TP03-CP-080606	08-13812-NC90B				✓
NC90	TP32-CP-080606	08-13813-NC90C				✓

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Diesel and Residual Range Hydrocarbons by Method NWTPH-Dx

This report documents the review of analytical data from the analyses of soil and sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
MZ93	4 Soil	Summary
NC19	8 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Receipt
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Blanks (Method)
Field Blanks
1 Surrogate Compounds
Matrix Spike/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Samples (LCS/LCSD)
Field Duplicates
Target Analyte List
1 Reporting Limits (MDL and MRL)
Compound Identification and Quantification
Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Receipt

SDG MZ93: The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received one of two sample coolers with a temperature outside the advisory control limits, at 8.2ºC. This temperature outlier did not impact data quality and no qualifiers were required.

Surrogate Compounds

SDG MZ93: The surrogate compound o-terphenyl was not recovered in Samples TP24-BA-080606-3 and TP11-BA-080606-3. Both samples were analyzed at 10x dilutions. No action was necessary.

SDG NC19: The surrogate compound o-terphenyl was not recovered in Samples TP-11 100% and TP-11 50%. These samples were analyzed at 20x and 50x dilutions, respectively. No action was necessary.

Reporting Limits

SDG MZ93: Samples TP24-BA-080606-3 and TP11-BA-080606-3 were analyzed at 10x dilution. The reporting limits were adjusted accordingly.

SDG NC19: Samples TP-11 100% (20x), TP-11 50% (50x), and TP-11 25% (20x) were analyzed at dilution. The reporting limits were adjusted accordingly.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD), and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the MS/MSD and LCS/LCSD relative percent difference values.

No data were qualified for any reason. All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxic Cleanup
Irondale RI/FS
Metals by Methods SW6010B, EPA 200.8 and Total Solids by Method 160.3

This report documents the review of analytical data from the analyses of soil and tissue samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington.

SDG	Number of Samples	Validation Level
MZ93	18 Soil and 3 Tissue	Summary
NC90	3 Tissue (Total Solids only)	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%). The following errors were found:

SDG MZ93: The lead result for Sample GEI-SS1-BA-080605-1 and the arsenic result for the laboratory control sample 08-12060-MZ93LCS were missing from the EDD. The results were added and no further action was taken.

III. TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

[1] Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
CRDL Standards
Laboratory Blanks
Field Blanks
[2] Laboratory Control Samples (LCS)
Matrix Spikes (MS)
[2] Laboratory Duplicates
Interference Check Samples
Field Duplicates
Serial Dilutions
Reported Results
Calculation Verification (Full validation only)

---

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preparation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. One cooler was received at the laboratory at a temperature outside of these limits, with a temperature of 8.2°C. This temperature outlier did not impact data quality and no action was taken.

Laboratory Control Samples

SDG MZ93: For the laboratory control sample (LCS) associated with the soil samples, the recovery for zinc (128%) was greater than the upper control limit of 120%. The associated samples were estimated (J-10) to indicate a potential high bias.

Laboratory Duplicates

SDG MZ93: The relative percent difference (RPD) for nickel (50.8%) was greater than the control limit of 35% for the soil samples. The associated nickel results were estimated (J-9).

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory RPD values indicated acceptable precision, except as previously noted. Accuracy was also acceptable as demonstrated by the matrix spike and LCS %R values, except as noted above.

Data were estimated based on LCS recovery and laboratory duplicate RPD outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
Arsenic Speciation by Method SW6800

This report documents the review of analytical data from the analyses of soil samples and the associated laboratory quality control (QC) samples. Applied Speciation and Consulting, LLC, Tukwila, Washington analyzed the samples.

SDG	Number of Samples	Validation Level
MZ93	4 Soil	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

The sample result summary forms stated incorrect units of ug/L. Samples were reported in mg/kg.

II. EDD TO HARDCOPY VERIFICATION

No EDDs were supplied. The results were entered into the database by EcoChem.

III. TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

Holding Times and Sample Preservation
Initial Calibration
2 Calibration Verification
1 Laboratory Blanks
Laboratory Control Samples
2 Matrix Spike/Matrix Spike Duplicates
Laboratory Duplicates
Reported Results
Calculation Verification (Full validation only)

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[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Calibration Verification

The calibration verifications for arsenic (V) were greater than the upper control limit of 110%. The associated results were estimated (J-5B) to indicate a possible high bias.

Laboratory Blanks

The laboratory analyzed for separate preparation blanks and averaged the results. The average value for arsenic (V) was greater than the method detection limit. In order to establish the effect on the sample data an action level was established at five times this value. All associated sample results were greater than the action level, therefore no qualification of data was necessary.

Matrix Spike/Matrix Spike Duplicates

The matrix spike/matrix spike duplicate (MS/MSD) recoveries for arsenic (III) were less than 10%. The laboratory stated that the nature of the sample matrix converted the arsenic (III) to arsenic (V). This was supported by the arsenic mass balance for the matrix spikes. Because the low recoveries were not due to problems with the sample preparation procedure, the arsenic (III) results were estimated (J/UJ-8) instead of being rejected.

Reported Results

Sample results were instrument blank corrected. The instrument blank results were less than the method reporting limit (MRL).

All sample results are reported in units of mg/kg on an “as received basis”.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. Accuracy was acceptable as demonstrated by the MS/MSD recovery values, with the exceptions previously noted. The MS/MSD and laboratory duplicate relative percent difference values indicated acceptable precision.

Data were estimated based on continuing calibration and MS/MSD recovery outliers.

All data, as qualified, are acceptable for use.

EcoChem, INC.
Environmental Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS
REASON CODES
AND CRITERIA TABLES

DATA QUALIFIER REASON CODES

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with “R” and “DNR” only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives
22	Elevated Detection Limit Due to Interference (i.e., laboratory, chemical and/or matrix)

DATA VALIDATION QUALIFIER CODES
National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification”.
NJ	The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X (EcoChem PJ)	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if $R^2 < 0.990$ J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 85% to 115%	Narrate if frequency not met. J(+)/UJ(-) if %R < 85% J(+) if %R >115%	5B
Method Blank	At least one per batch (≤10 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. Use PJ if only one %R outlier	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% (EcoChem PJ)	10

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. (EcoChem PJ)	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP EcoChem default: water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. (See TM-04)	11

DATA VALIDATION CRITERIA

Table No.: NFG-ICP
Revision No.: draft
Last Rev. Date: draft
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EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration Tissues: Frozen	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r > 0.995	J(+)/UJ(-) if r < 0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		(Refer to TM-02 for additional information)
			7

Reporting Limit Standard	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+) < 2x RL if %R <50% (< 30% Sb, Pb, Tl) J(+) < 2x RL, UJ(-) if %R 50-69% (30-49% Sb, Pb,Tl) J(+) < 2x RL if %R 130-180% (150-200% Sb, Pb, Tl) R(+) < 2x RL if %R > 180% (200% Sb, Pb, Tl)	14
Interference Check Samples (ICSA/ICSAB)	ICSAB %R 80 - 120% for all spiked elements | ICSA | < MDL for all unspiked elements except: K, Na	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R= 50 to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7

DATA VALIDATION CRITERIA

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spikes	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R > 125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R < 30% or J(+)/UJ(-) if Post Spike %R 75-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples >RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2x RL for solids) qualify all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample conc. > 50x MDL	J(+)/UJ(-) if %D >10% qualify all samples in batch	16
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

DATA VALIDATION CRITERIA

Table No.: NFG-ICPMS
Revision No.: Draft
Last Rev. Date: Draft
Page: 1 of 2

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Tune	Prior to ICAL monitoring compounds analyzed 5 times wih Std Dev. ≤ 5% mass calibration <0.1 amu from True Value Resolution < 0.9 AMU @ 10% peak height or <0.75 amu @ 5% peak height	Use Professional Judgment to evaluate tune J(+)/UJ(-) if tune criteria not met	5A
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r>0.995	J(+)/UJ(-) if r<0.995 (for multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Reporting Limit Standard (CRI)	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Co,Mn, Zn)	R(-),(+) < 2x RL if %R < 50% (< 30% Co,Mn, Zn) J(+) < 2x RL, UJ(-) if %R 50-69% (30%-49% Co,Mn, Zn) J(+) < 2x RL if %R 130%-180% (150%-200% Co,Mn, Zn) R(+) < 2x RL if %R > 180% (200% Co, Mn, Zn)	14
Interference Check Samples (ICSA/ICSAB)	Required by SW 6020, but not 200.8 ICSAB %R 80% - 120% for all spiked elements | ICSA | < IDL (MDL) for all unspiked elements	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R = 50% to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch Blank Spike: %R within 80%-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 75-125% for samples where results do not exceed 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% or J(+)/UJ(-) if Post Spike %R 75%-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, Spike parent sample at 2x the sample conc.	No qualifiers assigned based on this element	

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5 x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample values > 50x MDL	J(+)/UJ(-) if %D >10% All samples in batch	16
Internal Standards	Every sample SW6020: 60%-125% of cal blank IS 200.8: 30%-120% of cal blank IS	J (+)/UJ (-) all analytes associated with IS outlier	19
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Mercury Analysis by CVAA
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	28 days from date sampled Frozen tissues: HT extended to 6 months	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + 4 standards, one at RL r > 0.995	J(+)/UJ(-) if r<0.995	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	after each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Reporting Limit Standard (CRA)	conc at RL - analyzed beginning of run %R = 70-130%	R(-),(+)<2xRL if %R <50% J(+)<2x RL, UJ(-) if %R 50-69% J(+) <2x RL if %R 130-180% R(+)<2x RL if %R>180%	14
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 5% frequency 75-125% for samples less than 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% all samples in batch	8
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Mercury Analysis by CVAA
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5x RL: Water: Diff<RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9

EcoChem Validation Guidelines for Conventional Chemistry Analysis
(Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler Temperature 4°C ±2°C Preservation: Method Specific	Use Professional Judgment to qualify based to qualify for coole temp outliers J(+)/UJ(-) if preservation requirements not met	1
Holding Time	Method Specific	Professional Judgment J(+)/UJ(-) if holding time exceeded J(+)/R(-) if HT exceeded by > 3X	1
Initial Calibration	Method specific r>0.995	Use professional judgment J(+)/UJ(-) for r < 0.995	5A
Initial Calibration Verification (ICV)	Where applicable to method Independent source analyzed immediately after calibration %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5A
Continuing Cal Verification (CCV)	Where applicable to method Every ten samples, immed. following ICV/ICB and end of run %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5B

Initial and Continuing Cal Blanks (ICB/CCB)	Where applicable to method
	After each ICV and CCV every ten samples and end of run
	| blank| < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Method Blank	One per matrix per batch
	(not to exceed 20 samples)
	blank < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blk value, U(+) results < action level
		For (-) blk value, J(+)/UJ(-) results < action level
			7

Laboratory Control Sample	Waters: One per matrix per batch %R (80-120%)	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	Soils: One per matrix per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Matrix Spike	One per matrix per batch; 5% frequency 75-125% for samples less than 4 x spike level	J(+) if %R > 125% or < 75% UJ(-) if %R = 30-74% R(+/-) results < IDL if %R < 30%	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (may use RPD < 35%, Diff < 2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Conventional Chemistry Analysis
(Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff<RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9

EcoChem, INC.
Environmental Data Quality

APPENDIX B

QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary
Irondale

SDG	SAMPLE ID	LAB ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
MZ93	TP22-ASP-080606-3	08-12045-MZ93A	Arsenic, As(III) arsenite	0.023	mg/kg	U	UJ	8
MZ93	TP22-ASP-080606-3	08-12045-MZ93A	Arsenic, As(V) arsenate	1.00	mg/kg		J	5B
MZ93	TP03-ASP-080606-2	08-12046-MZ93B	Arsenic, As(III) arsenite	0.102	mg/kg	J	J	8
MZ93	TP03-ASP-080606-2	08-12046-MZ93B	Arsenic, As(V) arsenate	10.8	mg/kg		J	5B
MZ93	TP32-ASP-080606-3	08-12047-MZ93C	Arsenic, As(III) arsenite	0.053	mg/kg	J	J	8
MZ93	TP32-ASP-080606-3	08-12047-MZ93C	Arsenic, As(V) arsenate	31.0	mg/kg		J	5B
MZ93	TP08-ASP-080606-4	08-12048-MZ93D	Arsenic, As(III) arsenite	0.023	mg/kg	U	UJ	8
MZ93	TP08-ASP-080606-4	08-12048-MZ93D	Arsenic, As(V) arsenate	4.17	mg/kg		J	5B
MZ93	TP12-BA-080605-2	08-12049-MZ93E	Nickel	22	mg/kg		J	9
MZ93	TP12-BA-080605-2	08-12049-MZ93E	Zinc	33	mg/kg		J	10
MZ93	TP18-BA-080605-2	08-12050-MZ93F	Nickel	22	mg/kg		J	9
MZ93	TP18-BA-080605-2	08-12050-MZ93F	Zinc	39	mg/kg		J	10
MZ93	GEI-SS1-BA-080605-1	08-12051-MZ93G	Nickel	6	mg/kg		J	9
MZ93	GEI-SS1-BA-080605-1	08-12051-MZ93G	Zinc	55	mg/kg		J	10
MZ93	TP10-BA-080605-1	08-12052-MZ93H	Nickel	48	mg/kg		J	9
MZ93	TP10-BA-080605-1	08-12052-MZ93H	Zinc	29	mg/kg		J	10
MZ93	TP41-BA-080605-2	08-12053-MZ93I	Nickel	33	mg/kg		J	9
MZ93	TP41-BA-080605-2	08-12053-MZ93I	Zinc	48	mg/kg		J	10
MZ93	TP42-BA-080605-2.5	08-12054-MZ93J	Nickel	26	mg/kg		J	9
MZ93	TP42-BA-080605-2.5	08-12054-MZ93J	Zinc	63	mg/kg		J	10
MZ93	DP01-BA-080605-4	08-12055-MZ93K	Nickel	33	mg/kg		J	9
MZ93	DP01-BA-080605-4	08-12055-MZ93K	Zinc	86	mg/kg		J	10
MZ93	DP06-BA-080605-1	08-12056-MZ93L	Nickel	31	mg/kg		J	9
MZ93	DP06-BA-080605-1	08-12056-MZ93L	Zinc	106	mg/kg		J	10
MZ93	TP02-BA-080605-2.5	08-12057-MZ93M	Nickel	36	mg/kg		J	9
MZ93	TP02-BA-080605-2.5	08-12057-MZ93M	Zinc	42	mg/kg		J	10
MZ93	TP38-BA-080605-2	08-12058-MZ93N	Nickel	36	mg/kg		J	9
MZ93	TP38-BA-080605-2	08-12058-MZ93N	Zinc	79	mg/kg		J	10
MZ93	TP40-BA-080605-1	08-12059-MZ93O	Nickel	70	mg/kg		J	9
MZ93	TP40-BA-080605-1	08-12059-MZ93O	Zinc	90	mg/kg		J	10
MZ93	TP40-CS-080605	08-12061-MZ93Q	Nickel	90	mg/kg		J	9
MZ93	TP40-CS-080605	08-12061-MZ93Q	Zinc	80	mg/kg		J	10
MZ93	TP22-BS-080606-3	08-12063-MZ93S	Nickel	28	mg/kg		J	9
MZ93	TP22-BS-080606-3	08-12063-MZ93S	Zinc	32	mg/kg		J	10
MZ93	TP03-BS-080606-2	08-12064-MZ93T	Nickel	54	mg/kg		J	9
MZ93	TP03-BS-080606-2	08-12064-MZ93T	Zinc	1460	mg/kg		J	10
MZ93	TP03-CS-080606	08-12066-MZ93V	Nickel	60	mg/kg		J	9
MZ93	TP03-CS-080606	08-12066-MZ93V	Zinc	1820	mg/kg		J	10
MZ93	TP32-BA-080606-3	08-12067-MZ93W	Nickel	13	mg/kg		J	9
MZ93	TP32-BA-080606-3	08-12067-MZ93W	Zinc	84	mg/kg		J	10
MZ93	TP32-CS-080606	08-12069-MZ93Y	Nickel	19	mg/kg		J	9
MZ93	TP32-CS-080606	08-12069-MZ93Y	Zinc	81	mg/kg		J	10
MZ93	TP08-BA-080606-4	08-12072-MZ93AB	Nickel	31	mg/kg		J	9
MZ93	TP08-BA-080606-4	08-12072-MZ93AB	Zinc	45	mg/kg		J	10

EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

Washington Department of Ecology Toxics Cleanup Program
Remedial Investigation Feasiblity Study

Irondale, Washington

Prepared for:

SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

GeoEngineers, Inc.
600Stewart St. Suite 1700
Seattle, WA 98101

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C4122-2

September 14, 2007

Approved for Release

Christine Ransom
Project Manager
EcoChem, INC.

INTRODUCTION

Basis for the Data Validation

This report summarizes the results of the full (Level IV) and summary (Level III) data validation performed on sediment, slag, water, and quality control (QC) sample data for the Washington Department of Ecology – Remedial Investigation Feasibility Study at Irondale, Washington. A complete list of samples is provided in the **Sample Index**. Analytical Resources, Inc., Tukwila, Washington performed all analyses. The analytical methods and EcoChem project chemists are listed below.

Analysis	Method of Analysis	Primary Review	Secondary Review
Semivolatile Organic Compounds (SVOC)	EPA Method 8270D	Mark Brindle	Mark Lybeer
Semivolatile Organic Compounds (SVOC)	EPA Method 8270D-SIM	Mark Brindle	Mark Lybeer
Polycyclic Aromatic Hydrocarbons (PAH)	EPA Method 8270D-SIM	Mark Brindle	Mark Lybeer
Extractable Petroleum Hydrocarbons	WDOE-EPH	Mark Lybeer	Mark Brindle
Diesel and Residual Range Hydrocarbons	NWTPH-Dx	Mark Lybeer	Mark Brindle
Metals	SW6010B, EPA 200.8, and SW7470A	Jennifer Newkirk	Christine Ransom
Conventionals[1]	various	Jennifer Newkirk	Christine Ransom

The data validation is based on QC criteria documented in the above listed methods, the *Quality Assurance Project Plan (QAPP) - Investigation/Feasibility Study, Irondale, Washington (2007)*; and *USEPA National Functional Guidelines for Organic* (1999) *and Inorganic (2004) Data Review*. The QC criteria are summarized in **Appendix A.**

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

In order to differentiate between samples with identical IDs, the following: changes were made:

COC ID	Matrix	Amended ID
TP08-070621-6	Water	TPO8-070621-6
SW01-070629 (14:10)	Water	SW01DUP-070629

Data qualifier definitions and Data Validation Criteria Tables are included as **Appendix A**. **Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem.

SAMPLE INDEX
Irondale
8270 SVOC

SDG	SAMPLE ID	LAB ID	Method
LF91	SedRinsate-070629	07-13639-LF91A	PSDDA SW8270D
LF99	SED07-070628-0-4	07-13708-LF99A	PSDDA SW8270D
LF99	SED16-070628-0-4	07-13710-LF99C	PSDDA SW8270D
LF99	SED06-070628-0-4	07-13712-LF99E	PSDDA SW8270D
LF99	SED05-070628-0-4	07-13715-LF99H	PSDDA SW8270D
LF99	SED11-070628-0-4	07-13718-LF99K	PSDDA SW8270D
LF99	SED02-070628-0-4	07-13720-LF99M	PSDDA SW8270D
LF99	SED02-070628-4-18	07-13721-LF99N	PSDDA SW8270D
LF99	SED01-070628-0-4	07-13722-LF99O	PSDDA SW8270D
LF99	SED01-070628-4-24	07-13723-LF99P	PSDDA SW8270D
LF99	SED17-070629-0-4	07-13724-LF99Q	PSDDA SW8270D
LF99	SED09-070629-0-4	07-13726-LF99S	PSDDA SW8270D
LF99	SED03-070629-0-4	07-13728-LF99U	PSDDA SW8270D

SAMPLE INDEX
Irondale
8270 SIM

SDG	SAMPLE ID	LAB ID	Method
LF91	SedRinsate-070629	07-13639-LF91A	SW8270D SIM
LF99	SED07-070628-0-4	07-13708-LF99A	SW8270D SIM
LF99	SED16-070628-0-4	07-13710-LF99C	SW8270D SIM
LF99	SED06-070628-0-4	07-13712-LF99E	SW8270D SIM
LF99	SED05-070628-0-4	07-13715-LF99H	SW8270D SIM
LF99	SED11-070628-0-4	07-13718-LF99K	SW8270D SIM
LF99	SED02-070628-0-4	07-13720-LF99M	SW8270D SIM
LF99	SED02-070628-4-18	07-13721-LF99N	SW8270D SIM
LF99	SED01-070628-0-4	07-13722-LF99O	SW8270D SIM
LF99	SED01-070628-4-24	07-13723-LF99P	SW8270D SIM
LF99	SED17-070629-0-4	07-13724-LF99Q	SW8270D SIM
LF99	SED09-070629-0-4	07-13726-LF99S	SW8270D SIM
LF99	SED03-070629-0-4	07-13728-LF99U	SW8270D SIM

SAMPLE INDEX
Irondale
PAH SIM

SDG	SAMPLE ID	LAB ID	Method
LF60	DP02-070625-11	07-13372-LF60F	SW8270D SIM
LF60	DP02-070625-13	07-13373-LF60G	SW8270D SIM
LF60	DP01-070626-W	07-13375-LF60I	SW8270D SIM
LF60	DP07-070626-W	07-13376-LF60J	SW8270D SIM
LF60	DP05-070626-Rinsate	07-13380-LF60N	SW8270D SIM
LF60	DP03-070626-11	07-13383-LF60Q	SW8270D SIM
LF62	TP27-070625-5	07-13399-LF62D	SW8270D SIM
LF62	TP28-070625-5	07-13401-LF62F	SW8270D SIM
LF62	TP29-070625-7	07-13405-LF62J	SW8270D SIM
LF62	TP02-070625-2	07-13410-LF62O	SW8270D SIM
LF64	TP08-070621-4	07-13427-LF64K	SW8270D SIM
LF64	TP11-070621-2	07-13432-LF64P	SW8270D SIM
LF64	TP11-070621-4	07-13433-LF64Q	SW8270D SIM
LF64	TP11-070621-2Seep	07-13434-LF64R	SW8270D SIM
LF64	TP11-070621-6.5	07-13435-LF64S	SW8270D SIM
LF72	TP22-070626-2	07-13469-LF72N	SW8270D SIM
LF74	TP24-070622-2	07-13487-LF74M	SW8270D SIM
LF74	TP26-070622-6.5	07-13490-LF74P	SW8270D SIM
LF74	TP26-070622-7	07-13491-LF74Q	SW8270D SIM
LF88	MW03-070628	07-13573-LF88A	SW8270D SIM
LF88	MW05-070628	07-13574-LF88B	SW8270D SIM
LF88	MW04-070628	07-13575-LF88C	SW8270D SIM
LF88	MW02-070629	07-13576-LF88D	SW8270D SIM
LF88	MW03-070629	07-13577-LF88E	SW8270D SIM
LF98	TP04-070627-2	07-13704-LF98B	SW8270D SIM

SAMPLE INDEX
Irondale
EPH

SDG	SAMPLE ID	LAB ID	Method
LF64	TP11-070621-2	07-13432-LF64P	WDOE-EPH
LF74	TP26-070622-7	07-13491-LF74Q	WDOE-EPH
LF88	MW02-070629	07-13576-LF88D	WDOE-EPH
LF88	MW03-070629	07-13577-LF88E	WDOE-EPH

SAMPLE INDEX
Irondale
NWTPHDx

SDG	SAMPLE ID	LAB ID	Method
LF60	DP04-070625-7.5	07-13369-LF60C	NWTPD-Dx
LF60	DP04-070625-12	07-13370-LF60D	NWTPD-Dx
LF60	DP02-070625-11	07-13372-LF60F	NWTPD-Dx
LF60	DP02-070625-13	07-13373-LF60G	NWTPD-Dx
LF60	DP06-070625-7	07-13374-LF60H	NWTPD-Dx
LF60	DP01-070626-W	07-13375-LF60I	NWTPD-Dx
LF60	DP07-070626-W	07-13376-LF60J	NWTPD-Dx
LF60	DP05-070626-7	07-13378-LF60L	NWTPD-Dx
LF60	DP05-070626-Rinsate	07-13380-LF60N	NWTPD-Dx
LF60	DP03-070626-7	07-13382-LF60P	NWTPD-Dx
LF60	DP01-070626-5	07-13385-LF60S	NWTPD-Dx
LF60	DP01-070626-11	07-13386-LF60T	NWTPD-Dx
LF62	TP13-070625-8	07-13398-LF62C	NWTPD-Dx
LF62	TP27-070625-5	07-13399-LF62D	NWTPD-Dx
LF62	TP28-070625-3	07-13400-LF62E	NWTPD-Dx
LF62	TP28-070625-5	07-13401-LF62F	NWTPD-Dx
LF62	TP28-070625-6.5	07-13402-LF62G	NWTPD-Dx
LF62	TP29-070625-3	07-13403-LF62H	NWTPD-Dx
LF62	TP29-070625-6	07-13404-LF62I	NWTPD-Dx
LF62	TP29-070625-7	07-13405-LF62J	NWTPD-Dx
LF62	TP01-070625-2.5	07-13409-LF62N	NWTPD-Dx
LF62	TP02-070625-2	07-13410-LF62O	NWTPD-Dx
LF62	TP20-070625-2	07-13412-LF62Q	NWTPD-Dx
LF62	TP20-070625-6	07-13414-LF62S	NWTPD-Dx
LF64	TP15-070621-6.5	07-13419-LF64C	NWTPD-Dx
LF64	TP19-070621-7	07-13422-LF64F	NWTPD-Dx
LF64	TP06-070621-2	07-13423-LF64G	NWTPD-Dx
LF64	TP06-070621-4	07-13424-LF64H	NWTPD-Dx
LF64	TP06-070621-6.5	07-13425-LF64I	NWTPD-Dx
LF64	TP08-070621-1.5	07-13426-LF64J	NWTPD-Dx
LF64	TP08-070621-4	07-13427-LF64K	NWTPD-Dx
LF64	TP08-070621-6	07-13428-LF64L	NWTPD-Dx
LF64	TP07-070621-2	07-13429-LF64M	NWTPD-Dx
LF64	TP07-070621-4	07-13430-LF64N	NWTPD-Dx
LF64	TP07-070621-6.5	07-13431-LF64O	NWTPD-Dx
LF64	TP11-070621-2	07-13432-LF64P	NWTPD-Dx
LF64	TP11-070621-4	07-13433-LF64Q	NWTPD-Dx
LF64	TP11-070621-2Seep	07-13434-LF64R	NWTPD-Dx
LF64	TP11-070621-6.5	07-13435-LF64S	NWTPD-Dx
LF72	TP14-070626-8	07-13459-LF72D	NWTPD-Dx
LF72	TP18-070626-8	07-13463-LF72H	NWTPD-Dx
LF72	TP17-070626-2	07-13464-LF72I	NWTPD-Dx
LF72	TP22-070626-2	07-13469-LF72N	NWTPD-Dx
LF72	TP30-070626-3.5	07-13470-LF72O	NWTPD-Dx
LF74	TP09-070622-2	07-13475-LF74A	NWTPD-Dx
LF74	TP09-070622-4	07-13476-LF74B	NWTPD-Dx
LF74	TP09-070622-8	07-13478-LF74D	NWTPD-Dx
LF74	TP23-070622-7	07-13486-LF74L	NWTPD-Dx

SAMPLE INDEX
Irondale
NWTPHDx

SDG	SAMPLE ID	LAB ID	Method
LF74	TP24-070622-2	07-13487-LF74M	NWTPD-Dx
LF74	TP26-070622-2	07-13488-LF74N	NWTPD-Dx
LF74	TP26-070622-4	07-13489-LF74O	NWTPD-Dx
LF74	TP26-070622-6.5	07-13490-LF74P	NWTPD-Dx
LF74	TP26-070622-7	07-13491-LF74Q	NWTPD-Dx
LF74	TP12-070622-7	07-13495-LF74U	NWTPD-Dx
LF74	TP16-070622-7	07-13499-LF74Y	NWTPD-Dx
LF88	MW03-070628	07-13573-LF88A	NWTPD-Dx
LF88	MW05-070628	07-13574-LF88B	NWTPD-Dx
LF88	MW04-070628	07-13575-LF88C	NWTPD-Dx
LF88	MW02-070629	07-13576-LF88D	NWTPD-Dx
LF88	MW03-070629	07-13577-LF88E	NWTPD-Dx
LF91	SedRinsate-070629	07-13639-LF91A	NWTPD-Dx
LF98	TP04-070627-2	07-13704-LF98B	NWTPD-Dx
LF98	TP05-070627-2	07-13706-LF98D	NWTPD-Dx
LF98	TP05-070627-4	07-13707-LF98E	NWTPD-Dx
LF99	SED07-070628-0-4	07-13708-LF99A	NWTPD-Dx
LF99	SED16-070628-0-4	07-13710-LF99C	NWTPD-Dx
LF99	SED06-070628-0-4	07-13712-LF99E	NWTPD-Dx
LF99	SED05-070628-0-4	07-13715-LF99H	NWTPD-Dx
LF99	SED11-070628-0-4	07-13718-LF99K	NWTPD-Dx
LF99	SED02-070628-0-4	07-13720-LF99M	NWTPD-Dx
LF99	SED02-070628-4-18	07-13721-LF99N	NWTPD-Dx
LF99	SED01-070628-0-4	07-13722-LF99O	NWTPD-Dx
LF99	SED01-070628-4-24	07-13723-LF99P	NWTPD-Dx
LF99	SED17-070629-0-4	07-13724-LF99Q	NWTPD-Dx
LF99	SED09-070629-0-4	07-13726-LF99S	NWTPD-Dx
LF99	SED03-070629-0-4	07-13728-LF99U	NWTPD-Dx

SAMPLE INDEX
Irondale
Metals 6010B

SDG	SAMPLE ID	LAB ID	Method
LF60	DP04-070625-7.5	07-13369-LF60C	SW6010B
LF60	DP01-070626-W	07-13375-LF60I	SW6010B
LF60	DP07-070626-W	07-13376-LF60J	SW6010B
LF60	DP05-070626-7	07-13378-LF60L	SW6010B
LF60	DP05-070626-Rinsate	07-13380-LF60N	SW6010B
LF60	DP03-070626-7	07-13382-LF60P	SW6010B
LF60	DP01-070626-5	07-13385-LF60S	SW6010B
LF62	TP13-070625-2.5	07-13396-LF62A	SW6010B
LF62	TP13-070625-5	07-13397-LF62B	SW6010B
LF62	TP13-070625-8	07-13398-LF62C	SW6010B
LF62	TP27-070625-5	07-13399-LF62D	SW6010B
LF62	TP28-070625-5	07-13401-LF62F	SW6010B
LF62	TP21-070625-2	07-13406-LF62K	SW6010B
LF62	TP21-070625-4	07-13407-LF62L	SW6010B
LF62	TP01-070625-1	07-13408-LF62M	SW6010B
LF62	TP01-070625-2.5	07-13409-LF62N	SW6010B
LF62	TP02-070625-2	07-13410-LF62O	SW6010B
LF62	TP02-070625-3	07-13411-LF62P	SW6010B
LF62	TP20-070625-2	07-13412-LF62Q	SW6010B
LF62	TP20-070625-4	07-13413-LF62R	SW6010B
LF62	TP20-070625-6	07-13414-LF62S	SW6010B
LF62	TP21-070625-4	07-13570-LF62U	SW6010B
LF64	TP15-070621-2	07-13417-LF64A	SW6010B
LF64	TP15-070621-4	07-13418-LF64B	SW6010B
LF64	TP15-070621-6.5	07-13419-LF64C	SW6010B
LF64	TP19-070621-2	07-13420-LF64D	SW6010B
LF64	TP19-070621-5.5	07-13421-LF64E	SW6010B
LF64	TP19-070621-7	07-13422-LF64F	SW6010B
LF64	TP06-070621-2	07-13423-LF64G	SW6010B
LF64	TP06-070621-4	07-13424-LF64H	SW6010B
LF64	TP06-070621-6.5	07-13425-LF64I	SW6010B
LF64	TP08-070621-1.5	07-13426-LF64J	SW6010B
LF64	TP08-070621-4	07-13427-LF64K	SW6010B
LF64	TP08-070621-6	07-13428-LF64L	SW6010B
LF64	TP07-070621-2	07-13429-LF64M	SW6010B
LF64	TP07-070621-4	07-13430-LF64N	SW6010B
LF64	TP07-070621-6.5	07-13431-LF64O	SW6010B
LF64	TP11-070621-2	07-13432-LF64P	SW6010B
LF64	TP11-070621-6.5	07-13435-LF64S	SW6010B
LF64	TPO8-070621-6	07-13735-LF64U	SW6010B
LF72	TP14-070626-2	07-13456-LF72A	SW6010B
LF72	TP14-070626-6	07-13458-LF72C	SW6010B
LF72	TP14-070626-8	07-13459-LF72D	SW6010B
LF72	TP18-070626-1.5	07-13460-LF72E	SW6010B
LF72	TP18-070626-3	07-13461-LF72F	SW6010B
LF72	TP18-070626-8	07-13463-LF72H	SW6010B
LF72	TP17-070626-2	07-13464-LF72I	SW6010B
LF72	TP17-070626-6	07-13466-LF72K	SW6010B

SAMPLE INDEX
Irondale
Metals 6010B

SDG	SAMPLE ID	LAB ID	Method
LF72	TP17-070626-8	07-13467-LF72L	SW6010B
LF72	TP22-070626-2	07-13469-LF72N	SW6010B
LF72	TP30-070626-3.5	07-13470-LF72O	SW6010B
LF72	TP03-070626-1	07-13471-LF72P	SW6010B
LF72	TP03-070626-2	07-13472-LF72Q	SW6010B
LF74	TP09-070622-2	07-13475-LF74A	SW6010B
LF74	TP09-070622-4	07-13476-LF74B	SW6010B
LF74	TP09-070622-8	07-13478-LF74D	SW6010B
LF74	TP10-070622-2	07-13479-LF74E	SW6010B
LF74	TP10-070622-6	07-13481-LF74G	SW6010B
LF74	TP10-070622-7.5	07-13482-LF74H	SW6010B
LF74	TP23-070622-1/2	07-13483-LF74I	SW6010B
LF74	TP23-070622-2	07-13484-LF74J	SW6010B
LF74	TP23-070622-7	07-13486-LF74L	SW6010B
LF74	TP24-070622-2	07-13487-LF74M	SW6010B
LF74	TP26-070622-2	07-13488-LF74N	SW6010B
LF74	TP26-070622-6.5	07-13490-LF74P	SW6010B
LF74	TP12-070622-1.5	07-13493-LF74S	SW6010B
LF74	TP12-070622-3	07-13494-LF74T	SW6010B
LF74	TP12-070622-7	07-13495-LF74U	SW6010B
LF74	TP16-070622-2	07-13496-LF74V	SW6010B
LF74	TP16-070622-4	07-13497-LF74W	SW6010B
LF74	TP16-070622-7	07-13499-LF74Y	SW6010B
LF88	MW03-070628	07-13573-LF88A	SW6010B
LF88	MW05-070628	07-13574-LF88B	SW6010B
LF88	MW04-070628	07-13575-LF88C	SW6010B
LF88	MW02-070629	07-13576-LF88D	SW6010B
LF88	MW03-070629	07-13577-LF88E	SW6010B
LF88	SW02-070629	07-13578-LF88F	SW6010B
LF88	SW01-070629	07-13579-LF88G	SW6010B
LF88	MW03-070628	07-13581-LF88I	SW6010B
LF88	MW05-070628	07-13582-LF88J	SW6010B
LF88	MW04-070628	07-13583-LF88K	SW6010B
LF88	MW02-070629	07-13584-LF88L	SW6010B
LF88	MW03-070629	07-13585-LF88M	SW6010B
LF88	SW02-070629	07-13586-LF88N	SW6010B
LF88	SW01-070629	07-13587-LF88O	SW6010B
LF91	SedRinsate-070629	07-13639-LF91A	SW6010B
LF98	TP04-070627-2	07-13704-LF98B	SW6010B
LF98	TP04-070627-4	07-13705-LF98C	SW6010B
LF98	TP05-070627-2	07-13706-LF98D	SW6010B
LF98	TP05-070627-4	07-13707-LF98E	SW6010B
LF99	SED07-070628-0-4	07-13708-LF99A	SW6010B
LF99	SED16-070628-0-4	07-13710-LF99C	SW6010B
LF99	SED06-070628-0-4	07-13712-LF99E	SW6010B
LF99	SED05-070628-0-4	07-13715-LF99H	SW6010B
LF99	SED11-070628-0-4	07-13718-LF99K	SW6010B
LF99	SED02-070628-0-4	07-13720-LF99M	SW6010B

SAMPLE INDEX
Irondale
Metals 6010B

SDG	SAMPLE ID	LAB ID	Method
LF99	SED02-070628-4-18	07-13721-LF99N	SW6010B
LF99	SED01-070628-0-4	07-13722-LF99O	SW6010B
LF99	SED01-070628-4-24	07-13723-LF99P	SW6010B
LF99	SED17-070629-0-4	07-13724-LF99Q	SW6010B
LF99	SED09-070629-0-4	07-13726-LF99S	SW6010B
LF99	SED03-070629-0-4	07-13728-LF99U	SW6010B
LG26	SLAG1-070627	07-13848-LG26A	SW6010B
LG26	SLAG2-070627	07-13849-LG26B	SW6010B

SAMPLE INDEX
Irondale
Metals 200.8

SDG	SAMPLE ID	LAB ID	Method
LG93	MW03-070628	07-14212-LG93A	E200.8
LG93	MW05-070628	07-14213-LG93B	E200.8
LG93	MW04-070628	07-14214-LG93C	E200.8
LG93	MW02-070629	07-14215-LG93D	E200.8
LG93	MW03-070629	07-14216-LG93E	E200.8
LG93	SW02-070629	07-14217-LG93F	E200.8
LG93	SW01-070629	07-14218-LG93G	E200.8
LG93	SW01DUP-070629	07-14219-LG93H	E200.8
LG93	MW03-070628	07-14220-LG93I	E200.8
LG93	MW05-070628	07-14221-LG93J	E200.8
LG93	MW04-070628	07-14222-LG93K	E200.8
LG93	MW02-070629	07-14223-LG93L	E200.8
LG93	MW03-070629	07-14224-LG93M	E200.8
LG93	SW02-070629	07-14225-LG93N	E200.8
LG93	SW01-070629	07-14226-LG93O	E200.8
LG93	SW01DUP-070629	07-14227-LG93P	E200.8
LI46	DP01-070626-W	07-15035-LI46A	E200.8
LI46	DP07-070626-W	07-15036-LI46B	E200.8

SAMPLE INDEX
Irondale
Mercury

SDG	SAMPLE ID	LAB ID	Method
LF91	SedRinsate-070629	07-13639-LF91A	SW7470A
LF99	SED07-070628-0-4	07-13708-LF99A	SW7471A
LF99	SED16-070628-0-4	07-13710-LF99C	SW7471A
LF99	SED06-070628-0-4	07-13712-LF99E	SW7471A
LF99	SED05-070628-0-4	07-13715-LF99H	SW7471A
LF99	SED11-070628-0-4	07-13718-LF99K	SW7471A
LF99	SED02-070628-0-4	07-13720-LF99M	SW7471A
LF99	SED02-070628-4-18	07-13721-LF99N	SW7471A
LF99	SED01-070628-0-4	07-13722-LF99O	SW7471A
LF99	SED01-070628-4-24	07-13723-LF99P	SW7471A
LF99	SED17-070629-0-4	07-13724-LF99Q	SW7471A
LF99	SED09-070629-0-4	07-13726-LF99S	SW7471A
LF99	SED03-070629-0-4	07-13728-LF99U	SW7471A

SAMPLE INDEX
Irondale
Conventionals

SDG	SAMPLE ID	LAB ID	Method
LF99	SED07-070628-0-4	07-13708-LF99A	E160.4
LF99	SED16-070628-0-4	07-13710-LF99C	E160.4
LF99	SED06-070628-0-4	07-13712-LF99E	E160.4
LF99	SED05-070628-0-4	07-13715-LF99H	E160.4
LF99	SED11-070628-0-4	07-13718-LF99K	E160.4
LF99	SED02-070628-0-4	07-13720-LF99M	E160.4
LF99	SED02-070628-4-18	07-13721-LF99N	E160.4
LF99	SED01-070628-0-4	07-13722-LF99O	E160.4
LF99	SED01-070628-4-24	07-13723-LF99P	E160.4
LF99	SED17-070629-0-4	07-13724-LF99Q	E160.4
LF99	SED09-070629-0-4	07-13726-LF99S	E160.4
LF99	SED03-070629-0-4	07-13728-LF99U	E160.4
LF99	SED07-070628-0-4	07-13708-LF99A	E350.1
LF99	SED16-070628-0-4	07-13710-LF99C	E350.1
LF99	SED06-070628-0-4	07-13712-LF99E	E350.1
LF99	SED05-070628-0-4	07-13715-LF99H	E350.1
LF99	SED11-070628-0-4	07-13718-LF99K	E350.1
LF99	SED02-070628-0-4	07-13720-LF99M	E350.1
LF99	SED02-070628-4-18	07-13721-LF99N	E350.1
LF99	SED01-070628-0-4	07-13722-LF99O	E350.1
LF99	SED01-070628-4-24	07-13723-LF99P	E350.1
LF99	SED17-070629-0-4	07-13724-LF99Q	E350.1
LF99	SED09-070629-0-4	07-13726-LF99S	E350.1
LF99	SED03-070629-0-4	07-13728-LF99U	E350.1
LF99	SED07-070628-0-4	07-13708-LF99A	E376.2
LF99	SED16-070628-0-4	07-13710-LF99C	E376.2
LF99	SED06-070628-0-4	07-13712-LF99E	E376.2
LF99	SED05-070628-0-4	07-13715-LF99H	E376.2
LF99	SED11-070628-0-4	07-13718-LF99K	E376.2
LF99	SED02-070628-0-4	07-13720-LF99M	E376.2
LF99	SED02-070628-4-18	07-13721-LF99N	E376.2
LF99	SED01-070628-0-4	07-13722-LF99O	E376.2
LF99	SED01-070628-4-24	07-13723-LF99P	E376.2
LF99	SED17-070629-0-4	07-13724-LF99Q	E376.2
LF99	SED09-070629-0-4	07-13726-LF99S	E376.2
LF99	SED03-070629-0-4	07-13728-LF99U	E376.2
LF74	TP12-070622-1.5	07-13493-LF74S	Plumb,1981
LF99	SED07-070628-0-4	07-13708-LF99A	Plumb,1981
LF99	SED16-070628-0-4	07-13710-LF99C	Plumb,1981
LF99	SED06-070628-0-4	07-13712-LF99E	Plumb,1981
LF99	SED05-070628-0-4	07-13715-LF99H	Plumb,1981
LF99	SED11-070628-0-4	07-13718-LF99K	Plumb,1981
LF99	SED02-070628-0-4	07-13720-LF99M	Plumb,1981
LF99	SED02-070628-4-18	07-13721-LF99N	Plumb,1981
LF99	SED01-070628-0-4	07-13722-LF99O	Plumb,1981
LF99	SED01-070628-4-24	07-13723-LF99P	Plumb,1981
LF99	SED17-070629-0-4	07-13724-LF99Q	Plumb,1981
LF99	SED09-070629-0-4	07-13726-LF99S	Plumb,1981

SAMPLE INDEX
Irondale
Conventionals

SDG	SAMPLE ID	LAB ID	Method
LF99	SED03-070629-0-4	07-13728-LF99U	Plumb,1981
LK98	SED07-070628-0-4	07-16630-LK98A	PSEP
LK98	SED16-070628-0-4	07-16631-LK98B	PSEP
LK98	SED06-070628-0-4	07-16632-LK98C	PSEP
LK98	SED05-070628-0-4	07-16633-LK98D	PSEP
LK98	SED11-070628-0-4	07-16634-LK98E	PSEP
LK98	SED02-070628-0-4	07-16635-LK98F	PSEP
LK98	SED02-070628-4-18	07-16636-LK98G	PSEP
LK98	SED01-070628-0-4	07-16637-LK98H	PSEP
LK98	SED01-070628-4-24	07-16638-LK98I	PSEP
LK98	SED17-070629-0-4	07-16639-LK98J	PSEP
LK98	SED09-070629-0-4	07-16640-LK98K	PSEP
LK98	SED03-070629-0-4	07-16641-LK98L	PSEP

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
SVOC by EPA Method 8270D

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
LF91	1 Rinsate Blank	Summary
LF99	12 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

Holding Times and Sample Preservation
GC/MS Instrument Performance Check
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
1 Laboratory Blanks
1 Field Blanks
Surrogate Compounds
2 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Sample (LCS)
2 Internal Standards
Target Analyte List
Reporting Limits
Compound Identification (Full validation only)
Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Laboratory Blanks

To assess the impact of each blank contaminant on the reported sample results, an action level is established at five times the concentration detected in the blank (ten times for phthalates). If a contaminant is detected in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U). If the result is also less than the reporting limit, then the result is elevated to the reporting limit. No action is taken if the sample result is greater than the action level, or for non-detected results.

SDG LF91: A positive result for bis(2-ethylhexyl) phthalate was reported in the method blank. This analyte was not detected in the associated sample and no action was required.

Field Blanks

SDG LF91: Butyl benzyl phthalate was detected in the rinsate blank SedRinsate-070629. This compound was not detected in the associated samples. No qualifiers were required.

Matrix Spike/Matrix Spike Duplicate

SDG LF99: The matrix spike/matrix spike duplicate (MS/MSD) analyses were performed using Sample SED06-070628-0-4. Spiking compounds benzyl alcohol and benzoic acid were not recovered. These compounds were not detected in the parent sample; reporting limits were rejected (R-8).

Internal Standards

SDG LF99: The area of the internal standard chrysene-d12 was greater than the upper control limit in Sample SED02-070628-4-18. Results and reporting limits for all associated analytes were estimated (J/UJ-19) in this sample. The sample extract was diluted and reanalyzed to confirm that matrix interference caused the outlier. Only chrysene was reported from the dilution analysis. Both sets of results were reported. The results from the dilution analysis were qualified as do-not-report (DNR-11). The original results should be used instead.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, laboratory control sample, and MS/MSD percent recovery values, with the exceptions noted above. Precision was also acceptable as demonstrated by the MS/MSD RPD values.

Data were estimated based on internal standard outliers. Data were qualified as do-not-report (DNR) in order to report only one set of results for each sample. Data were rejected because of the failure to recovery MS/MSD spiking compounds.

Data that have been rejected or labeled DNR are not useable for any purpose.

All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
SVOC by EPA Method 8270D-SIM

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
LF91	1 Rinsate Blank	Summary
LF99	12 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

Holding Times & Sample Preservation
GC/MS Instrument Performance Check
1 Initial Calibration (ICAL)
2 Continuing Calibration (CCAL)
Laboratory Blanks
1 Field Blanks
Surrogate Compounds
1 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
2 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)
Internal Standards
Target Analyte List
Reporting Limits
Compound Identification (Full validation only)
Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Initial Calibration (ICAL)

All values for the relative response factor (RRF) were greater than the 0.05 minimum control limits, with the exception noted below. All values for percent relative standard deviation (%RSD) were within the 30% control limit.

SDG LF91: The RRF value for hexachlorobutadiene was less than the control limit in the 7/26/07 ICAL on Instrument NT2. This analyte was not detected in the associated rinsate blank and no action was required.

Continuing Calibration (CCAL)

All values for the RRF were greater than the 0.05 minimum control limits, with the exception noted below. All values for percent difference (%D) were within the ±25% control limits, with the exceptions noted below. Results and reporting limits in samples associated with outliers indicative of a low bias were qualified as estimated (J/UJ); positive results in samples associated with outliers indicative of a high bias were qualified as estimated (J). In cases of extreme bias, where the %D was greater than ±90%, positive results were estimated and reporting limits were rejected (R).

SDG LF91: The RRF value for hexachlorobutadiene was less than the control limit in the 7/26/07 13:52 CCAL. This analyte was not detected in the associated rinsate blank and no action was required.

SDG LF99: The %D value for benzyl alcohol was outside the ±25% control limit in the 7/19/07 11:54 CCAL. This analyte was not detected in the associated sediment samples and the reporting limits were qualified as estimated (UJ-5B).

Field Blanks

SDG LF91: Butyl benzyl phthalate was detected in the rinsate blank, SedRinsate-070629. This compound was not detected in the associated samples. No qualifiers were required.

Matrix Spike/Matrix Spike Duplicate

SDG LF91: No matrix spike/matrix spike duplicate (MS/MSD) analyses were performed with this SDG. Accuracy and precision were evaluated using the laboratory control sample/laboratory control sample duplicate (LCS/LCSD) set.

SDG LF99: The MS/MSD analyses were performed using Sample SED06-070628-0-4. The MS percent recovery (%R) value for 1,4-dichlorobenzene was less than the lower control limit of 50%, at 48%. The MSD and LCS %R values for 1,4-dichlorobenzene were within control limits and no action was required.

Laboratory Control Sample/Laboratory Control Sample Duplicate

SDG LF91: The relative percent difference (RPD) values for 1,4-dichlorobenzene, hexachlorobutadiene, benzyl alcohol, and 1,2-dichlorobenzene were greater than the control limit. These analytes were not detected in the associated rinsate blank and no action was required.

SDG LF99: The LCS %R value for 2,4-dimethylphenol was less than the lower control limit of 50%, at 39% in LCS-071207 (sediment). 2,4-Dimethylphenol was not detected in the associated sediment sample. All reporting limits were qualified as estimated (UJ-10).

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, LCS/LCSD, and MS/MSD %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the LCS/LCSD and MS/MSD RPD values, with the exceptions previously noted.

Data were estimated based on continuing calibration, %D, and LCS %R outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
Polycyclic Aromatic Hydrocarbons by EPA Method 8270D-SIM

This report documents the review of analytical data from the analyses of water and soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
LF60	3 Sediment, 2 Water, 1 Rinsate Blank	Summary
LF62	4 Sediment	Summary
LF64	5 Sediment	Summary
LF72	1 Sediment	Summary
LF74	3 Sediment	Full
LF88	5 Water	Summary
LF98	1 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Preservation
GC/MS Instrument Performance Check
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Laboratory Blanks
1 Field Blanks
1 Surrogate Compounds
Laboratory Control Sample (LCS)
1 Matrix Spike/Matrix Spike Duplicates (MS/MSD)
Internal Standards
2 Field Duplicates
Target Analyte List
Reporting Limits
2 Compound Identification (Full validation only)
1 Calculation Verification (Full validation only)

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[1] Quality control results are discussed below, but no data were qualified

[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Holding Times and Sample Preservation

SDG LF64: Sample TP11-070621-4 was re-extracted outside of the 14-day holding time criterion due to a low surrogate percent recovery (%R) value. Both sets of results were reported. It was determined that the resuls from the re-extraction should be used. These results were estimated J/UJ-1 due to the exceeded holding time.

Field Blanks

SDG LF60: Naphthalene was detected in the rinsate blank DP05-070626-Rinsate. This compound was not detected in any associated samples. No qualifiers were required.

Surrogate Compounds

SDG LF64: The %R value for 2-methylnaphthalene-d10 was less than the lower control limit of 43%, at 39% in Sample TP11-070621-4. The sample was re-extracted (47 days after collection) and reanalyzed at five times (5x) dilution. Both sets of results were reported in the hardcopy, however only the results of the re-extraction were included in the EDD. The results from the re-extraction should be used.

Matrix Spike/Matrix Spike Duplicate

SDG LF60: For the water samples, matrix spike/matrix spike duplicate (MS/MSD) analyses were performed using Sample DP07-070626-W. The MSD %R values for indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene were less than the lower control limit. The %R values for these analytes were within control limits in the MS and no action was required. The relative percent difference (RPD) values for eight of 19 analytes were outside the control limits. These analytes were not detected in the parent sample, therefore no qualification of data was necessary.

Field Duplicates

SDG LF88: One set of field duplicates was submitted: MW02-070629 and MW03-070629. The RPD values were less than 35%. For results greater than 5x the reporting limit (RL). For results less than 5x the RL, the difference between the sample and duplicate was less than the RL, with the exceptions of pyrene and chrysene. Results for these two analytes were estimated (J/UJ-9) in the samples listed above.

Compound Identification

SDG LF64: The laboratory flagged the acenaphthene result "M" in Sample TP11-070621-2 to indicate that the parameters for spectral match were low. This result was qualified as tentatively identified and estimated (NJ-21).

SDG LF88: The laboratory flagged the naphthalene and phenanthrene results "M" in Sample MW02-070629 to indicate that the parameters for spectral match were low. These results were qualified as tentatively identified and estimated (NJ-21).

SDG LF74: The laboratory flagged the following results "M" to indicate that the parameters for spectral match were low: Sample TP24-070622-2 (benzo(a)pyrene) and Sample TP26-070622-6.5 (acenaphthene, phenanthrene, benzo(a)pyrene). These results were qualified as tentatively identified and estimated (NJ-21).

The reported result for fluorene in Sample TP26-070622-7 exceeded the linear range of the initial calibration and was "E" flagged by the laboratory. The sample was diluted (5x) and reanalyzed. Both sets of results were reported. The fluorene result in the original analysis was labeled do-not-report (DNR-20). All results in the dilution analysis except fluorene were labeled do-not-report (DNR-11).

Calculation Verification

SDG LF74: Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, laboratory control sample/laboratory control sample duplicate (LCS/LCSD) and MS/MSD %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD values, except as previously noted.

Results were qualified as estimated based on surrogate %R and field precision outliers. Data were qualified as tentatively identified and estimated due to poor spectral match. Data were labeled do-not-report (DNR) in order to report only one set of results for each sample.

Data that have been labeled DNR should not be used.

All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
Extractable Petroleum Hydrocarbons by Method WDOE-EPH

This report documents the review of analytical data from the analyses of sediment, water, and associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
LF64	1 Sediment	Summary
LF74	1 Sediment	Full
LF88	2 Water	Summary

I DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

Holding Times & Sample Receipt
Initial Calibration (ICAL)
1 Continuing Calibration (CCAL)
Laboratory Blanks
Field Blanks
Surrogate Compounds
Laboratory Control Samples (LCS)
2 Matrix Spike and Matrix Spike Duplicate (MS/MSD)
1 Field Duplicates
Reporting Limits
Compound Identification (Full validation only)
1 Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified.***

[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Continuing Calibration (CCAL)

The percent difference (%D) values for the aromatic ranges (C_{12}-C_{16}), (C_{16}-C_{21}), and (C_{21}-C_{34}) were outside the control limit of ±20% in the CCAL analyzed on 7/13/07 at 18:13. There were no positive results for these ranges in the associated samples. As these %D values were indicative of potential high bias, the reporting limits were not affected and no action was taken.

Field Blanks

No field blanks were submitted.

Matrix Spike/Matrix Spike Duplicate

Matrix spike/matrix spike duplicate (MS/MSD) samples were analyzed at the proper frequency of one per matrix per batch. All percent recovery (%R) values and relative percent difference (RPD) values were within the laboratory acceptance limits, with the following exceptions:

SDG LF74: MS/MSD analyses were performed using Sample TP-26-070622-7. The %R values for the aliphatic (C_8-C_{10}) range were less than the control limits of 50%. The aliphatic (C_8-C_{10}) range result was estimated (J-8) in the parent sample.

Field Duplicates

SDG LF08: One set of field duplicates was submitted: MW02-070629 and MW03-070629. All precision criteria were met.

Calculation Verification

SDG LF74: The areas for the surrogates were not provided, therefore they could not be recalculated from the raw data. All other recalculations verified the results reported by the laboratory and no action was taken.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample, and MS/MSD %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the MS/MSD and field duplicate RPD values.

One result for C8-C10 aliphatics was estimated based on MS/MSD %R outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
Diesel and Residual Range Hydrocarbons by Method NWTPH-Dx

This report documents the review of analytical data from the analyses of sediment, water, and associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
LF60	9 Sediment, 2 Water & 1 Rinsate Blank	Summary
LF62	12 Sediment	Summary
LF64	15 Sediment	Summary
LF72	5 Sediment	Summary
LF74	11 Sediment	Full
LF88	5 Water	Summary
LF91	1 Rinsate Blank	Summary
LF98	3 Sediment	Summary
LF99	12 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Receipt
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
2 Laboratory Blanks
1 Field Blanks
2 Surrogate Compounds
Laboratory Control Samples (LCS/LCSD)
Matrix Spike/Matrix Spike Duplicates (MS/MSD)
1 Field Duplicates
Target Analyte List
Reporting Limits
1 Compound Identification (Full validation only)
1 Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified.***

[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Receipt

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C.

The QAPP-required holding time criterion for soil samples is 14 days from date of sampling to date of extraction. The QAPP-required holding time criterion for extracts is 40 days from extraction to analysis. All samples were extracted and analyzed within the holding time criteria.

SDG LF74: One of two sample coolers were received at the laboratory at a temperature less than the lower control limit, at 1.0 ºC. The temperature outlier did not impact data quality, therefore no action was taken.

Laboratory Blanks

In order to assess the impact of laboratory blank contamination on the reported sample results, action levels at five times the blank concentrations are established. If the concentrations in the associated field samples are less than the action levels, the results are qualified as not detected (U). If the results are also less than the reporting limit, the results are elevated to the reporting limit.

SDG LF60: A positive value for diesel range organics (DRO) was reported in the laboratory blank extracted on 7/3/07. Because of the potential blank contamination, the associated samples were re-extracted and reanalyzed. Although the method blank for the re-extraction was clean, the samples were re-extracted outside of the holding time period.

The original results should be reported and the re-extracted results should not be used. The diesel results in Samples DP02-070625-13 and DP01-070626-11 were qualified as not detected (U-7). All results from the re-extracted batch were labeled do-not-report (DNR-11).

Field Blanks

SDG LF60: One field blank, DP05-070626-Rinsate, was reported with this SDG. No positive results were reported in this blank.

SDG LF91: One field blank, SedRinsate-070629, was reported with this SDG. No positive results were reported in this blank.

Surrogates

SDG LF60: The percent recovery (%R) value for o-terphenyl was less than the control limit in Sample DP06-070625-7. The reporting limits for diesel and motor oil were estimated (UJ-13) to indicate a potential low bias.

The surrogate o-terphenyl was diluted out in Sample DP02-070625-11 (40x). No action was taken on this basis.

Field Duplicates

SDG LF88: One set of field duplicates was submitted: MW02-070629 and MW03-07-0629. There were positive results for both DRO and motor oil in Sample MW02-070629. These analytes were not detected in Sample MW03-070629. The differences between the positive results and the reporting limits (RL) were greater than the RL; the results for both samples were estimated (J/UJ-9).

Compound Identification

All samples in these SDGs were sulfuric acid/silica gel "cleaned" prior to analysis to reduce the effects of biogenic interference in the samples. Biogenic interference can elevate the motor oil chromatographic response, making the sample results to be biased high.

Calculation Verification

SDG LF74: Several recalculations were performed on this SDG. No calculation errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD), and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate relative percent difference values, with the exceptions previously noted.

Data were estimated because of surrogate %R and field precision outliers. Data were also qualified as not detected because of blank contamination.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
Metals by Methods SW6010B, EPA 200.8, and SW7470A

This report documents the review of analytical data from the analyses of sediment and water samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
LF26	2 Slag	Summary
LF60	4 Sediment, 2 Water, 1 Rinsate Blank	Summary
LF62	16 Sediment	Summary
LF64	17 Sediment & 1 Water	Summary
LF72	13 Sediment	Summary
LF74	18 Sediment	Full
LF88	16 Water	Summary
LF91	1 Rinsate Blank	Summary
LF98	4 Sediment	Summary
LG93	16 Water	Summary
LI46	2 Water	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

SDGs LG93 and LI46: These SDGs contain the results of the re-analysis of the water samples in SDGs LF88 and LF60. The samples were re-analyzed by ICP-MS in order to obtain lower detection limits for arsenic, lead, and nickel.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
CRDL Standards
ICP Interference Check Samples
ICP Serial Dilutions
ICPMS Internal Standards
Laboratory Blanks

1 Field Blanks
Laboratory Control Samples (LCS)
2 Matrix Spikes (MS)
2 Laboratory Duplicates
2 Field Duplicates
Target Analyte List
Reporting Limits
1 Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The majority of the coolers were received at the laboratory at temperatures outside of these limits, with temperatures ranging from 1.0° to 4.2°C. These temperature outliers did not impact data quality and no action was taken.

Field Blanks

SDG LF60: One field blank, DP05-070626-Rinsate Blank, was submitted with this SDG. Iron was detected in this blank at a level greater than the method detection limit (MDL). In order to establish the effect on the field samples, an action level of five times the blank concentration was established. All associated samples were greater than the action level and no qualification of data was necessary..

SDG LF91: One field blank, SedRinsate-070629, was submitted with this SDG. There were no positive results in the field blank.

Matrix Spike Samples

Matrix spike samples (MS) were analyzed at the proper frequency of one per 20 samples or one per batch; whichever was more frequent. The percent recovery (%R) values were within the control limits of 75%-125% with the exceptions noted below. For %R values greater than 125%, the associated positive results were estimated (J) to indicate a possible high bias. No action was taken for non-detects. For %R values less than 75%, the associated positive results and detection limits were qualified as estimated (J/UJ) to indicate a possible low bias.

SDG LF64: The MS %R values for copper (227%) and zinc (148%) were greater than the upper control limit of 125%. All associated results were estimated (J-8).

SDG LF72: The MS %R values for nickel (61%) was less than the lower control limit of 75%. All associated results were estimated (J-8) to indicate a potential low bias.

SDG LF26: The MS %R value for nickel (61%) was less than the lower control limit of 75%. All associated results were estimated (J-8) to indicate a potential low bias.

SDG LG93: The MS %R value for arsenic (140%) was greater than the upper control limit of 125%. All associated results were estimated (J-8) to indicate a potential high bias.

Laboratory Duplicates

Note that the relative percent difference (RPD) value is used to assess precision only if both sample results are greater than five times (5x) the reporting limit (RL) for a given analyte; otherwise the difference between the two results is used to evaluate precision. The RPD control limit is 20%. For results less than 5x the RL, the difference between the sample and duplicate must be less than 2x the RL for solid matrices and less than the RL for water matrices.

SDG LF64: The RPD values for copper, iron, nickel, and zinc were greater than the 20% control limit. Associated results were qualified as estimated (J/UJ-9).

SDG LF62: The RPD value for lead (143%) was greater than the 20% control limit. Associated results were qualified as estimated (J/UJ-9).

SDG LF72: The RPD value for nickel was greater than the 20% control limit. Associated results were qualified as estimated (J-9).

SDG LF74: The RPD value for lead was greater than the 20% control limit. Associated results were qualified as estimated (J/UJ-9).

SDG LF26: The RPD value for copper (33.6%) was greater than the 20% control limit. Associated results were qualified as estimated (J-9).

Field Duplicates

Note that the RPD value is used to assess precision **only** if both sample results are greater than 5x the RL for a given analyte; otherwise the difference between the two results is used to evaluate precision. For water matrices, the RPD control limit is 35% or the difference must be less than the RL. For solid matrices, the RPD control limit is 50% or the difference must be less than 2x the RL.

SDG LF88: Two sets of field duplicates were submitted with this SDG: MW02-070629 & MW03-070629 and SW02-070629 & SW01-070629. For samples MW02-070629 & MW03-070629, the RPD for total iron (53.9%) was greater than the control limit of 35% and the difference between results for total copper was greater than the RL. The total iron and copper results for these two samples were estimated (J-9).

For Samples SW02-070629 & SW01-070629, the RPD for total iron (61.5%) was greater than the control limit. The total iron results in both samples were estimated (J-9).

Calculation Verification

SDG LF64: The results for the water sample TPO8-070621-6 and the associated laboratory QC were reported in mg/L (ppm). The results in the EDD were changed to ug/L (ppb) in order to have consistent units for all water samples.

SDG LF74: Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

SDGs LG93 and LI46: The samples in these SDGs were analyzed by ICP-MS in order to obtain lower detection limits for arsenic, lead, and nickel. The original results for these analytes in SDGs LF60 and LF88 were qualified as do-not-report (DNR-11).

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory and field duplicate RPD values indicated acceptable precision, except as noted above. Accuracy was also acceptable, as demonstrated by the MS and laboratory control sample %R values, except as previously noted.

Data were estimated based on MS %R, laboratory duplicate RPD, and field duplicate RPD outliers.

Data were flagged as do-not-report (DNR) to indicate which result should be used from multiple reported results. Data flagged as DNR should not be used for any reason.

All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
Conventional Parameter Analyses

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
LF74	18 Sediment	Full
LF99	12 Sediment	Summary
LK98	12 Sediment (grain size only)	Summary

The analytical tests that were performed are summarized below:

Parameter	Method
Total Solids	160.3
Grain Size	PSEP 1986
Total Organic Carbon (TOC)	Plumb, 1981
Total Volatile Solids (TVS)	160.4
Ammonia as Nitrogen	350.1
Total Sulfides	376.2

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

SDG LK98: The EDD contained data for lab duplicates and triplicates for all grain size samples. Only the duplicate and triplicate associated with Sample SED07-070628-0-4 were included in the data package.

III. TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

2 Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
Laboratory Blanks
Laboratory Control Samples (LCS)
2 Matrix Spikes (MS)
2 Laboratory Replicates
1 Calculation Verification (Full data validation only)

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[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The majority of the coolers were received at the laboratory at temperatures outside of these limits, with temperatures ranging from 1.0° to 4.2°C. These temperature outliers did not impact data quality and no action was taken.

SDG LF99: All TVS analyses were performed after the 7 day holding time. Several samples were also analyzed for sulfide after the 7 day holding time. These results were estimated (J-1).

SDG LK98: Samples SED17-070629-0-4, SED09-070629-0-4, and SED03-070629-0-4 were stored frozen after TOC analysis. All grain size results for these samples were estimated (J/UJ-1).

Matrix Spikes

Matrix spike samples (MS) were analyzed at the proper frequency of one per 20 samples or one per batch; whichever was more frequent. The percent recovery (%R) values were within the control limits of 75%-125% with the exceptions noted below. For %R values greater than 125%, the associated positive results were estimated (J) to indicate a possible high bias. No action was taken for non-detects. For %R values less than 75%, the associated positive results and detection limits were qualified as estimated (J/UJ) to indicate a possible low bias.

SDG LF99: The MS %R value for total organic carbon (41.7%) was greater than the upper control limit of 125%. All associated results were estimated (J-8) to indicate a potential high bias.

Laboratory Replicates

Note that the relative percent difference (RPD) or percent relative standard deviation (%RSD) values are used to assess precision only if both sample results are greater than five times the reporting limit for a given analyte; otherwise the difference between the two results is used to evaluate precision. The RPD and %RSD control limits are 20%.

SDG LF99: The RPD values for TVS and TOC were greater than the 20% control limit. Associated results were qualified as estimated (J/UJ-9).

Calculation Verification

SDG LF74: Calculation verifications were performed on this SDG. No calculation errors were found.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory replicate RPD and %RSD values indicated acceptable precision, except as previously noted. Accuracy was also acceptable, as demonstrated by the MS and laboratory control sample %R values.

Data were estimated based on exceeded holding times, improper sample preservation, and laboratory replicate RPD and %RSD outliers.

All data, as qualified, are acceptable for use.

EcoChem, INC.
Environmental Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS AND VALIDATION CRITERIA

DATA VALIDATION QUALIFIER CODES
National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification”.
NJ	The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with “R” and “DNR” only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	Water: J(+)/UJ(-) if ext. > 7 and < 21 days J(+)/R(-) if ext > 21 days (EcoChem PJ) Solids/Wastes: J(+)/UJ(-) if ext. > 14 and < 42 days J(+)/R(-) if ext. > 42 days (EcoChem PJ) J(+)/UJ(-) if analysis >40 days	1
Tuning	DFTPP Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	(EcoChem PJ, see TM-06) J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	(EcoChem PJ, see TM-06) If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Field Blanks (Not Required)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS low conc. H2O SVOA	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS regular SVOA (H2O & solid)	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R <LCL J(+)/R(-) if %R < 10% (EcoChem PJ)	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Minimum of 3 acid and 3 base/neutral compounds Use method acceptance criteria	Do not qualify if only 1 acid and/or 1 B/N surrogate is out unless <10% J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10%	13
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT>30 seconds, narrate and Notify PM	19
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants See Technical Director for ID issues	4
Quantitation/ Identification	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	See Technical Director if outliers	14 21 (false +)

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Soils: 4°C ±2°C Waters: Nitric Acid to pH < 2 For Dissolved metals, 0.45um filter & preserve after filtration	Use Professional Judgment to qualify for cooler temperature outliers J(+)/UJ(-) if preservation requirements are not met	1
Holding Time	180 days from date sampled	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r>0.995	J(+)/UJ(-) if r<0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after Calibration %R within +/- 10% of true value	J(+)/UJ(-) if %R 75%-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within +/- 10% of true value	J(+)/UJ(-) if %R = 75%-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B
Reporting Limit Standard (CRQL)	2X RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+)<2X RL if %R <50% (< 30% Sb, Pb, Tl) J(+)<2X RL, UJ(-) if %R 50-69% (30%-49% Sb, Pb,Tl) J(+) <2X RL if %R 130%-180% (150%-200%Sb, Pb, Tl) R(+)<2X RL if %R>180% (200% Sb, Pb, Tl)	14

Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Method Blank	One per matrix per batch
	(batch not to exceed 20 samples)
	blank < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blk value, U(+) results < action level
		For (-) blk value, J(+)/UJ(-) results < action level
			7

Interference Check Sample (ICSA/ICSAB)	ICSAB %R 80% - 120% for all spiked elements | ICSA | < IDL (MDL) for all unspiked elements except: K, Na	For samples with Al,Ca,Fe, or Mg > ICS levels R(+/-) if %R<50% J(+) if %R >120% J(+)/UJ(-) if %R= 50% to 79% Use Professional Judgment for ICSA to dermine if bias is present see TM-09 for additional details	17

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Matrix Spike	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30%: UJ(-) if Post Spike %R 75%-125% all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (Diff <2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2X RL for solids) all samples in batch	9
Serial Dilution	5x dilution one per matrix %D <10% for values > 50x MDL	J(+)/UJ(-) if %D >10% all samples in batch	16
Laboratory Control Sample (LCS)	Water: One per batch %R (80-120%)	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	Soil: One per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff<RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Determined annually Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Metals Analysis by ICP/MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Soils: 4°C ±2°C Waters: Nitric Acid to pH < 2 For Dissolved metals, 0.45um filter & preserve after filtration	PJ - no qualifier for cooler temperature outliers J(+)/UJ(-) if preservation requirements are not met	1
Holding Time	180 days from date sampled	J(+)/UJ(-) if holding time exceeded	1
Tune	Prior to ICAL monitoring compounds analyzed 5 times wih Std Dev. ≤ 5% mass calibration <0.1 amu from True Value Resolution < 0.9 AMU @ 10% peak height or <0.75 amu @ 5% peak height	J(+)/UJ(-) if tune criteria not met	5A
Initial Calibration	Blank + minimum 1 standard once every 24 hours if more than 1 standard r>0.995	J(+)/UJ(-) if r<0.995 (for multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after Cal %R within +/- 10% of true value	J(+)/UJ(-) if %R 75%-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run +/- 10% of True value	J(+)/UJ(-) if %R 75%-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B
CRDL/Reporting Limit Standard (CRI)	2X CRDL (RL) analyzed beginning of run (some labs use RL as concentration) Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Co,Mn, Zn)	R(-),(+)<2X RL if %R <50% (< 30% Co,Mn, Zn) J(+)<2X RL, UJ(-) if %R 50-69% (30%-49% Co,Mn, Zn) J(+) <2X RL if %R 130%-180% (150%-200% Co,Mn, Zn) R(+)<2X RL if %R>180%(200% Co,Mn, Zn)	14

Initial and Continuing Calibration Blanks (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Method Blank	One per matrix per batch
	(batch not to exceed 20 samples)
	| blank | < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blk value, U(+) results < action level
		For (-) blk value, J(+)/UJ(-) results < action level
			7

Field Blanks	Associated with samples taken on same day	Action level is 5x blank conc. U(+) sample values < AL	6

EcoChem Validation Guidelines for Metals Analysis by ICP/MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Interference Check Sample (ICSA/ICSAB)	Required by SW 6020, but not 200.8 ICSAB +/- 20% of true value ICSA < +/- IDL	Where Al,Ca,Fe,Mg = ICS levels J(+) if %R >120% J(+)/UJ(-) if %R = 50% to 79% R(+/-) if %R<50% Professional Judgment for ICSA > +/- IDL see TM-09 for additional details	17
Post-digestion Spike	If Matrix Spike is outside 75-125% Spike parent sample at 2X the sample conc.	No qualifiers assigned based on this element	
Matrix Spike	One per matrix per batch 75-125% for samples where results do not exceed 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30%: UJ(-) if Post Spike %R 75%-125% all samples in batch	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (may use RPD < 35%, Diff < 2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9
Laboratory Control Sample (LCS)	Water: One per batch %R (80-120%)	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	Soil: One per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Serial Dilution	5x dilution one per matrix %D <10% for values > 50x MDL	J(+)/UJ(-) if %D >10%	16
Internal Standards	Every Sample SW6020: 60%-125% 200.8: 30%-120%	J (+)/UJ (-) all analytes associated with IS outlier	19
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff<RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Determined annually Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Mercury Analysis by CVAA
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Soils: 4°C ±2°C Waters: Nitric Acid to pH < 2 For Dissolved metals, 0.45um filter & preserve after filtration	PJ - no qualifier for cooler temperature outliers J(+)/UJ(-) if preservation requirements are not met	1
Holding Time	28 days from date sampled	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + 4 standards r > 0.995 once every 24 hours	J(+)/UJ(-) if r<0.995	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after Cal %R within +/- 20% of true value	R(+/-) if %R < 65% R(+) if %R > 135% J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within +/- 20% of true value	R(+/-) if %R < 65% R(+) if %R > 135% J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135%	5B
CRQL/Reporting Limit Standard (CRA)	@ CRQL/ RL - analyzed beginning of run %R = 70%-130%	R(-),(+)<2XRL if %R <50% J(+)<2X RL, UJ(-) if %R 50-69% J(+) <2X RL if %R 130%-180% R(+)<2X RL if %R>180%	14

Initial and Continuing Calibration Blanks (ICB/CCB)	after each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Method Blank	One per matrix per batch
	(batch not to exceed 20 samples)
	| blank | < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blk value, U(+) results < action level
		For (-) blk value, J(+)/UJ(-) results < action level
			7

Matrix Spike	One per matrix per batch 5% frequency 75-125% for samples less than 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% all samples in batch	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (may use RPD < 35%, Diff < 2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Mercury Analysis by CVAA
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Control Sample (LCS)	Water: One per batch %R (80-120%)	R(+/-) if %R < 50%; J(+) if %R >120% J(+)/UJ(-) if %R = 50-79%	10
	Soil: One per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff<RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9

DATA VALIDATION CRITERIA

Table No.: Eco-Conv
Revision No.: 0
Last Rev. Date: FINAL DRAFT

EcoChem Validation Guidelines for Conventional Chemistry Analysis
(Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	4°C ±2° Water: NaOH to pH > 12 (for CN)	J(+)/UJ(-) if preservation requirements not met EcoChem PJ	1
Holding Time	Method Specific	Professional Judgment J(+)/UJ(-) if holding time exceeded J(+)/R(-) if HT exceeded by > 3X	1
Initial Calibration	Method specific once every 24 hours One at CRDL r>0.995	Use professional judgment J(+)/UJ(-) for r < 0.995	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after cal. %R method specific	R(+/-) if %R sig < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R sig > UCL	5A
Continuing Cal Verification (CCV)	Every ten samples, immed. following ICV/ICB and end of run %R method specific	R(+/-) if %R sig < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R sig > UCL	5B
Initial and Continuing Cal Blanks (ICB/CCB)	After each ICV and CCV every ten samples and end of run blank < +/- IDL	For positive blk results: UJ(+) < 5X blk contamination For negative blk results: J(+)/UJ(-) < abs. value of 5X blk contamination	7
Prep Blank	One per matrix per batch (not to exceed 20 samples)	For positive blk results: UJ(+) < 5X blk contamination For negative blk results: J(+)/UJ(-) < abs. value of 5X blk contamination	7
Matrix Spike	One per matrix per batch; 5% frequency 75-125% for samples less than 4 x spike level	J(+) if %R > 125% or < 75% UJ(-) if %R = 30-74% R(+/-) results < IDL if %R < 30%	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x CRDL Diff < CRDL for samples >CRDL and <5 x CRDL (may use RPD < 35%, Diff < 2X CRDL for solids)	J(+)/UJ(-) in assoc samples if RPD > 20% or diff > CRDL	9
Laboratory Control Sample	Waters: One per matrix per batch %R (80-120%)	R(+/-) if MS/MSD & LCS %R outside limits J(+)/UJ(-) if %R = 50-79% J(+) if %R > 120% R(+/-) if %R < 50%	10
	Soils: One per matrix per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10

EcoChem Validation Guidelines for Conventional Chemistry Analysis
(Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blanks	taken on same day as samples	Action level is 5x blk conc. U(+) sample values < AL	6
Field Duplicates	Waters RPD < 35% Soils RPD < 50% for values > 5 x CRDL Diff < CRDL for samples >CRDL and <5 x CRDL (may use Diff < 2X CRDL for solids)	J(+)/UJ(-) in parent samples only	9

EcoChem, INC.
Environmental Data Quality

APPENDIX B

QUALIFIED DATA SUMMARY TABLE

QUALIFIED DATA SUMMARY TABLE
Irondale

SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LF60	DP04-070625-7.5	07-13369-LF60CRE	Diesel Range Hydrocarbons		mg/kg	U	DNR	11
LF60	DP04-070625-7.5	07-13369-LF60CRE	Motor Oil		mg/kg	U	DNR	11
LF60	DP04-070625-12	07-13370-LF60DRE	Diesel Range Hydrocarbons		mg/kg	U	DNR	11
LF60	DP04-070625-12	07-13370-LF60DRE	Motor Oil		mg/kg	U	DNR	11
LF60	DP02-070625-11	07-13372-LF60FRE	Diesel Range Hydrocarbons	4800	mg/kg		DNR	11
LF60	DP02-070625-11	07-13372-LF60FRE	Motor Oil	4600	mg/kg		DNR	11
LF60	DP02-070625-13	07-13373-LF60G	Diesel Range Hydrocarbons	12	mg/kg		U	7
LF60	DP02-070625-13	07-13373-LF60GRE	Diesel Range Hydrocarbons		mg/kg	U	DNR	11
LF60	DP02-070625-13	07-13373-LF60GRE	Motor Oil	23	mg/kg		DNR	11
LF60	DP06-070625-7	07-13374-LF60H	Diesel Range Hydrocarbons		mg/kg	U	UJ	13
LF60	DP06-070625-7	07-13374-LF60H	Motor Oil		mg/kg	U	UJ	13
LF60	DP06-070625-7	07-13374-LF60HRE	Diesel Range Hydrocarbons		mg/kg	U	DNR	11
LF60	DP06-070625-7	07-13374-LF60HRE	Motor Oil		mg/kg	U	DNR	11
LF60	DP01-070626-W	07-13375-LF60I	Arsenic		ug/l	U	DNR	11
LF60	DP01-070626-W	07-13375-LF60I	Lead		ug/l	U	DNR	11
LF60	DP07-070626-W	07-13376-LF60J	Arsenic		ug/l	U	DNR	11
LF60	DP05-070626-7	07-13378-LF60LRE	Diesel Range Hydrocarbons		mg/kg	U	DNR	11
LF60	DP05-070626-7	07-13378-LF60LRE	Motor Oil		mg/kg	U	DNR	11
LF60	DP03-070626-7	07-13382-LF60PRE	Diesel Range Hydrocarbons		mg/kg	U	DNR	11
LF60	DP03-070626-7	07-13382-LF60PRE	Motor Oil		mg/kg	U	DNR	11
LF60	DP01-070626-5	07-13385-LF60SRE	Diesel Range Hydrocarbons		mg/kg	U	DNR	11
LF60	DP01-070626-11	07-13386-LF60T	Diesel Range Hydrocarbons	8.0	mg/kg		U	7
LF60	DP01-070626-11	07-13386-LF60TRE	Diesel Range Hydrocarbons		mg/kg	U	DNR	11
LF60	DP01-070626-11	07-13386-LF60TRE	Motor Oil		mg/kg	U	DNR	11
LF60	DP01-070626-5	07-14846-LF60SRE	Motor Oil		mg/kg	U	DNR	11
LF62	TP13-070625-2.5	07-13396-LF62A	Lead		mg/kg	U	UJ	9
LF62	TP13-070625-5	07-13397-LF62B	Lead		mg/kg	U	UJ	9
LF62	TP13-070625-8	07-13398-LF62C	Lead		mg/kg	U	UJ	9
LF62	TP27-070625-5	07-13399-LF62D	Lead	3	mg/kg		J	9
LF62	TP28-070625-5	07-13401-LF62F	Lead	4	mg/kg		J	9
LF62	TP21-070625-2	07-13406-LF62K	Lead	31	mg/kg		J	9
LF62	TP21-070625-4	07-13407-LF62L	Lead	33	mg/kg		J	9
LF62	TP01-070625-1	07-13408-LF62M	Lead	7	mg/kg		J	9
LF62	TP01-070625-2.5	07-13409-LF62N	Lead		mg/kg	U	UJ	9
LF62	TP02-070625-2	07-13410-LF62O	Lead	130	mg/kg		J	9
LF62	TP02-070625-3	07-13411-LF62P	Lead	3	mg/kg		J	9
LF62	TP20-070625-2	07-13412-LF62Q	Lead	4	mg/kg		J	9
LF62	TP20-070625-4	07-13413-LF62R	Lead		mg/kg	U	UJ	9
LF62	TP20-070625-6	07-13414-LF62S	Lead		mg/kg	U	UJ	9
LF64	TP15-070621-2	07-13417-LF64A	Copper	5.6	mg/kg		J	8,9

QUALIFIED DATA SUMMARY TABLE
Irondale

SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LF64	TP15-070621-2	07-13417-LF64A	Iron	9930	mg/kg		J	9
LF64	TP15-070621-2	07-13417-LF64A	Nickel	19	mg/kg		J	9
LF64	TP15-070621-2	07-13417-LF64A	Zinc	18	mg/kg		J	8,9
LF64	TP15-070621-4	07-13418-LF64B	Copper	5.0	mg/kg		J	8,9
LF64	TP15-070621-4	07-13418-LF64B	Iron	10100	mg/kg		J	9
LF64	TP15-070621-4	07-13418-LF64B	Nickel	21	mg/kg		J	9
LF64	TP15-070621-4	07-13418-LF64B	Zinc	19	mg/kg		J	8,9
LF64	TP15-070621-6.5	07-13419-LF64C	Copper	5.2	mg/kg		J	8,9
LF64	TP15-070621-6.5	07-13419-LF64C	Iron	9070	mg/kg		J	9
LF64	TP15-070621-6.5	07-13419-LF64C	Nickel	26	mg/kg		J	9
LF64	TP15-070621-6.5	07-13419-LF64C	Zinc	18	mg/kg		J	8,9
LF64	TP19-070621-2	07-13420-LF64D	Copper	9.3	mg/kg		J	8,9
LF64	TP19-070621-2	07-13420-LF64D	Iron	12800	mg/kg		J	9
LF64	TP19-070621-2	07-13420-LF64D	Nickel	23	mg/kg		J	9
LF64	TP19-070621-2	07-13420-LF64D	Zinc	20	mg/kg		J	8,9
LF64	TP19-070621-5.5	07-13421-LF64E	Copper	4.9	mg/kg		J	8,9
LF64	TP19-070621-5.5	07-13421-LF64E	Iron	9130	mg/kg		J	9
LF64	TP19-070621-5.5	07-13421-LF64E	Nickel	19	mg/kg		J	9
LF64	TP19-070621-5.5	07-13421-LF64E	Zinc	18	mg/kg		J	8,9
LF64	TP19-070621-7	07-13422-LF64F	Copper	6.1	mg/kg		J	8,9
LF64	TP19-070621-7	07-13422-LF64F	Iron	10600	mg/kg		J	9
LF64	TP19-070621-7	07-13422-LF64F	Nickel	25	mg/kg		J	9
LF64	TP19-070621-7	07-13422-LF64F	Zinc	21	mg/kg		J	8,9
LF64	TP06-070621-2	07-13423-LF64G	Copper	14.9	mg/kg		J	8,9
LF64	TP06-070621-2	07-13423-LF64G	Iron	18100	mg/kg		J	9
LF64	TP06-070621-2	07-13423-LF64G	Nickel	43	mg/kg		J	9
LF64	TP06-070621-2	07-13423-LF64G	Zinc	29	mg/kg		J	8,9
LF64	TP06-070621-4	07-13424-LF64H	Copper	10.6	mg/kg		J	8,9
LF64	TP06-070621-4	07-13424-LF64H	Iron	13100	mg/kg		J	9
LF64	TP06-070621-4	07-13424-LF64H	Nickel	32	mg/kg		J	9
LF64	TP06-070621-4	07-13424-LF64H	Zinc	26	mg/kg		J	8,9
LF64	TP06-070621-6.5	07-13425-LF64I	Copper	10.8	mg/kg		J	8,9
LF64	TP06-070621-6.5	07-13425-LF64I	Iron	14100	mg/kg		J	9
LF64	TP06-070621-6.5	07-13425-LF64I	Nickel	47	mg/kg		J	9
LF64	TP06-070621-6.5	07-13425-LF64I	Zinc	33	mg/kg		J	8,9
LF64	TP08-070621-1.5	07-13426-LF64J	Copper	137	mg/kg		J	8,9
LF64	TP08-070621-1.5	07-13426-LF64J	Iron	39800	mg/kg		J	9
LF64	TP08-070621-1.5	07-13426-LF64J	Nickel	42	mg/kg		J	9
LF64	TP08-070621-1.5	07-13426-LF64J	Zinc	68	mg/kg		J	8,9
LF64	TP08-070621-4	07-13427-LF64K	Copper	95	mg/kg		J	8,9
LF64	TP08-070621-4	07-13427-LF64K	Iron	143000	mg/kg		J	9
LF64	TP08-070621-4	07-13427-LF64K	Nickel	28	mg/kg		J	9
LF64	TP08-070621-4	07-13427-LF64K	Zinc	44	mg/kg		J	8,9
LF64	TP08-070621-6	07-13428-LF64L	Copper	1640	mg/kg		J	8,9
LF64	TP08-070621-6	07-13428-LF64L	Iron	171000	mg/kg		J	9
LF64	TP08-070621-6	07-13428-LF64L	Nickel		mg/kg	U	UJ	9
LF64	TP08-070621-6	07-13428-LF64L	Zinc	110	mg/kg		J	8,9
LF64	TP07-070621-2	07-13429-LF64M	Copper	18.5	mg/kg		J	8,9
LF64	TP07-070621-2	07-13429-LF64M	Iron	20100	mg/kg		J	9
LF64	TP07-070621-2	07-13429-LF64M	Nickel	36	mg/kg		J	9
LF64	TP07-070621-2	07-13429-LF64M	Zinc	28	mg/kg		J	8,9
LF64	TP07-070621-4	07-13430-LF64N	Copper	21.7	mg/kg		J	8,9

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SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LF64	TP07-070621-4	07-13430-LF64N	Iron	14600	mg/kg		J	9
LF64	TP07-070621-4	07-13430-LF64N	Nickel	38	mg/kg		J	9
LF64	TP07-070621-4	07-13430-LF64N	Zinc	30	mg/kg		J	8,9
LF64	TP07-070621-6.5	07-13431-LF64O	Copper	11.2	mg/kg		J	8,9
LF64	TP07-070621-6.5	07-13431-LF64O	Iron	13100	mg/kg		J	9
LF64	TP07-070621-6.5	07-13431-LF64O	Nickel	32	mg/kg		J	9
LF64	TP07-070621-6.5	07-13431-LF64O	Zinc	28	mg/kg		J	8,9
LF64	TP11-070621-2	07-13432-LF64P	Copper	69.0	mg/kg		J	8,9
LF64	TP11-070621-2	07-13432-LF64P	Iron	17400	mg/kg		J	9
LF64	TP11-070621-2	07-13432-LF64P	Nickel	46	mg/kg		J	9
LF64	TP11-070621-2	07-13432-LF64P	Zinc	35	mg/kg		J	8,9
LF64	TP11-070621-2	07-13432-LF64P	Acenaphthene	650	ug/kg	M	NJ	21
LF64	TP11-070621-4	07-13433-LF64Q	1-Methylnaphthalene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	2-Methylnaphthalene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Acenaphthene	730	ug/kg		J	1
LF64	TP11-070621-4	07-13433-LF64Q	Acenaphthylene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Anthracene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Benzo(a)anthracene	460	ug/kg		J	1
LF64	TP11-070621-4	07-13433-LF64Q	Benzo(a)pyrene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Benzo(b)fluoranthene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Benzo(g,h,i)perylene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Benzo(k)fluoranthene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Chrysene	1500	ug/kg		J	1
LF64	TP11-070621-4	07-13433-LF64Q	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Dibenzofuran		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Fluoranthene	610	ug/kg		J	1
LF64	TP11-070621-4	07-13433-LF64Q	Fluorene	2800	ug/kg		J	1
LF64	TP11-070621-4	07-13433-LF64Q	Indeno(1,2,3-cd)pyrene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Naphthalene		ug/kg	U	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Phenanthrene		ug/kg	Y	UJ	1
LF64	TP11-070621-4	07-13433-LF64Q	Pyrene	1300	ug/kg		J	1
LF64	TP11-070621-6.5	07-13435-LF64S	Copper	9.7	mg/kg		J	8,9
LF64	TP11-070621-6.5	07-13435-LF64S	Iron	13000	mg/kg		J	9
LF64	TP11-070621-6.5	07-13435-LF64S	Nickel	35	mg/kg		J	9
LF64	TP11-070621-6.5	07-13435-LF64S	Zinc	25	mg/kg		J	8,9
LF72	TP14-070626-2	07-13456-LF72A	Nickel	28	mg/kg		J	8,9
LF72	TP14-070626-6	07-13458-LF72C	Nickel	19	mg/kg		J	8,9
LF72	TP14-070626-8	07-13459-LF72D	Nickel	19	mg/kg		J	8,9
LF72	TP18-070626-1.5	07-13460-LF72E	Nickel	27	mg/kg		J	8,9
LF72	TP18-070626-3	07-13461-LF72F	Nickel	18	mg/kg		J	8,9
LF72	TP18-070626-8	07-13463-LF72H	Nickel	22	mg/kg		J	8,9
LF72	TP17-070626-2	07-13464-LF72I	Nickel	19	mg/kg		J	8,9
LF72	TP17-070626-6	07-13466-LF72K	Nickel	20	mg/kg		J	8,9
LF72	TP17-070626-8	07-13467-LF72L	Nickel	21	mg/kg		J	8,9
LF72	TP22-070626-2	07-13469-LF72N	Nickel	140	mg/kg		J	8,9
LF72	TP30-070626-3.5	07-13470-LF72O	Nickel	32	mg/kg		J	8,9
LF72	TP03-070626-1	07-13471-LF72P	Nickel	160	mg/kg		J	8,9
LF72	TP03-070626-2	07-13472-LF72Q	Nickel	25	mg/kg		J	8,9
LF74	TP24-070622-2	07-13487-LF74M	Benzo(a)pyrene	380	ug/kg	M	NJ	21
LF74	TP26-070622-6.5	07-13490-LF74P	Acenaphthene	790	ug/kg	M	NJ	21
LF74	TP26-070622-6.5	07-13490-LF74P	Benzo(a)pyrene	120	ug/kg	M	NJ	21
LF74	TP26-070622-6.5	07-13490-LF74P	Phenanthrene	420	ug/kg	M	NJ	21

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SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LF74	TP26-070622-7	07-13491-LF74Q	C8-C10 Aliphatics	27000	ug/kg		J	8
LF74	TP26-070622-7	07-13491-LF74Q	Fluorene	9800	ug/kg	E	DNR	20
LF74	TP26-070622-7	07-13491-LF74QDL	1-Methylnaphthalene		ug/kg	U	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	2-Methylnaphthalene		ug/kg	U	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Acenaphthene	3100	ug/kg		DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Acenaphthylene		ug/kg	U	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Anthracene	290	ug/kg		DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Benzo(a)anthracene	750	ug/kg		DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Benzo(a)pyrene		ug/kg	U	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Benzo(b)fluoranthene	340	ug/kg	M	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Benzo(g,h,i)perylene		ug/kg	U	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Benzo(k)fluoranthene	340	ug/kg	M	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Chrysene	1700	ug/kg		DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Dibenz(a,h)anthracene		ug/kg	U	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Dibenzofuran		ug/kg	U	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Fluoranthene	1200	ug/kg		DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Indeno(1,2,3-cd)pyrene		ug/kg	U	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Naphthalene		ug/kg	Y	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Phenanthrene		ug/kg	Y	DNR	11
LF74	TP26-070622-7	07-13491-LF74QDL	Pyrene	2100	ug/kg		DNR	11
LF88	MW03-070628	07-13573-LF88A	Arsenic		ug/l	U	DNR	11
LF88	MW03-070628	07-13573-LF88A	Iron	260	ug/l		J	9
LF88	MW03-070628	07-13573-LF88A	Lead		ug/l	U	DNR	11
LF88	MW03-070628	07-13573-LF88A	Nickel		ug/l	U	DNR	11
LF88	MW05-070628	07-13574-LF88B	Arsenic		ug/l	U	DNR	11
LF88	MW05-070628	07-13574-LF88B	Iron	230	ug/l		J	9
LF88	MW05-070628	07-13574-LF88B	Lead		ug/l	U	DNR	11
LF88	MW05-070628	07-13574-LF88B	Nickel		ug/l	U	DNR	11
LF88	MW04-070628	07-13575-LF88C	Arsenic		ug/l	U	DNR	11
LF88	MW04-070628	07-13575-LF88C	Iron	380	ug/l		J	9
LF88	MW04-070628	07-13575-LF88C	Lead		ug/l	U	DNR	11
LF88	MW04-070628	07-13575-LF88C	Nickel		ug/l	U	DNR	11
LF88	MW02-070629	07-13576-LF88D	Chrysene	0.3	ug/L		J	9
LF88	MW02-070629	07-13576-LF88D	Naphthalene	0.11	ug/L	M	NJ	21
LF88	MW02-070629	07-13576-LF88D	Phenanthrene	0.11	ug/L	M	NJ	21
LF88	MW02-070629	07-13576-LF88D	Pyrene	0.34	ug/L		J	9
LF88	MW02-070629	07-13576-LF88D	Diesel Range Hydrocarbons	1.8	mg/L		J	9
LF88	MW02-070629	07-13576-LF88D	Motor Oil	1.7	mg/L		J	9
LF88	MW02-070629	07-13576-LF88D	Arsenic		ug/l	U	DNR	11
LF88	MW02-070629	07-13576-LF88D	Iron	1860	ug/l		J	9
LF88	MW02-070629	07-13576-LF88D	Lead		ug/l	U	DNR	11
LF88	MW02-070629	07-13576-LF88D	Nickel		ug/l	U	DNR	11
LF88	MW03-070629	07-13577-LF88E	Benzo(a)anthracene		ug/L	U	UJ	9
LF88	MW03-070629	07-13577-LF88E	Fluoranthene		ug/L	U	UJ	9
LF88	MW03-070629	07-13577-LF88E	Diesel Range Hydrocarbons		mg/L	U	UJ	9
LF88	MW03-070629	07-13577-LF88E	Motor Oil		mg/L	U	UJ	9
LF88	MW03-070629	07-13577-LF88E	Arsenic		ug/l	U	DNR	11
LF88	MW03-070629	07-13577-LF88E	Iron	1070	ug/l		J	9
LF88	MW03-070629	07-13577-LF88E	Lead		ug/l	U	DNR	11
LF88	MW03-070629	07-13577-LF88E	Nickel		ug/l	U	DNR	11

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SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LF88	SW02-070629	07-13578-LF88F	Arsenic		ug/l	U	DNR	11
LF88	SW02-070629	07-13578-LF88F	Iron	1360	ug/l		J	9
LF88	SW02-070629	07-13578-LF88F	Lead		ug/l	U	DNR	11
LF88	SW02-070629	07-13578-LF88F	Nickel		ug/l	U	DNR	11
LF88	SW01-070629	07-13579-LF88G	Arsenic		ug/l	U	DNR	11
LF88	SW01-070629	07-13579-LF88G	Iron	720	ug/l		J	9
LF88	SW01-070629	07-13579-LF88G	Lead		ug/l	U	DNR	11
LF88	SW01-070629	07-13579-LF88G	Nickel		ug/l	U	DNR	11
LF88	SW01DUP-070629	07-13580-LF88H	Arsenic		ug/l	U	DNR	11
LF88	SW01DUP-070629	07-13580-LF88H	Iron	990	ug/l		J	9
LF88	SW01DUP-070629	07-13580-LF88H	Lead		ug/l	U	DNR	11
LF88	SW01DUP-070629	07-13580-LF88H	Nickel		ug/l	U	DNR	11
LF88	MW03-070628	07-13581-LF88I	Arsenic		ug/l	U	DNR	11
LF88	MW03-070628	07-13581-LF88I	Iron		ug/l	U	UJ	9
LF88	MW03-070628	07-13581-LF88I	Lead		ug/l	U	DNR	11
LF88	MW03-070628	07-13581-LF88I	Nickel		ug/l	U	DNR	11
LF88	MW05-070628	07-13582-LF88J	Arsenic		ug/l	U	DNR	11
LF88	MW05-070628	07-13582-LF88J	Iron		ug/l	U	UJ	9
LF88	MW05-070628	07-13582-LF88J	Lead		ug/l	U	DNR	11
LF88	MW05-070628	07-13582-LF88J	Nickel		ug/l	U	DNR	11
LF88	MW04-070628	07-13583-LF88K	Arsenic		ug/l	U	DNR	11
LF88	MW04-070628	07-13583-LF88K	Iron	190	ug/l		J	9
LF88	MW04-070628	07-13583-LF88K	Lead		ug/l	U	DNR	11
LF88	MW04-070628	07-13583-LF88K	Nickel		ug/l	U	DNR	11
LF88	MW02-070629	07-13584-LF88L	Arsenic		ug/l	U	DNR	11
LF88	MW02-070629	07-13584-LF88L	Iron	270	ug/l		J	9
LF88	MW02-070629	07-13584-LF88L	Lead		ug/l	U	DNR	11
LF88	MW02-070629	07-13584-LF88L	Nickel		ug/l	U	DNR	11
LF88	MW03-070629	07-13585-LF88M	Arsenic		ug/l	U	DNR	11
LF88	MW03-070629	07-13585-LF88M	Iron	260	ug/l		J	9
LF88	MW03-070629	07-13585-LF88M	Lead		ug/l	U	DNR	11
LF88	MW03-070629	07-13585-LF88M	Nickel		ug/l	U	DNR	11
LF88	SW02-070629	07-13586-LF88N	Arsenic		ug/l	U	DNR	11
LF88	SW02-070629	07-13586-LF88N	Iron		ug/l	U	UJ	9
LF88	SW02-070629	07-13586-LF88N	Lead		ug/l	U	DNR	11
LF88	SW02-070629	07-13586-LF88N	Nickel		ug/l	U	DNR	11
LF88	SW01-070629	07-13587-LF88O	Arsenic		ug/l	U	DNR	11
LF88	SW01-070629	07-13587-LF88O	Iron		ug/l	U	UJ	9
LF88	SW01-070629	07-13587-LF88O	Lead		ug/l	U	DNR	11
LF88	SW01-070629	07-13587-LF88O	Nickel		ug/l	U	DNR	11
LF88	SW01DUP-070629	07-13588-LF88P	Arsenic		ug/l	U	DNR	11
LF88	SW01DUP-070629	07-13588-LF88P	Iron		ug/l	U	UJ	9
LF88	SW01DUP-070629	07-13588-LF88P	Lead		ug/l	U	DNR	11
LF88	SW01DUP-070629	07-13588-LF88P	Nickel		ug/l	U	DNR	11
LF99	SED07-070628-0-4	07-13708-LF99A	Total Volatile Solids	2.15	Percent		J	1,9
LF99	SED07-070628-0-4	07-13708-LF99A	Sulfide	47.9	mg/kg		J	1
LF99	SED07-070628-0-4	07-13708-LF99A	Total Organic Carbon	0.284	Percent		J	8,9
LF99	SED07-070628-0-4	07-13708-LF99A	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED07-070628-0-4	07-13708-LF99A	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED16-070628-0-4	07-13710-LF99C	Total Volatile Solids		Percent	U	UJ	1,9
LF99	SED16-070628-0-4	07-13710-LF99C	Sulfide	242	mg/kg		J	1
LF99	SED16-070628-0-4	07-13710-LF99C	Total Organic Carbon	0.214	Percent		J	8,9

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SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LF99	SED16-070628-0-4	07-13710-LF99C	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED16-070628-0-4	07-13710-LF99C	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED06-070628-0-4	07-13712-LF99E	Total Volatile Solids		Percent	U	UJ	1,9
LF99	SED06-070628-0-4	07-13712-LF99E	Sulfide	527	mg/kg		J	1
LF99	SED06-070628-0-4	07-13712-LF99E	Total Organic Carbon	0.206	Percent		J	8,9
LF99	SED06-070628-0-4	07-13712-LF99E	Benzoic Acid		ug/kg	U	R	8
LF99	SED06-070628-0-4	07-13712-LF99E	Benzyl Alcohol		ug/kg	U	R	8
LF99	SED06-070628-0-4	07-13712-LF99E	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED06-070628-0-4	07-13712-LF99E	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED05-070628-0-4	07-13715-LF99H	Total Volatile Solids	1.74	Percent		J	1,9
LF99	SED05-070628-0-4	07-13715-LF99H	Sulfide	252	mg/kg		J	1
LF99	SED05-070628-0-4	07-13715-LF99H	Total Organic Carbon	0.791	Percent		J	8,9
LF99	SED05-070628-0-4	07-13715-LF99H	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED05-070628-0-4	07-13715-LF99H	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED11-070628-0-4	07-13718-LF99K	Total Volatile Solids	5.61	Percent		J	1,9
LF99	SED11-070628-0-4	07-13718-LF99K	Sulfide	902	mg/kg		J	1
LF99	SED11-070628-0-4	07-13718-LF99K	Total Organic Carbon	0.258	Percent		J	8,9
LF99	SED11-070628-0-4	07-13718-LF99K	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED11-070628-0-4	07-13718-LF99K	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED02-070628-0-4	07-13720-LF99M	Total Volatile Solids	3.9	Percent		J	1,9
LF99	SED02-070628-0-4	07-13720-LF99M	Sulfide	1860	mg/kg		J	1
LF99	SED02-070628-0-4	07-13720-LF99M	Total Organic Carbon	0.339	Percent		J	8,9
LF99	SED02-070628-0-4	07-13720-LF99M	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED02-070628-0-4	07-13720-LF99M	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED02-070628-4-18	07-13721-LF99N	Total Volatile Solids	8.03	Percent		J	1,9
LF99	SED02-070628-4-18	07-13721-LF99N	Sulfide	2000	mg/kg		J	1
LF99	SED02-070628-4-18	07-13721-LF99N	Total Organic Carbon	10.4	Percent		J	8,9
LF99	SED02-070628-4-18	07-13721-LF99N	Benzo(a)anthracene	710	ug/kg		J	19
LF99	SED02-070628-4-18	07-13721-LF99N	bis(2-Ethylhexyl)phthalate		ug/kg	U	UJ	19
LF99	SED02-070628-4-18	07-13721-LF99N	Butylbenzylphthalate		ug/kg	U	UJ	19
LF99	SED02-070628-4-18	07-13721-LF99N	Chrysene	3300	ug/kg		J	19
LF99	SED02-070628-4-18	07-13721-LF99N	Di-n-Octyl phthalate		ug/kg	U	UJ	19
LF99	SED02-070628-4-18	07-13721-LF99N	Pyrene	2300	ug/kg		J	19
LF99	SED02-070628-4-18	07-13721-LF99N	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED02-070628-4-18	07-13721-LF99N	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED02-070628-4-18	07-13721-LF99NDL	1,2,4-Trichlorobenzene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	1,2-Dichlorobenzene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	1,3-Dichlorobenzene		ug/kg	U	DNR	11

QUALIFIED DATA SUMMARY TABLE
Irondale

SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LF99	SED02-070628-4-18	07-13721-LF99NDL	1,4-Dichlorobenzene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	2,4-Dimethylphenol		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	2-Methylnaphthalene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	2-Methylphenol		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	4-Methylphenol		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Acenaphthene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Acenaphthylene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Anthracene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Benzo(a)anthracene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Benzo(a)pyrene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Benzo(b)fluoranthene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Benzo(g,h,i)perylene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Benzo(k)fluoranthene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Benzoic Acid		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Benzyl Alcohol		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	bis(2-Ethylhexyl)phthalate		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Butylbenzylphthalate		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Chrysene	3400	ug/kg	J	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Dibenz(a,h)anthracene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Dibenzofuran		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Diethylphthalate		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Dimethylphthalate		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Di-n-Butylphthalate		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Di-n-Octyl phthalate		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Fluoranthene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Fluorene		ug/kg	U	DNR	11

QUALIFIED DATA SUMMARY TABLE
Irondale

SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LF99	SED02-070628-4-18	07-13721-LF99NDL	Hexachlorobenzene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Hexachlorobutadiene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Indeno(1,2,3-cd)pyrene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Naphthalene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	N-Nitrosodiphenylamine		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Pentachlorophenol		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Phenanthrene		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Phenol		ug/kg	U	DNR	11
LF99	SED02-070628-4-18	07-13721-LF99NDL	Pyrene		ug/kg	U	DNR	11
LF99	SED01-070628-0-4	07-13722-LF99O	Total Volatile Solids	4.56	Percent		J	1,9
LF99	SED01-070628-0-4	07-13722-LF99O	Sulfide	1120	mg/kg		J	1
LF99	SED01-070628-0-4	07-13722-LF99O	Total Organic Carbon	0.162	Percent		J	8,9
LF99	SED01-070628-0-4	07-13722-LF99O	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED01-070628-0-4	07-13722-LF99O	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED01-070628-4-24	07-13723-LF99P	Total Volatile Solids	1.3	Percent		J	1,9
LF99	SED01-070628-4-24	07-13723-LF99P	Sulfide	827	mg/kg		J	1
LF99	SED01-070628-4-24	07-13723-LF99P	Total Organic Carbon	0.376	Percent		J	8,9
LF99	SED01-070628-4-24	07-13723-LF99P	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED01-070628-4-24	07-13723-LF99P	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED17-070629-0-4	07-13724-LF99Q	Total Volatile Solids	1.97	Percent		J	1,9
LF99	SED17-070629-0-4	07-13724-LF99Q	Total Organic Carbon	0.752	Percent		J	8,9
LF99	SED17-070629-0-4	07-13724-LF99Q	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED17-070629-0-4	07-13724-LF99Q	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED09-070629-0-4	07-13726-LF99S	Total Volatile Solids	1.79	Percent		J	1,9
LF99	SED09-070629-0-4	07-13726-LF99S	Total Organic Carbon	1.03	Percent		J	8,9
LF99	SED09-070629-0-4	07-13726-LF99S	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED09-070629-0-4	07-13726-LF99S	Benzyl Alcohol		ug/kg	U	UJ	5B
LF99	SED03-070629-0-4	07-13728-LF99U	Total Volatile Solids	2.2	Percent		J	1,9
LF99	SED03-070629-0-4	07-13728-LF99U	Total Organic Carbon	0.84	Percent		J	8,9
LF99	SED03-070629-0-4	07-13728-LF99U	2,4-Dimethylphenol		ug/kg	U	UJ	10
LF99	SED03-070629-0-4	07-13728-LF99U	Benzyl Alcohol		ug/kg	U	UJ	5B
LG26	SLAG1-070627	07-13848-LG26A	Copper	3060	mg/kg		J	9
LG26	SLAG1-070627	07-13848-LG26A	Nickel	80	mg/kg		J	8
LG26	SLAG2-070627	07-13849-LG26B	Copper	13.8	mg/kg		J	9
LG26	SLAG2-070627	07-13849-LG26B	Nickel	16	mg/kg		J	8
LG93	MW05-070628	07-14221-LG93J	Arsenic	1.8	ug/l		J	8
LG93	MW04-070628	07-14222-LG93K	Arsenic	0.5	ug/l		J	8
LG93	MW02-070629	07-14223-LG93L	Arsenic	0.96	ug/l		J	8

QUALIFIED DATA SUMMARY TABLE
Irondale

SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LG93	MW03-070629	07-14224-LG93M	Arsenic	0.91	ug/l		J	8
LG93	SW02-070629	07-14225-LG93N	Arsenic	0.92	ug/l		J	8
LG93	SW01-070629	07-14226-LG93O	Arsenic	0.92	ug/l		J	8
LG93	SW01DUP-070629	07-14227-LG93P	Arsenic	0.93	ug/l		J	8
LK98	SED17-070629-0-4	07-16639-LK98J	Coarse Sand	13.8	%		J	1
LK98	SED17-070629-0-4	07-16639-LK98J	Fine Sand	21.8	%		J	1
LK98	SED17-070629-0-4	07-16639-LK98J	Gravel	25.6	%		J	1
LK98	SED17-070629-0-4	07-16639-LK98J	Medium Sand	8.2	%		J	1
LK98	SED17-070629-0-4	07-16639-LK98J	Total Fines	1.9	%		J	1
LK98	SED17-070629-0-4	07-16639-LK98J	Very Coarse Sand	26.6	%		J	1
LK98	SED17-070629-0-4	07-16639-LK98J	Very Fine Sand	2.1	%		J	1
LK98	SED09-070629-0-4	07-16640-LK98K	Coarse Sand	9.7	%		J	1
LK98	SED09-070629-0-4	07-16640-LK98K	Fine Sand	30.8	%		J	1
LK98	SED09-070629-0-4	07-16640-LK98K	Gravel	23.4	%		J	1
LK98	SED09-070629-0-4	07-16640-LK98K	Medium Sand	17.6	%		J	1
LK98	SED09-070629-0-4	07-16640-LK98K	Total Fines	1.4	%		J	1
LK98	SED09-070629-0-4	07-16640-LK98K	Very Coarse Sand	9.3	%		J	1
LK98	SED09-070629-0-4	07-16640-LK98K	Very Fine Sand	7.9	%		J	1
LK98	SED03-070629-0-4	07-16641-LK98L	Coarse Sand	5.5	%		J	1
LK98	SED03-070629-0-4	07-16641-LK98L	Fine Sand	27.9	%		J	1
LK98	SED03-070629-0-4	07-16641-LK98L	Gravel	30.8	%		J	1
LK98	SED03-070629-0-4	07-16641-LK98L	Medium Sand	8.2	%		J	1
LK98	SED03-070629-0-4	07-16641-LK98L	Total Fines	0.9	%		J	1
LK98	SED03-070629-0-4	07-16641-LK98L	Very Coarse Sand	16.2	%		J	1
LK98	SED03-070629-0-4	07-16641-LK98L	Very Fine Sand	10.4	%		J	1

EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

Washington Department of Ecology Toxics Cleanup Program Remedial Investigation Feasiblity Study

Irondale, Washington

Prepared for:

SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

GeoEngineers, Inc.
600 Stewart Street, Suite 1700
Seattle, WA 98101

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C4122-2

October 26, 2007

Approved for Release

Christine Ransom
Project Manager
EcoChem, INC.

INTRODUCTION

Basis for the Data Validation

This report summarizes the results of the summary (Level III) data validation performed on soil, sediment, slag, and quality control (QC) sample data for the Washington Department of Ecology – Remedial Investigation Feasibility Study at Irondale, Washington. A complete list of samples is provided in the **Sample Index**. Analytical Resources, Inc., Tukwila, Washington performed all analyses. The analytical methods and EcoChem project chemists are listed below.

Analysis	Method of Analysis	Primary Review	Secondary Review
Diesel and Residual Range Hydrocarbons	NWTPH-Dx	Mark Lybeer	Mark Brindle
Metals	SW7060A	Patricia Lambrecht	Christine Ransom

The data validation is based on QC criteria documented in the above listed methods, the *Quality Assurance Project Plan (QAPP) - Investigation/Feasibility Study, Irondale, Washington (2007)*; and *USEPA National Functional Guidelines for Organic* (1999) *and Inorganic (2004) Data Review*. The QC criteria are summarized in **Appendix A.**

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

Data qualifier definitions and Data Validation Criteria Tables are included as Appendix A. **Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem.

SAMPLE INDEX
Irondale
NWTPHDx

SDG	SAMPLE ID	LAB ID	Method
LN33	SED11-070628-4-24	07-18008-LN33A	NWTPHD-Cleaned
LN33	SED17-070629-4-24	07-18009-LN33B	NWTPHD-Cleaned
LN33	SED09-070629-4-24	07-18010-LN33C	NWTPHD-Cleaned
LN33	SED03-070629-4-12	07-18011-LN33D	NWTPHD-Cleaned

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
Diesel and Residual Range Hydrocarbons by Method NWTPH-Dx

This report documents the review of analytical data from the analyses of sediment, water, and associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
LF60	9 Sediment, 2 Water & 1 Rinsate Blank	Summary
LF62	12 Sediment	Summary
LF64	15 Sediment	Summary
LF72	5 Sediment	Summary
LF74	11 Sediment	Full
LF88	5 Water	Summary
LF91	1 Rinsate Blank	Summary
LF98	3 Sediment	Summary
LF99	12 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Receipt
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
2 Laboratory Blanks
1 Field Blanks
2 Surrogate Compounds
Laboratory Control Samples (LCS/LCSD)
Matrix Spike/Matrix Spike Duplicates (MS/MSD)
1 Field Duplicates
Target Analyte List
Reporting Limits
1 Compound Identification (Full validation only)
1 Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Receipt

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C.

The QAPP-required holding time criterion for soil samples is 14 days from date of sampling to date of extraction. The QAPP-required holding time criterion for extracts is 40 days from extraction to analysis. All samples were extracted and analyzed within the holding time criteria.

SDG LF74: One of two sample coolers were received at the laboratory at a temperature less than the lower control limit, at 1.0 ºC. The temperature outlier did not impact data quality, therefore no action was taken.

Laboratory Blanks

In order to assess the impact of laboratory blank contamination on the reported sample results, action levels at five times the blank concentrations are established. If the concentrations in the associated field samples are less than the action levels, the results are qualified as not detected (U). If the results are also less than the reporting limit, the results are elevated to the reporting limit.

SDG LF60: A positive value for diesel range organics (DRO) was reported in the laboratory blank extracted on 7/3/07. Because of the potential blank contamination, the associated samples were re-extracted and reanalyzed. Although the method blank for the re-extraction was clean, the samples were re-extracted outside of the holding time period.

The original results should be reported and the re-extracted results should not be used. The diesel results in Samples DP02-070625-13 and DP01-070626-11 were qualified as not detected (U-7). All results from the re-extracted batch were labeled do-not-report (DNR-11).

Field Blanks

SDG LF60: One field blank, DP05-070626-Rinsate, was reported with this SDG. No positive results were reported in this blank.

SDG LF91: One field blank, SedRinsate-070629, was reported with this SDG. No positive results were reported in this blank.

Surrogates

SDG LF60: The percent recovery (%R) value for o-terphenyl was less than the control limit in Sample DP06-070625-7. The reporting limits for diesel and motor oil were estimated (UJ-13) to indicate a potential low bias.

The surrogate o-terphenyl was diluted out in Sample DP02-070625-11 (40x). No action was taken on this basis.

Field Duplicates

SDG LF88: One set of field duplicates was submitted: MW02-070629 and MW03-07-0629. There were positive results for both DRO and motor oil in Sample MW02-070629. These analytes were not detected in Sample MW03-070629. The differences between the positive results and the reporting limits (RL) were greater than the RL; the results for both samples were estimated (J/UJ-9).

Compound Identification

All samples in these SDGs were sulfuric acid/silica gel "cleaned" prior to analysis to reduce the effects of biogenic interference in the samples. Biogenic interference can elevate the motor oil chromatographic response, making the sample results to be biased high.

Calculation Verification

SDG LF74: Several recalculations were performed on this SDG. No calculation errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD), and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate relative percent difference values, with the exceptions previously noted.

Data were estimated because of surrogate %R and field precision outliers. Data were also qualified as not detected because of blank contamination.

All data, as qualified, are acceptable for use.

SAMPLE INDEX
Irondale
Metals 6010B

SDG	SAMPLE ID	LAB ID	Method
LM02	DP03-070626-7	07-17261-LM02A	SW7060A
LM02	DP01-070626-5	07-17262-LM02B	SW7060A
LM02	TP21-070625-2	07-17263-LM02C	SW7060A
LM02	TP02-070625-2	07-17264-LM02D	SW7060A
LM02	TP08-070621-1.5	07-17265-LM02E	SW7060A
LM02	TP08-070621-6	07-17266-LM02F	SW7060A
LM02	TP22-070626-2	07-17267-LM02G	SW7060A
LM02	TP03-070626-1	07-17268-LM02H	SW7060A
LM02	TP12-070622-1.5	07-17269-LM02I	SW7060A
LM02	SLAG1-070627	07-17270-LM02J	SW7060A
LM02	SLAG2-070627	07-17271-LM02K	SW7060A

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
Arsenic by Method SW7060A

This report documents the review of analytical data from the analyses of soil and slag samples and the associated laboratory and field quality control (QC) samples. Analytical Resources, Inc., Tukwila, Washington analyzed the samples.

SDG	Number of Samples	Validation Level
LM02	9 Soil, 2 Slag	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

1 Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
CRDL Standards
Laboratory Blanks
1 Field Blanks
Laboratory Control Samples
2 Matrix Spikes
Laboratory Duplicates
2 GFAA Post Digestion Spike
1 Field Duplicates
Standard Addition Results
1 Reported Results
Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified.***

[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. One of the coolers was received at the laboratory at a temperature less than the lower limit, at 1.0°C. This temperature outlier did not impact data quality and no action was taken.

Field Blanks

There were no field blanks analyzed with these samples.

Matrix Spikes

A matrix spike (MS) was analyzed at the proper frequency of one per 20 samples or one per batch; whichever was more frequent. The percent recovery (%R) values for arsenic (34.6%) was less than the lower control limit of 75%. All associated results were qualified as estimated (J/UJ - 8) to indicate a possible low bias.

Field Duplicates

There were no field duplicates analyzed with these samples.

GFAA Post Digestion Spike

The post digestion spike recoveries for Samples DP03-070626-7 (66.2%) and SLAG2-070627 (77%) were less than the lower control limit of 85%. Arsenic was not detected in these samples. Reporting limits were estimated (UJ-15) to indicate a potential low bias.

Reported Results

Several sample required dilution due to high sample concentrations or matrix interferences. Reporting limits were elevated accordingly.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory duplicate relative percent difference values indicated acceptable precision. Accuracy was also acceptable, as demonstrated by the MS, laboratory control sample, and post digestion spike %R values, except as previously noted.

Data were estimated based on MS and post digestion spike %R outliers.

All data, as qualified, are acceptable for use.

QUALIFIED DATA SUMMARY TABLE
Irondale

SDG	Sample ID	Laboratory ID	Analyte	Result*	Units	Lab Qual	DV Qual	Reason Code
LM02	DP03-070626-7	07-17261-LM02A	Arsenic		mg/kg	U	UJ	8,15
LM02	DP01-070626-5	07-17262-LM02B	Arsenic	32	mg/kg		J	8
LM02	TP21-070625-2	07-17263-LM02C	Arsenic	7.9	mg/kg		J	8
LM02	TP02-070625-2	07-17264-LM02D	Arsenic	13	mg/kg		J	8
LM02	TP08-070621-1.5	07-17265-LM02E	Arsenic	14	mg/kg		J	8
LM02	TP08-070621-6	07-17266-LM02F	Arsenic	27	mg/kg		J	8
LM02	TP22-070626-2	07-17267-LM02G	Arsenic	64	mg/kg		J	8
LM02	TP03-070626-1	07-17268-LM02H	Arsenic	58	mg/kg		J	8
LM02	TP12-070622-1.5	07-17269-LM02I	Arsenic	6.5	mg/kg		J	8
LM02	SLAG1-070627	07-17270-LM02J	Arsenic	36	mg/kg		J	8
LM02	SLAG2-070627	07-17271-LM02K	Arsenic		mg/kg	U	UJ	8,15

EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

WASHINGTON DOE TOXICS CLEANUP PROGRAM
REMEDIAL INVESTIGATION FEASIBLITY STUDY
IRONDALE, WASHINGTON

Prepared for:

SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C4122-4

April 15, 2008

Approved for Release

Christine Ransom
Project Manager
EcoChem, INC.

INTRODUCTION

Basis for the Data Validation

This report summarizes the results of the summary (Level III) data validation performed on sediment, groundwater, field blank, and quality control (QC) sample data for the Washington Department of Ecology – Remedial Investigation Feasibility Study at Irondale, Washington. A complete list of samples is provided in the **Sample Index**. Analytical Resources, Inc., Tukwila, Washington performed all analyses. The analytical methods and EcoChem project chemists are listed below.

Analysis	Method of Analysis	Primary Review	Secondary Review
Semivolatile Organic Compounds (SVOC)	EPA Method 8270D	Jennifer Newkirk	John Mitchell
Polycyclic Aromatic Hydrocarbons (PAH)	EPA Method 8270D-SIM	Jennifer Newkirk/ Mark Lybeer	John Mitchell
Diesel and Residual Range Hydrocarbons	NWTPH-Dx	Mark Lybeer	John Mitchell
Metals	SW6010B, EPA 200.8, and SW7470A	Jennifer Newkirk	Christine Ransom
Conventionals[1]	various	Jennifer Newkirk	Christine Ransom

The data validation is based on QC criteria documented in the above listed methods, the *Quality Assurance Project Plan (QAPP) - Investigation/Feasibility Study, Irondale, Washington (2007)*; and *USEPA National Functional Guidelines for Organic* (1999) *and Inorganic (2004) Data Review*. The QC criteria are summarized in **Appendix A.**

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

Data qualifier definitions and Data Validation Criteria Tables are included as **Appendix A**. **Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem.

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SDG	Sample ID	Laboratory ID	SVOC	PAH	PCB	Fuels	Metals	Grain Size	Total Solids	Preserved Total Solids	Total Volatile Solids	N-Ammonia	Sulfide	TOC
MB44	ID-50-SD	07-26515-MB44A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-51-SD	07-26516-MB44B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-52-SD	07-26517-MB44C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-53-SD	07-26518-MB44D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-54-SD	07-26519-MB44E	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-56-SD	07-26520-MB44F	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-57-SD	07-26521-MB44G	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-59-SD	07-26522-MB44H	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-59-D	07-26523-MB44I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-59-T	07-26524-MB44J						✓	✓	✓	✓	✓	✓	✓
MB44	ID-58-SD	07-26525-MB44K	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-55-SD	07-26526-MB44L	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-04-SD	07-26527-MB44M	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MB44	ID-00-RB	07-26528-MB44N	✓	✓	✓	✓	✓							
MB44	ID-00-ER	07-26529-MB44O	✓	✓	✓	✓	✓							
MC25	MW2-071212	07-27013-MC25A		✓		✓	✓							
MC25	MW3-071212	07-27014-MC25B		✓		✓	✓							
MC25	MW4-071212	07-27015-MC25C		✓		✓	✓							
MC25	MW5-071212	07-27016-MC25D		✓		✓	✓							
MC25	RINSATE-071211	07-27017-MC25E		✓		✓	✓							
MC25	MW2-071212	07-27018-MC25F					✓							
MC25	MW3-071212	07-27019-MC25G					✓							
MC25	MW4-071212	07-27020-MC25H					✓							
MC25	MW5-071212	07-27021-MC25I					✓							
MC71	SED18-071210-5	07-27288-MC71B				✓								
MC71	SED18-071210-7.5	07-27289-MC71C				✓								
MC71	SED18-071210-10	07-27290-MC71D				✓								
MC71	SED18-071210-12.5	07-27291-MC71E				✓								
MC71	SED20-071210-1.5	07-27292-MC71F				✓								
MC71	SED20-071210-3.5	07-27293-MC71G				✓								

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SDG	Sample ID	Laboratory ID	SVOC	PAH	PCB	Fuels	Metals	Grain Size	Total Solids	Preserved Total Solids	Total Volatile Solids	N-Ammonia	Sulfide	TOC
MC71	SED20-071210-5	07-27294-MC71H				✓								
MC71	SED20-071210-6.5	07-27295-MC71I				✓								
MC71	SED21-071210-2.5	07-27296-MC71J				✓								
MC71	SED21-071210-5	07-27297-MC71K				✓								
MC71	SED23-071210-2.5	07-27302-MC71P				✓								
MC71	GEISS1-071213-.25	07-27305-MC71S					✓							
MC71	GEISS1-071213-1.5	07-27306-MC71T					✓							
MC71	GEISS2-071213-1.5	07-27307-MC71U					✓							
MC71	GEISS3-071213-1	07-27308-MC71V					✓							
MC71	TP32-071210-1.5	07-27309-MC71W					✓							
MC71	TP32-071210-5	07-27310-MC71X					✓							
MC71	TP33-071211-2	07-27313-MC71AA					✓							
MC71	TP34-071210-1.5	07-27315-MC71AC					✓							
MC71	TP34-071210-5	07-27316-MC71AD					✓							
MC71	TP32-071210-7.5	07-27311-MC71Y				✓								
MC71	TP35-071210-1.5	07-27320-MC71AH				✓								
MC71	TP35-071210-5	07-27321-MC71AI				✓								
MC71	TP35-071210-7.5	07-27322-MC71AJ				✓								
MC71	TP36A-071211-9.5	07-27328-MC71AP				✓								
MC71	TP37-071212-1.5	07-27330-MC71AR					✓							
MC72	TP37-071212-5.5	07-27332-MC72A					✓							
MC72	TP38-071212-1	07-27333-MC72B					✓							
MC72	TP38-071212-5	07-27334-MC72C					✓							
MC72	TP39-071212-1	07-27335-MC72D					✓							
MC72	TP39-071212-5	07-27336-MC72E					✓							
MC72	TP40-071212-.5	07-27337-MC72F					✓							
MC72	UBSS1-071212-.5	07-27338-MC72G					✓							
MC72	TP40-071212-5	07-27339-MC72H					✓							
MC72	TP41-071213-1	07-27340-MC72I					✓							
MC72	TP41-071213-3	07-27341-MC72J					✓							

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SDG	Sample ID	Laboratory ID	SVOC	PAH	PCB	Fuels	Metals	Grain Size	Total Solids	Preserved Total Solids	Total Volatile Solids	N-Ammonia	Sulfide	TOC
MC72	TP42-071212-2	07-27342-MC72K					✓							
MC72	TP42-071212-5	07-27343-MC72L					✓							
MC72	UBSS2-071212-.5	07-27345-MC72N					✓							
MC72	TP43-071211-2	07-27346-MC72O					✓							
MC72	TP43-071211-5.5	07-27347-MC72P					✓							
MC72	TP43-071211-10	07-27348-MC72Q					✓							
MC76	UBS1-071212-.5	07-27350-MC76A					✓							
MC76	TP41-071213-1W	07-27351-MC76B					✓							
MC76	UBS2-071212-.5	07-27352-MC76C					✓							
ME43	SED18-071210-5	08-284-ME43A	✓	✓										
ME43	SED20-071210-1.5	08-285-ME43B	✓	✓										
ME43	SED21-071210-5	08-286-ME43C	✓	✓										
MF81	SED18-071210-5	08-1055-MF81A							✓					✓
MF81	SED20-071210-1.5	08-1056-MF81B							✓					✓
MF81	SED21-071210-5	08-1057-MF81C							✓					✓

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
SVOC by EPA Method 8270D

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
ME43	3 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

2 Holding Times and Sample Preservation
GC/MS Instrument Performance Check
Initial Calibration (ICAL)
2 Continuing Calibration (CCAL)
Laboratory Blanks
Field Blanks
1 Surrogate Compounds
Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Sample (LCS)
Internal Standards
Target Analyte List
Reporting Limits
Compound Identification (Full validation only)
Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The majority of the coolers were received at the laboratory at temperatures outside of these limits, with temperatures ranging from 1.8° to 3.8°C. These temperature outliers did not impact data quality and no action was taken.

The analytical holding time of 14 days had expired (by three days) prior to the laboratory archiving the samples at -20° C. All associated results and reporting limits were qualified as estimated (J/UJ-1).

Continuing Calibration

The RRF values were greater than the 0.05 minimum control limit for the continuing calibrations (CCALs).

The CCAL percent difference (%D) values were within the ±25% control limits, with the following exception:

The %D value for benzoic acid in the CCAL analyzed 1/17/08 15:11 was outside the control limit. This analyte was not detected in the associated samples; reporting limits were qualified as estimated (UJ-5B).

Surrogate Compounds

The percent recovery (%R) value for 2,4,6-tribromophenol was greater than the upper control limit for Sample SED18-071210-5. No qualifiers were applied for this single outlier.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, laboratory control sample, and matrix spike/matrix spike duplicate (MS/MSD) percent recovery values, with the exception noted above. Precision was also acceptable as demonstrated by the MS/MSD relative percent difference values.

Data were qualified based on exceeded holding times and a continuing calibration %D outlier.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Polycyclic Aromatic Hydrocarbons by EPA Method 8270D-SIM

This report documents the review of analytical data from the analyses of 4 water samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington.

SDG	Number of Samples	Validation Level
MC25	4 Water & 1 Field Blank	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Preservation
GC/MS Instrument Performance Check
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
2 Laboratory Blanks
1 Field Blanks
Surrogate Compounds
1 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Sample/Laboratory Control Sample Duplicates (LCS/LCSD)
Internal Standards
Target Analyte List
Reporting Limits (MDL and MRL)
Reported Results

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[1] ***Quality control results are discussed below, but no data were qualified***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The majority of the coolers were received at the laboratory at temperatures outside of these limits. These temperature outliers did not impact data quality and no action was taken.

Laboratory Blanks

To assess the impact of each blank contaminant on the reported sample results, an action level is established at five times the concentration reported in the blank. If a contaminant is reported in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-7). If the result is also less than the reporting limit, then the result is elevated to the reporting limit. No action is taken if the sample result is greater than the action level, or for non-detected results.

Method blanks were analyzed at the appropriate frequency. A summary of contaminant levels, associated samples, and action levels is provided in the data validation worksheets. Various target analytes were detected in the method blanks. However, only the following analytes were qualified as not detected in one or more samples in the associated laboratory data sets.

SDG MC25: naphthalene (5 results), fluoranthene (1 result)

Field Blanks

Laboratory method blanks are used to evaluate all associated field blanks. Any remaining positive results in the trip blank are then used to evaluate all associated samples, including equipment blanks. Any remaining positive results in the equipment blank are used to evaluate the associated samples.

One rinsate blank, RINSATE-071211, was included in this data package. After qualifiers were applied for laboratory blank contamination, no positive results for any target analytes remained in this blank.

Matrix Spike/Matrix Spike Duplicates

No matrix spike/matrix spike duplicate (MS/MSD) analyses were performed. Accuracy and precision were assessed using the laboratory control sample and laboratory control sample duplicate (LCS/LCSD).

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate and LCS/LCSD percent recovery values. Precision was also acceptable as demonstrated by the LCS/LCSD relative percent difference values.

Data were qualified as not detected because of method blank contamination.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RIFS
SVOC by EPA Method 8270D-SIM

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
ME43	3 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

2 Holding Times & Sample Preservation
GC/MS Instrument Performance Check
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Laboratory Blanks
Field Blanks
1 Surrogate Compounds
2 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)
Internal Standards
Target Analyte List
1 Reporting Limits
Compound Identification (Full validation only)
Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified***

[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The majority of the coolers were received at the laboratory at temperatures outside of these limits, with temperatures ranging from 1.8° to 3.8°C. These temperature outliers did not impact data quality and no action was taken.

The analytical holding time of 14 days had expired (by three days) prior to the laboratory archiving the samples at -20° C. All associated results and reporting limits were qualified as estimated (J/UJ-1).

Surrogate Compounds

The %R value for 2-flurophenol was less than the lower control limit for Sample SED18-071210-5. No qualifiers were applied for this single outlier.

Matrix Spike/Matrix Spike Duplicates

The matrix spike/matrix spike duplicate (MS/MSD) analyses were performed using Sample SED20-071210-1.5. The percent recovery (%R) values for 2,4-dimethylphenol were much less than the lower control limit, at 4.0% and 4.1%. The result for this analyte was qualified as estimated (J-8) in the parent sample to indicate a potential low bias.

Reporting Limits

Reporting limits were elevated due to smaller than normal sample volumes used for extraction and required dilutions. Screening showed that samples contained high levels of oil which causes matrix interference.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), and MS/MSD %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the LCS/LCSD and MS/MSD RPD values.

Data were estimated based on exceeded holding times and MS/MSD %R outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Diesel and Residual Range Hydrocarbons by Method NWTPH-Dx

This report documents the review of analytical data from the analyses of sediment samples, water samples, and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
MC25	4 Water & 1 Rinsate Blank	Summary
MC71	16 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Receipt
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Blanks (Method)
1 Blanks (Field)
Surrogate Compounds
1 Matrix Spike/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Samples (LCS/LCSD)
1 Field Duplicates
Target Analyte List
Reporting Limits (MDL and MRL)
1 Compound Identification
Calculation Verification (Full validation only)
Hardcopy to EDD Verification

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[1] ***Quality control results are discussed below, but no data were qualified.***

[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. One of the coolers was received at the laboratory at 1.8°C, outside of these limits. This temperature outlier did not impact data quality and no action was taken.

Blanks (Field)

Laboratory method blanks are used to evaluate all associated field blanks. Any remaining positive results in the trip blank are then used to evaluate all associated samples, including equipment blanks. Any remaining positive results in the equipment blank are used to evaluate the associated samples.

SDG MC25: One rinsate blank, RINSATE-071211, was included in this data package. There were no positive results detected in this blank. No qualifiers were required.

Matrix Spike/Matrix Spike Duplicates

SDG MC25: No matrix spike/matrix spike duplicate (MS/MSD) analysis was performed. Accuracy and precision were assessed using the laboratory control sample and laboratory control sample duplicate (LCS/LCSD).

SDG MC71: No MS/MSD percent recovery (%R) values were reported as the diesel concentration in the parent sample, SED18-071210-5, was significantly higher than the spiked concentration. The relative percent difference (RPD) value was within the acceptance limit for precision.

Field Duplicates

No field duplicates were submitted.

Compound Identification

All samples were sulfuric acid/silica gel “cleaned” prior to analysis to reduce the effects of biogenic interference in the samples.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, MS/MSD, and LCS/LCSD %R values. Precision was also acceptable as demonstrated by the MS/MSD and LCS/LCSD RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Metals by Methods SW6010B, EPA 200.8, SW 7060A

This report documents the review of analytical data from the analyses of water, sediment, and tissue samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington.

SDG	Number of Samples	Validation Level
MC25	4 Water & 1 Field Blank	Summary
MC71	10 Sediment	Summary
MC72	16 Sediment	Summary
MC76	3 Tissue	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

1 Holding Times and Sample Preservation
Initial Calibration
1 Calibration Verification
1 CRDL Standards
Laboratory Blanks
Field Blanks
Laboratory Control Samples (LCS)
2 Matrix Spikes (MS)

1 Laboratory Duplicates
ICP Interference Check Samples
Field Duplicates
Serial Dilutions
ICPMS Internal Standards
GFAA Post Digestion Spikes
1 Reported Results
Calculation Verification (Full validation only)

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[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

SDGs MC25, MC71 & MC72: The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The majority of the coolers were received at the laboratory at temperatures outside of these limits, with temperatures ranging from 1.8° to 3.8°C. These temperature outliers did not impact data quality and no action was taken.

Calibration Verification

SDG MC71: The recovery for arsenic was greater than the upper control limit of 110% for the calibration verification (CCV) sample analyzed on 1/3/2008 at 13:17. The associated samples were re-analyzed and no action was necessary.

CRDL Standards

Contract required detection limit (CRDL) standards were analyzed at the beginning of each analytical sequence. For recovery values greater than upper control limit of 130%, positive results less than two times the CRDL were estimated (J-14) to indicate a potential high bias. For recovery values less than the lower control limit of 70%, positive results less than twice the CRDL and non-detects were estimated (J/UJ-14) to indicate a potential low bias. The following outliers were noted:

SDG MC25: iron (64%) – Two CRDL standards were analyzed, the initial standard was in control but the second analysis yielded a recovery below the control limit. As the samples were analyzed closer to the second CRDL standard, results were estimated (J/UJ-14) to indicate a potential low bias.

SDGs MC71 & MC72: zinc (63%) – Associated results were greater than the action level and no qualification of data was required.

SDG MC76: arsenic (136%) – Associated positive results were greater than the action level and no qualification of data was required.

Laboratory Blanks

SDG MC76: Zinc was detected in the method blank at a level greater than the method detection limits (MDL). To evaluate the effect on the sample data, an action level of five times the blank concentration was established. All associated results were greater than the action level; no qualification of data was required.

Field Blanks

SDG MC25: One field blank, RINSATE-071211, was submitted with this SDG. Iron was detected in this blank at a level greater than the MDL. In order to establish the effect on the field samples, an action level of five times the blank concentration was established. All associated positive sample results were less than the action level and were qualified as not detected (U-6).

Matrix Spikes (MS)

Matrix spike samples (MS) were analyzed at the proper frequency of one per 20 samples or one per batch; whichever was more frequent. The percent recovery (%R) values were within the control limits of 75%-125% with the exceptions noted below. For %R values greater than 125%, the associated positive results were estimated (J) to indicate a possible high bias. No action was taken for non-detects. For %R values less than 75%, the associated positive results and detection limits were qualified as estimated (J/UJ) to indicate a possible low bias.

SDG MC71: The MS %R value for copper (35%) was less than the lower control limit of 75%. All associated results were estimated (J-8) to indicate a potential low bias.

SDG MC76: There was insufficient sample mass available to analyze a matrix spike for the tissue samples. Method accuracy was evaluated using the laboratory control sample recoveries.

Laboratory Duplicates

SDG MC76: There was insufficient sample mass available to analyze a laboratory duplicate for the tissue samples. Laboratory precision could not be assessed.

Reported Results

SDG MC25: Sample MW3-071212 required additional dilutions due to matrix effects. The reporting limits for total and dissolved metals were elevated accordingly.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory duplicate relative percent difference values indicated acceptable precision. Accuracy was also acceptable, as demonstrated by the MS and laboratory control sample %R values, except as previously noted.

Detection limits were elevated based on field blank contamination. Data were estimated based on CRDL and MS recovery outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Conventional Parameter Analyses

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington.

SDG	Number of Samples	Validation Level
MC71	10 Sediment	Summary
MF81	3 Sediment	Summary

The analytical tests that were performed are summarized below:

Parameter	Method
Total Solids (TS)	160.3
Total Organic Carbon (TOC)	Plumb 1981

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

- [1] Holding Times and Sample Preservation
- Initial Calibration
- Calibration Verification
- Laboratory Blanks
- Laboratory Control Samples (LCS)
- Matrix Spikes (MS)
- Laboratory Replicates
- Field Duplicates

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[1] ***Quality control results are discussed below, but no data were qualified.***

[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. One sample cooler was receive at a temperature of 1.8°C. This temperature outlier did not impact data quality and no action was taken.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory replicate relative percent difference values and percent relative standard deviation values indicated acceptable precision. Accuracy was also acceptable, as demonstrated by the matrix spike and laboratory control sample recoveries.

No data were qualified for any reason. All data, as reported, are acceptable for use.

Qualified Data Summary Table
SAIC
Irondale

SDG	Sample ID	Laboratory ID	Method	Analyte	Value	Unit	Lab Quailifier	Validator Qualifier	Validator Reason Code
MB44	ID-50-SD	07-26515-MB44A	ASTM D422	Percent retained 32 micron	8.3	Percent		J	9
MB44	ID-51-SD	07-26516-MB44B	ASTM D422	Percent retained 32 micron	6.0	Percent		J	9
MB44	ID-52-SD	07-26517-MB44C	ASTM D422	Percent retained 32 micron	6.1	Percent		J	9
MB44	ID-53-SD	07-26518-MB44D	ASTM D422	Percent retained 32 micron	5.9	Percent		J	9
MB44	ID-54-SD	07-26519-MB44E	ASTM D422	Percent retained 32 micron	2.3	Percent		J	9
MB44	ID-56-SD	07-26520-MB44F	ASTM D422	Percent retained 32 micron	2.7	Percent		J	9
MB44	ID-57-SD	07-26521-MB44G	ASTM D422	Percent retained 32 micron	5.1	Percent		J	9
MB44	ID-59-SD	07-26522-MB44H	ASTM D422	Percent retained 32 micron	34.2	Percent		J	9
MB44	ID-59-D	07-26523-MB44I	ASTM D422	Percent retained 32 micron	12.0	Percent		J	9
MB44	ID-59-T	07-26524-MB44J	ASTM D422	Percent retained 32 micron	10.8	Percent		J	9
MB44	ID-58-SD	07-26525-MB44K	ASTM D422	Percent retained 32 micron	1.1	Percent		J	9
MB44	ID-55-SD	07-26526-MB44L	ASTM D422	Percent retained 32 micron	5.1	Percent		J	9
MB44	ID-04-SD	07-26527-MB44M	ASTM D422	Percent retained 32 micron	0.4	Percent		J	9
MB44	ID-50-SD	07-26515-MB44A	E160.3	Total Solids	67.00	Percent		J	1
MB44	ID-51-SD	07-26516-MB44B	E160.3	Total Solids	72.90	Percent		J	1
MB44	ID-52-SD	07-26517-MB44C	E160.3	Total Solids	70.90	Percent		J	1
MB44	ID-53-SD	07-26518-MB44D	E160.3	Total Solids	58.40	Percent		J	1
MB44	ID-54-SD	07-26519-MB44E	E160.3	Total Solids	68.80	Percent		J	1
MB44	ID-56-SD	07-26520-MB44F	E160.3	Total Solids	58.00	Percent		J	1
MB44	ID-57-SD	07-26521-MB44G	E160.3	Total Solids	64.00	Percent		J	1
MB44	ID-50-SD	07-26515-MB44A	E160.4	Total Volatile Solids	2.32	Percent		J	1
MB44	ID-51-SD	07-26516-MB44B	E160.4	Total Volatile Solids	2.34	Percent		J	1
MB44	ID-52-SD	07-26517-MB44C	E160.4	Total Volatile Solids	1.66	Percent		J	1
MB44	ID-53-SD	07-26518-MB44D	E160.4	Total Volatile Solids	2.93	Percent		J	1
MB44	ID-54-SD	07-26519-MB44E	E160.4	Total Volatile Solids	1.37	Percent		J	1
MB44	ID-56-SD	07-26520-MB44F	E160.4	Total Volatile Solids	3.27	Percent		J	1
MB44	ID-57-SD	07-26521-MB44G	E160.4	Total Volatile Solids	2.28	Percent		J	1
MB44	ID-50-SD	07-26515-MB44A	E350.1M	N-Ammonia	10.9	mg-N/kg		J	1
MB44	ID-51-SD	07-26516-MB44B	E350.1M	N-Ammonia	19.0	mg-N/kg		J	1
MB44	ID-52-SD	07-26517-MB44C	E350.1M	N-Ammonia	12.6	mg-N/kg		J	1
MB44	ID-53-SD	07-26518-MB44D	E350.1M	N-Ammonia	30.0	mg-N/kg		J	1
MB44	ID-54-SD	07-26519-MB44E	E350.1M	N-Ammonia	12.8	mg-N/kg		J	1
MB44	ID-56-SD	07-26520-MB44F	E350.1M	N-Ammonia	12.1	mg-N/kg		J	1
MB44	ID-57-SD	07-26521-MB44G	E350.1M	N-Ammonia	7.62	mg-N/kg		J	1
MB44	ID-50-SD	07-26515-MB44A	E376.2	Sulfide	126	mg/kg		J	1,8
MB44	ID-51-SD	07-26516-MB44B	E376.2	Sulfide	371	mg/kg		J	1,8
MB44	ID-52-SD	07-26517-MB44C	E376.2	Sulfide	690	mg/kg		J	1,8
MB44	ID-53-SD	07-26518-MB44D	E376.2	Sulfide	73.7	mg/kg		J	1,8
MB44	ID-54-SD	07-26519-MB44E	E376.2	Sulfide	1130	mg/kg		J	1,8
MB44	ID-56-SD	07-26520-MB44F	E376.2	Sulfide	290	mg/kg		J	1,8
MB44	ID-57-SD	07-26521-MB44G	E376.2	Sulfide	201	mg/kg		J	1,8
MB44	ID-59-SD	07-26522-MB44H	E376.2	Sulfide	110	mg/kg		J	8

Qualified Data Summary Table
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SDG	Sample ID	Laboratory ID	Method	Analyte	Value	Unit	Lab Quailifier	Validator Qualifier	Validator Reason Code
MB44	ID-59-D	07-26523-MB44I	E376.2	Sulfide	54.1	mg/kg		J	8
MB44	ID-59-T	07-26524-MB44J	E376.2	Sulfide	139	mg/kg		J	8
MB44	ID-58-SD	07-26525-MB44K	E376.2	Sulfide	131	mg/kg		J	8
MB44	ID-55-SD	07-26526-MB44L	E376.2	Sulfide	148	mg/kg		J	8
MB44	ID-04-SD	07-26527-MB44M	E376.2	Sulfide	707	mg/kg		J	8
MB44	ID-50-SD	07-26515-MB44A	Plumb,1981	Total Organic Carbon	1.51	Percent		J	8
MB44	ID-51-SD	07-26516-MB44B	Plumb,1981	Total Organic Carbon	1.18	Percent		J	8
MB44	ID-52-SD	07-26517-MB44C	Plumb,1981	Total Organic Carbon	0.564	Percent		J	8
MB44	ID-53-SD	07-26518-MB44D	Plumb,1981	Total Organic Carbon	1.63	Percent		J	8
MB44	ID-54-SD	07-26519-MB44E	Plumb,1981	Total Organic Carbon	1.06	Percent		J	8
MB44	ID-56-SD	07-26520-MB44F	Plumb,1981	Total Organic Carbon	2.15	Percent		J	8
MB44	ID-57-SD	07-26521-MB44G	Plumb,1981	Total Organic Carbon	1.13	Percent		J	8
MB44	ID-59-SD	07-26522-MB44H	Plumb,1981	Total Organic Carbon	0.736	Percent		J	8
MB44	ID-59-D	07-26523-MB44I	Plumb,1981	Total Organic Carbon	1.29	Percent		J	8
MB44	ID-59-T	07-26524-MB44J	Plumb,1981	Total Organic Carbon	0.909	Percent		J	8
MB44	ID-58-SD	07-26525-MB44K	Plumb,1981	Total Organic Carbon	1.18	Percent		J	8
MB44	ID-55-SD	07-26526-MB44L	Plumb,1981	Total Organic Carbon	0.379	Percent		J	8
MB44	ID-04-SD	07-26527-MB44M	Plumb,1981	Total Organic Carbon	0.388	Percent		J	8
MB44	ID-50-SD	07-26515-MB44A	SW6010B	Chromium	16.0	mg/kg		J	8
MB44	ID-50-SD	07-26515-MB44A	SW6010B	Zinc	30	mg/kg		J	8
MB44	ID-51-SD	07-26516-MB44B	SW6010B	Chromium	14.7	mg/kg		J	8
MB44	ID-51-SD	07-26516-MB44B	SW6010B	Zinc	29	mg/kg		J	8
MB44	ID-52-SD	07-26517-MB44C	SW6010B	Chromium	17.6	mg/kg		J	8
MB44	ID-52-SD	07-26517-MB44C	SW6010B	Zinc	35	mg/kg		J	8
MB44	ID-53-SD	07-26518-MB44D	SW6010B	Chromium	15.1	mg/kg		J	8
MB44	ID-53-SD	07-26518-MB44D	SW6010B	Zinc	28	mg/kg		J	8
MB44	ID-54-SD	07-26519-MB44E	SW6010B	Chromium	8.4	mg/kg		J	8
MB44	ID-54-SD	07-26519-MB44E	SW6010B	Zinc	16	mg/kg		J	8
MB44	ID-56-SD	07-26520-MB44F	SW6010B	Chromium	16.9	mg/kg		J	8
MB44	ID-56-SD	07-26520-MB44F	SW6010B	Zinc	36	mg/kg		J	8
MB44	ID-57-SD	07-26521-MB44G	SW6010B	Chromium	9.6	mg/kg		J	8
MB44	ID-57-SD	07-26521-MB44G	SW6010B	Zinc	19	mg/kg		J	8
MB44	ID-59-SD	07-26522-MB44H	SW6010B	Chromium	22.1	mg/kg		J	8
MB44	ID-59-SD	07-26522-MB44H	SW6010B	Zinc	39	mg/kg		J	8
MB44	ID-59-D	07-26523-MB44I	SW6010B	Chromium	23.7	mg/kg		J	8
MB44	ID-59-D	07-26523-MB44I	SW6010B	Zinc	36	mg/kg		J	8
MB44	ID-58-SD	07-26525-MB44K	SW6010B	Chromium	11.8	mg/kg		J	8
MB44	ID-58-SD	07-26525-MB44K	SW6010B	Zinc	21	mg/kg		J	8
MB44	ID-55-SD	07-26526-MB44L	SW6010B	Chromium	10.6	mg/kg		J	8
MB44	ID-55-SD	07-26526-MB44L	SW6010B	Zinc	18	mg/kg		J	8
MB44	ID-04-SD	07-26527-MB44M	SW6010B	Chromium	18.5	mg/kg		J	8
MB44	ID-04-SD	07-26527-MB44M	SW6010B	Zinc	68	mg/kg		J	8

Qualified Data Summary Table
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SDG	Sample ID	Laboratory ID	Method	Analyte	Value	Unit	Lab Quailifier	Validator Qualifier	Validator Reason Code
MC25	MW2-071212	07-27013-MC25A	LVI SW8270D SIM	Fluoranthene	0.014	ug/L	B	U	7
MC25	MW2-071212	07-27013-MC25A	LVI SW8270D SIM	Naphthalene	0.011	ug/L	B	U	7
MC25	MW3-071212	07-27014-MC25B	LVI SW8270D SIM	Naphthalene	0.013	ug/L	B	U	7
MC25	MW4-071212	07-27015-MC25C	LVI SW8270D SIM	Naphthalene	0.012	ug/L	B	U	7
MC25	MW5-071212	07-27016-MC25D	LVI SW8270D SIM	Naphthalene	0.012	ug/L	B	U	7
MC25	RINSATE-071211	07-27017-MC25E	LVI SW8270D SIM	Naphthalene	0.023	ug/L	B	U	7
MC25	MW2-071212	07-27013-MC25A	SW6010B	Iron	230	ug/l		U	6
MC25	MW3-071212	07-27014-MC25B	SW6010B	Iron		ug/l	U	UJ	14
MC25	MW4-071212	07-27015-MC25C	SW6010B	Iron	120	ug/l		UJ	6,14
MC25	MW5-071212	07-27016-MC25D	SW6010B	Iron	90	ug/l		UJ	6,14
MC25	RINSATE-071211	07-27017-MC25E	SW6010B	Iron	150	ug/l		J	14
MC25	MW2-071212	07-27018-MC25F	SW6010B	Iron		ug/l	U	UJ	14
MC25	MW3-071212	07-27019-MC25G	SW6010B	Iron		ug/l	U	UJ	14
MC25	MW4-071212	07-27020-MC25H	SW6010B	Iron	70	ug/l		UJ	6,14
MC25	MW5-071212	07-27021-MC25I	SW6010B	Iron		ug/l	U	UJ	14
MC71	GEISS1-071213-.25	07-27305-MC71S	SW6010B	Copper	205	mg/kg		J	8
MC71	GEISS1-071213-1.5	07-27306-MC71T	SW6010B	Copper	103	mg/kg		J	8
MC71	GEISS2-071213-1.5	07-27307-MC71U	SW6010B	Copper	42	mg/kg		J	8
MC71	GEISS3-071213-1	07-27308-MC71V	SW6010B	Copper	46	mg/kg		J	8
MC71	TP32-071210-1.5	07-27309-MC71W	SW6010B	Copper	5810	mg/kg		J	8
MC71	TP32-071210-5	07-27310-MC71X	SW6010B	Copper	122	mg/kg		J	8
MC71	TP33-071211-2	07-27313-MC71AA	SW6010B	Copper	321	mg/kg		J	8
MC71	TP34-071210-1.5	07-27315-MC71AC	SW6010B	Copper	43	mg/kg		J	8
MC71	TP34-071210-5	07-27316-MC71AD	SW6010B	Copper	144	mg/kg		J	8
MC71	TP37-071212-1.5	07-27330-MC71AR	SW6010B	Copper	8.7	mg/kg		J	8
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Benzyl Alcohol		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	2,4-Dimethylphenol		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	4-Methylphenol		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	1,4-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Phenol		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	bis(2-Ethylhexyl)phthalate		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Di-n-Octyl phthalate		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Hexachlorobenzene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Anthracene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Pyrene	770	ug/kg		J	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Dimethylphthalate		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Dibenzofuran		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Benzo(g,h,i)perylene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Indeno(1,2,3-cd)pyrene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Benzo(b)fluoranthene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Fluoranthene	280	ug/kg		J	1

Qualified Data Summary Table
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SDG	Sample ID	Laboratory ID	Method	Analyte	Value	Unit	Lab Quailifier	Validator Qualifier	Validator Reason Code
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Benzo(k)fluoranthene	130	ug/kg		J	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Acenaphthylene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Chrysene	800	ug/kg		J	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Benzo(a)pyrene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	1,3-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Benzo(a)anthracene	310	ug/kg		J	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Benzoic Acid		ug/kg	U	UJ	1,5B
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Acenaphthene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Diethylphthalate		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Di-n-Butylphthalate		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Phenanthrene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Butylbenzylphthalate		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Fluorene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Hexachlorobutadiene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Pentachlorophenol		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	1-Methylnaphthalene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	Naphthalene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	2-Methylnaphthalene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	2-Methylphenol		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	PSDDA SW8270D	1,2-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Benzyl Alcohol		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	2,4-Dimethylphenol		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	4-Methylphenol		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	1,4-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Phenol		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	bis(2-Ethylhexyl)phthalate		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Di-n-Octyl phthalate		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Hexachlorobenzene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Anthracene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Pyrene	260	ug/kg		J	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Dimethylphthalate		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Dibenzofuran		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Benzo(g,h,i)perylene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Indeno(1,2,3-cd)pyrene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Benzo(b)fluoranthene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Fluoranthene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Benzo(k)fluoranthene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Acenaphthylene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Chrysene	200	ug/kg		J	1

Qualified Data Summary Table
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SDG	Sample ID	Laboratory ID	Method	Analyte	Value	Unit	Lab Quailifier	Validator Qualifier	Validator Reason Code
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Benzo(a)pyrene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	1,3-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Benzo(a)anthracene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Benzoic Acid		ug/kg	U	UJ	1,5B
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Acenaphthene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Diethylphthalate		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Di-n-Butylphthalate		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Phenanthrene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Butylbenzylphthalate		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Fluorene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Hexachlorobutadiene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Pentachlorophenol		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	1-Methylnaphthalene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	Naphthalene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	2-Methylnaphthalene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	2-Methylphenol		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	PSDDA SW8270D	1,2-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Benzyl Alcohol		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	2,4-Dimethylphenol		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	4-Methylphenol		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	1,4-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Phenol		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	bis(2-Ethylhexyl)phthalate	25	ug/kg		J	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Di-n-Octyl phthalate		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Hexachlorobenzene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Anthracene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Pyrene	40	ug/kg		J	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Dimethylphthalate		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Dibenzofuran		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Benzo(g,h,i)perylene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Indeno(1,2,3-cd)pyrene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Benzo(b)fluoranthene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Fluoranthene	36	ug/kg		J	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Benzo(k)fluoranthene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Acenaphthylene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Chrysene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Benzo(a)pyrene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	1,3-Dichlorobenzene		ug/kg	U	UJ	1

Qualified Data Summary Table
SAIC
Irondale

SDG	Sample ID	Laboratory ID	Method	Analyte	Value	Unit	Lab Quailifier	Validator Qualifier	Validator Reason Code
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Benzo(a)anthracene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Benzoic Acid		ug/kg	U	UJ	1,5B
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Acenaphthene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Diethylphthalate	41	ug/kg		J	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Di-n-Butylphthalate		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Phenanthrene	24	ug/kg		J	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Butylbenzylphthalate		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Fluorene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Hexachlorobutadiene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Pentachlorophenol		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	1-Methylnaphthalene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	Naphthalene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	2-Methylnaphthalene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	2-Methylphenol		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	PSDDA SW8270D	1,2-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	Benzyl Alcohol		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	2,4-Dimethylphenol	140	ug/kg		J	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	1,4-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	Hexachlorobenzene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	Butylbenzylphthalate		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	N-Nitrosodiphenylamine		ug/kg	Y	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	Hexachlorobutadiene		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	Pentachlorophenol		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	2-Methylphenol		ug/kg	U	UJ	1
ME43	SED18-071210-5	08-284-ME43A	SW8270D SIM	1,2-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	Benzyl Alcohol		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	2,4-Dimethylphenol	88	ug/kg		J	1,8
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	1,4-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	Hexachlorobenzene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	Butylbenzylphthalate		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	Hexachlorobutadiene		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	Pentachlorophenol		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	2-Methylphenol		ug/kg	U	UJ	1
ME43	SED20-071210-1.5	08-285-ME43B	SW8270D SIM	1,2-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	Benzyl Alcohol		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	2,4-Dimethylphenol	6.2	ug/kg		J	1

Qualified Data Summary Table
SAIC
Irondale

SDG	Sample ID	Laboratory ID	Method	Analyte	Value	Unit	Lab Quailifier	Validator Qualifier	Validator Reason Code
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	1,4-Dichlorobenzene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	Hexachlorobenzene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	Butylbenzylphthalate		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	Hexachlorobutadiene		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	Pentachlorophenol		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	2-Methylphenol		ug/kg	U	UJ	1
ME43	SED21-071210-5	08-286-ME43C	SW8270D SIM	1,2-Dichlorobenzene		ug/kg	U	UJ	1

EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

WASHINGTON DOE TOXICS CLEANUP PROGRAM
REMEDIAL INVESTIGATION FEASIBLITY STUDY
IRONDALE, WASHINGTON

Prepared for:

SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

GeoEngineers, Inc.
600 Stewart Street, Suite 1700
Seattle, WA 98101

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C4122-7

April 2, 2009

Approved for Release

Christine Ransom
Project Manager
EcoChem, INC.

INTRODUCTION

Basis for the Data Validation

This report summarizes the results of the summary (Level III) data validation performed on groundwater and quality control (QC) sample data for the Washington Department of Ecology – Remedial Investigation Feasibility Study at Irondale, Washington. A complete list of samples is provided in the **Sample Index**. Analytical Resources, Inc., Tukwila, Washington performed all analyses. The analytical methods and EcoChem project chemists are listed below.

Analysis	Method of Analysis	Primary Review	Secondary Review
SVOC-SIM	SW8270D-SIM	Jennifer Newkirk	Eric Strout
Diesel and Residual Range Hydrocarbons	NWTPH-Dx	Linda Holz	Eric Strout
Metals	SW6010B & EPA 200.8	Linda Holz	Christine Ransom

The data validation is based on QC criteria documented in the above listed methods, the *Quality Assurance Project Plan (QAPP) - Investigation/Feasibility Study, Irondale, Washington (2007)*; and *USEPA National Functional Guidelines for Organic* (1999) *and Inorganic (2004) Data Review*.

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

Data qualifier definitions, reason codes, and validation criteria are included as **Appendix A**. **Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem.

SAMPLE INDEX
Irondale - Groundwaters

SDG	Sample ID	Laboratory ID	SVOC-SIM	TPH-Dx	Metals
OH58	MW04-090109	09-1271-OH58A	✓	✓	✓
	MW05-090109	09-1272-OH58B	✓	✓	✓
	MW03-090109	09-1273-OH58C	✓	✓	✓
	MW02-090109	09-1274-OH58D	✓	✓	✓
	MW02-090109-DUPE	09-1275-OH58E	✓	✓	✓
	MW04-090109	09-1276-OH58F			✓
	MW05-090109	09-1277-OH58G			✓
	MW03-090109	09-1278-OH58H			✓
	MW02-090109	09-1279-OH58I			✓
	MW02-090109-DUPE	09-1280-OH58J			✓

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Metals by Methods SW6010B and E200.8

This report documents the review of analytical data from the analyses of groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH58	5 Groundwater	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table:

1 Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
CRDL Standards
Laboratory Blanks
Laboratory Control Samples (LCS)
Matrix Spikes (MS)
Laboratory Duplicates
2 Field Duplicates
Interference Check Samples
Serial Dilutions
1 Reported Results

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[1] *Quality control results are discussed below, but no data were qualified.*

[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Field Duplicates

The relative percent difference (RPD) value is used to assess precision only if both sample results are greater than 5x the RL for a given analyte; otherwise, the difference between the two results is used to evaluate precision. For water matrices, the RPD control limit is 35% or the difference must be less than the RL.

Data for one set of field duplicates were submitted: MW02-090109 and MW02-090109-DUPE. The RPD values for total iron (67.3%) and dissolved copper (52.6%) were greater than the 35% control limit. The total iron and dissolved copper results for these two samples were estimated (J-9).

Reported Results

Some results for dissolved arsenic and nickel were slightly higher than for the total fraction. The results fell within normal analytical precision and no action was necessary.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory and field replicate RPD values indicated acceptable precision, except as noted above. Accuracy was also acceptable, as demonstrated by the matrix spike and laboratory control sample recoveries.

Data were estimated based on a field duplicate precision outlier.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Selected Semivolatiles by EPA Method 8270D-SIM

This report documents the review of analytical data from the analyses of groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH58	5 Groundwater	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

SDG OH58: There was a calibration calculation error in the data submitted by the laboratory. Results were recalculated correctly and a revised hardcopy and electronic data deliverable were submitted.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table:

1 Holding Times and Sample Preservation
GC/MS Instrument Performance Check
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
2 Laboratory Blanks
Field Blanks
Surrogate Compounds
Laboratory Control Samples (LCS)
Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Internal Standards
2 Field Duplicates
Target Analyte List
Reporting Limits
Reported Results

---

[1] ***Quality control results are discussed below, but no data were qualified***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Laboratory Blanks

To assess the impact of each blank contaminant on the reported sample results, an action level is established at five times the concentration reported in the blank. If a contaminant is reported in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-7). If the result is also less than the reporting limit, then the result is elevated to the reporting limit. No action is taken if the sample result is greater than the action level, or for non-detected results.

Method blanks were analyzed at the appropriate frequency. Various target analytes were detected in the method blanks, however, only the following analytes were qualified as not detected in one or more samples.

A total of three naphthalene results were qualified as not-detected (U-7).

Field Duplicates

The relative percent difference (RPD) value is used to assess precision only if both sample results are greater than 5x the RL for a given analyte; otherwise, the difference between the two results is used to evaluate precision. For water matrices, the RPD control limit is 35% or the difference must be less than the RL.

One set of field duplicates (MW02-090109 and MW02-090109-DUPE) were submitted. The benzo(a)pyrene difference value was greater than the reporting limit. The benzo(a)pyrene results were estimated (J/UJ-9) in the parent and duplicate samples.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD), and laboratory control sample recoveries. Precision was also acceptable as demonstrated by the MS/MSD and field duplicate RPD values, with the exception noted above.

Data were estimated based on a field duplicate precision outlier. Data were qualified as not detected based on contamination in the associated method blank.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Diesel and Residual Range Hydrocarbons by Method NWTPH-Dx

This report documents the review of analytical data from the analyses of groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH58	5 Groundwater	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Preservation
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Blanks (Method)
Field Blanks
Surrogate Compounds
Matrix Spike/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Samples (LCS/LCSD)
2 Field Duplicates
Target Analyte List
Reporting Limits
Reported Results
Compound Identification and Quantification

---

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Field Duplicates

The relative percent difference (RPD) value is used to assess precision only if both sample results are greater than 5x the reporting limit (RL) for a given analyte; otherwise, the difference between the two results is used to evaluate precision. For water matrices, the RPD value control limit is 35% or the difference must be less than the RL.

One set of field duplicates, MW02-090109 and MW02-090109-DUPE, was submitted. The difference of the diesel range hydrocarbon results was greater than the RL. The diesel results were estimated (J/UJ-9) in these two samples.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample percent recovery (%R) values. Precision was also acceptable, as demonstrated by the field duplicate and MS/MSD RPD values, with the exception noted above.

Data were estimated based on a field duplicate precision outlier.

All data, as qualified, are acceptable for use.

EcoChem, INC.
Environmental Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS REASON CODES AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification”.
NJ	The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with “R” and “DNR” only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives
22	Elevated Detection Limit Due to Interference (i.e., laboratory, chemical and/or matrix)

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	<u>Water</u>: J(+)/UJ(-) if ext. > 7 and < 21 days J(+)/R(-) if ext > 21 days (EcoChem PJ) <u>Solids/Wastes</u>: J(+)/UJ(-) if ext. > 14 and < 42 days J(+)/R(-) if ext. > 42 days (EcoChem PJ) J(+)/UJ(-) if analysis >40 days	1
Tuning	DFTPP Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	(EcoChem PJ, see TM-06) J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	(EcoChem PJ, see TM-06) If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Field Blanks (Not Required)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS low conc. H2O SVOA	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS regular SVOA (H2O & solid)	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R <LCL J(+)/R(-) if %R < 10% (EcoChem PJ)	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Minimum of 3 acid and 3 base/neutral compounds Use method acceptance criteria	Do not qualify if only 1 acid and/or 1 B/N surrogate is out unless <10% J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10%	13
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT>30 seconds, narrate and Notify PM	19
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants See Technical Director for ID issues	4
Quantitation/ Identification	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	See Technical Director if outliers	14 21 (false +)

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx,
June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X (EcoChem PJ)	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if $R^2 < 0.990$ J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 85% to 115%	Narrate if frequency not met. J(+)/UJ(-) if %R < 85% J(+) if %R >115%	5B
Method Blank	At least one per batch (≤10 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. Use PJ if only one %R outlier	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% (EcoChem PJ)	10

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. (EcoChem PJ)	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP EcoChem default: water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. (See TM-04)	11

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration Tissues: Frozen	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r > 0.995	J(+)/UJ(-) if r < 0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		(Refer to TM-02 for additional information)
			7

Reporting Limit Standard	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+) < 2x RL if %R <50% (< 30% Sb, Pb, Tl) J(+) < 2x RL, UJ(-) if %R 50-69% (30-49% Sb, Pb,Tl) J(+) < 2x RL if %R 130-180% (150-200% Sb, Pb, Tl) R(+) < 2x RL if %R > 180% (200% Sb, Pb, Tl)	14
Interference Check Samples (ICSA/ICSAB)	ICSAB %R 80 - 120% for all spiked elements | ICSA | < MDL for all unspiked elements except: K, Na	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R= 50 to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spikes	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R > 125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R < 30% or J(+)/UJ(-) if Post Spike %R 75-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples >RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2x RL for solids) qualify all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample conc. > 50x MDL	J(+)/UJ(-) if %D >10% qualify all samples in batch	16
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Tune	Prior to ICAL monitoring compounds analyzed 5 times wih Std Dev. ≤ 5% mass calibration <0.1 amu from True Value Resolution < 0.9 AMU @ 10% peak height or <0.75 amu @ 5% peak height	Use Professional Judgment to evaluate tune J(+)/UJ(-) if tune criteria not met	5A
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r>0.995	J(+)/UJ(-) if r<0.995 (for multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Reporting Limit Standard (CRI)	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Co,Mn, Zn)	R(-),(+) < 2x RL if %R < 50% (< 30% Co,Mn, Zn) J(+) < 2x RL, UJ(-) if %R 50-69% (30%-49% Co,Mn, Zn) J(+) < 2x RL if %R 130%-180% (150%-200% Co,Mn, Zn) R(+) < 2x RL if %R > 180% (200% Co, Mn, Zn)	14
Interference Check Samples (ICSA/ICSAB)	Required by SW 6020, but not 200.8 ICSAB %R 80% - 120% for all spiked elements | ICSA | < IDL (MDL) for all unspiked elements	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R = 50% to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch Blank Spike: %R within 80%-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 75-125% for samples where results do not exceed 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% or J(+)/UJ(-) if Post Spike %R 75%-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, Spike parent sample at 2x the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5 x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample values > 50x MDL	J(+)/UJ(-) if %D >10% All samples in batch	16
Internal Standards	Every sample SW6020: 60%-125% of cal blank IS 200.8: 30%-120% of cal blank IS	J (+)/UJ (-) all analytes associated with IS outlier	19
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem, INC.
Environmental Data Quality

APPENDIX B
QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary
Irondale - Groundwaters

SDG	SAMPLE ID	LAB ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
OH58	MW02-090109	09-1274-OH58D	Diesel Range Hydrocarbons	0.72	mg/L		J	9
OH58	MW02-090109-DUPE	09-1275-OH58E	Diesel Range Hydrocarbons		mg/L	U	UJ	9
OH58	MW02-090109	09-1274-OH58D	Iron	1430	ug/l		J	9
OH58	MW02-090109-DUPE	09-1275-OH58E	Iron	710	ug/l		J	9
OH58	MW02-090109	09-1279-OH58I	Copper	12	ug/l		J	9
OH58	MW02-090109-DUPE	09-1280-OH58J	Copper	7	ug/l		J	9
OH58	MW04-090109	09-1271-OH58A	Naphthalene	0.012	ug/L	B	U	7
OH58	MW05-090109	09-1272-OH58B	Naphthalene	0.012	ug/L	B	U	7
OH58	MW03-090109	09-1273-OH58C	Naphthalene	0.010	ug/L	B	U	7
OH58	MW02-090109	09-1274-OH58D	Benzo(a)pyrene		ug/L	U	UJ	9
OH58	MW02-090109-DUPE	09-1275-OH58E	Benzo(a)pyrene	0.032	ug/L		J	9

APPENDIX C

SAIC SUBTIDAL DATA REPORT (SAIC REPORT)

SAMPLE CONTAINER LOGBOOK

Irondale Iron and Steel Plant
Sediment Quality Investigation
Irondale, WA

November/December, 2007

Science Applications
International Corporation

Sample Container Logbook

Page 1

	Station: ID-50
Project Number: 01-0236-00-0984-300	**Time Collected:** 1035
Crew: TH, WH, LD	**Date:** 11/30/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
377	ID-50-7X	Bioassay	Newfields
378	"	"	
004	ID-50-SD	Conventionals	~~CAS~~ ARI
001	"	Total Sulfides	"
003	"	SVOC/PCB/TPH-DX	"
002	"	Metals	"
005	"	Archive	"

Notes:

Completed by:

Sample Container Logbook

	Station: ID-51
Project Number: 01-0236-00-0984-300	**Time Collected:** 1120
Crew: TH, WH, CD	**Date:** 11/30/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
379	ID-51-TX	Bioassays	Newfields
380	"	"	"
008	ID-51-SD	Conventionals	~~CAS~~ ARI
006	"	Total Sulfides	"
009	"	SVOC/PCB/NWTPH-Dx	"
007	"	Metals	"
010	"	Archive	"

Notes:

SAIC

Completed by:

Sample Container Logbook

	Station: ID-52
Project Number: 01-0236-00-0984-300	**Time Collected:** 1151
Crew: TH, ~~BW~~, LD, WH	**Date:** 11/30/7
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
381	ID-52-TX	Bioassays	Newfields
382	"	"	"
014	ID-52-SD	Conventionals	ARI
011	"	Total Sulfides	"
013	"	SVOC/PCB/TPH-Dx	"
012	"	Metals	"
015	"	Archive	"

Notes:

Completed by:

Sample Container Logbook

	Station: ID-53
Project Number: 01-0236-00-0984-300	**Time Collected:** 1254
Crew: TH, WH, LD	**Date:** 11/30/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
383	ID-53-TX	Bioassays	Newfields
384	"	"	"
~~018~~ 019	ID-53-SD	Conventionals	ARI
016	"	Total Sulfides	"
018	"	SVOC/PCB/NWTPH-DX	"
017	"	Metals	"
020	"	Archive	"

Notes:

Completed by:

Sample Container Logbook

	Station: ID-54
Project Number: 01-0236-00-0984-300	**Time Collected:** ~~11/30/07~~ 1323
Crew: TH, BD, LD, WH	**Date:** 11/30/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
385	ID-54-TX	Bioassays	Newfields
386	"	"	"
024	ID-54-SD	Conventionals	ARI
021	"	Total Sulfides	"
023	"	SVOC/PCB/NWTPH-Dx	"
022	"	Metals	"
025	"	Archive	"

Notes:

Completed by:

Sample Container Logbook

	Station: ID-56
Project Number: 01-0236-00-0984-300	**Time Collected:** 1411
Crew: TH, CD, WH	**Date:** 11/30/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
387	ID-56-TX	Bioassay	Newfields
388	"	"	"
029	ID-56-SD	Conventionals	ARI
026	"	Total Sulfides	"
028	"	SVOC/PCB/NWTPH-Dx	"
027	"	Metals	"
030	"	Archive	"

Notes:

Completed by:

Sample Container Logbook

	Station: ID-57
Project Number: 01-0236-00-0984-300	Time Collected: 1437
Crew: TH, CD, WH	Date: 11/30/7
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
430 ~~389~~	ID-57-TX	Bioassays	Newfields
431 ~~390~~	"	"	"
034	ID-57-SD	Conventionals	ARI
031	"	Total Sulfides	"
033	"	SVOC/PCB/NWTPH-DX	"
032	"	Metals	"
035	"	Archive	"

Notes:

Completed by:

Sample Container Logbook

	Station: ID-59-TX
Project Number: 01-0236-00-0984-300	**Time Collected:** 09:25
Crew: TH, LD, WA	**Date:** 12/7/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
~~ID-59-TX~~			wD
~~ID-59-TX~~			wD
840	ID-59-TX	BioAssay	Newfields
841	ID-59-TX	BioAssay	Newfields
845	ID-59-SD	Conventionals	ARI
846	"	Total Sulfides	
847	"	SVOCs, PCBs, NWTPH-Dx	
848	"	Metals	
849	"	Archive	
850	ID-59-D	Conventionals	
851	"	Total Sulfides	
852	"	SVOCs, PCBs, NWTPH-Dx	
853	"	Metals	
854	ID-59-T	Conventionals	
855	"	Total Sulfides	

Notes:

Completed by:

Sample Container Logbook

	Station: ID-58
Project Number: 01-0236-00-0984-300	**Time Collected:** 09:58
Crew: TH, LD, WH	**Date:** 12/7/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
838	ID-58-TX	Bio Assay	Newfields
839	"	"	"
856	ID-58-SD	Conventionals	ARI
857	"	Total Sulfides	"
858	"	SVOCs, PCBs, NWTPH-Dx	"
859	"	Metals	"
860	"	Archive	"

Notes:

Completed by:

Sample Container Logbook

	Station: ID-55
Project Number: 01-0236-00-0984-300	**Time Collected:** 10:45
Crew: LD, TH, WH	**Date:** 12/7/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
842	ID-55-TX	BioAssay	NewFields
843	"	"	"
861	ID-55-SD	Conventionals	ARI
862	"	Total Sulfides	"
863	"	SVOCs, PCBs, NWTPH-Dx	"
864	"	Metals	"
865	"	Archive	"

Notes:

Completed by:

Sample Container Logbook

	Station: ID-04
Project Number: 01-0236-00-0984-300	**Time Collected:** 11:47
Crew: TH, CD, WA	**Date:** 12/7/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
WP ~~ID-04~~ 866	ID-04-SD	Conventionals	ARI
867	"	Total Sulfides	"
868	"	SVOC, PCB, NWTPH-Dx	"
869	"	Metals	"
870	"	Archive	"

Notes:

Completed by:

Sample Container Logbook

	Station: ID-00
Project Number: 01-0236-00-0984-300	**Time Collected:** 12:15
Crew: TH, LD, WH	**Date:** 12/7/07
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
871	ID-00-RB	SVOC, PCB, NWTPH-Dx Rinsate Blank	ARI
872	"	"	"
873	"	"	"
874	"	"	"
875	"	Rinsate Blank Metals	"
876	ID-00-ER	SVOC, PCB, NWTPH-Dx Equip. Rinsate	"
877	"	"	"
878	"	"	"
879	"	"	"
880	"	metals Equip. Rinsate	"

Notes:

SAIC

Completed by:

EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

WASHINGTON DOE TOXICS CLEANUP PROGRAM
REMEDIAL INVESTIGATION FEASIBLITY STUDY
IRONDALE, WASHINGTON

Prepared for:

SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C4122-5

March 20, 2008

Approved for Release

Christine Ransom
Project Manager
EcoChem, INC.

INTRODUCTION

Basis for the Data Validation

This report summarizes the results of the summary (Level III) data validation performed on sediment, field blank, and quality control (QC) sample data for the Washington Department of Ecology – Remedial Investigation Feasibility Study at Irondale, Washington. A complete list of samples is provided in the **Sample Index**. Analytical Resources, Inc., Tukwila, Washington performed all analyses. The analytical methods and EcoChem project chemists are listed below.

Analysis	**Method of Analysis**	**Primary Review**	**Secondary Review**
Semivolatile Organic Compounds (SVOC)	EPA Method 8270D	Mark Lybeer	Mark Brindle
Polycyclic Aromatic Hydrocarbons (PAH)	EPA Method 8270D-SIM	Mark Lybeer	Mark Brindle
PCB Aroclors	SW8082	Mark Lybeer	Mark Brindle
Diesel and Residual Range Hydrocarbons	NWTPH-Dx	Mark Lybeer	Mark Brindle
Metals	SW6010B, EPA 200.8, and SW7470A	Jennifer Newkirk	Christine Ransom
Conventionals[1]	various	Jennifer Newkirk	Christine Ransom

The data validation is based on QC criteria documented in the above listed methods, the *Quality Assurance Project Plan (QAPP) - Investigation/Feasibility Study, Irondale, Washington (2007)*; and *USEPA National Functional Guidelines for Organic* (1999) *and Inorganic (2004) Data Review*. The QC criteria are summarized in **Appendix A.**

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

Data qualifier definitions and Data Validation Criteria Tables are included as **Appendix A. Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem.

SAMPLE INDEX
Irondale
SDG MB44

SAMPLE ID	LAB ID	SVOC	SVOC-SIM	PCB	TPH-Dx	METALS	CONV
ID-50-SD	07-26515-MB44A	X	X	X	X	X	X
ID-51-SD	07-26516-MB44B	X	X	X	X	X	X
ID-52-SD	07-26517-MB44C	X	X	X	X	X	X
ID-53-SD	07-26518-MB44D	X	X	X	X	X	X
ID-54-SD	07-26519-MB44E	X	X	X	X	X	X
ID-56-SD	07-26520-MB44F	X	X	X	X	X	X
ID-57-SD	07-26521-MB44G	X	X	X	X	X	X
ID-59-SD	07-26522-MB44H	X	X	X	X	X	X
ID-59-D	07-26523-MB44I	X	X	X	X	X	X
ID-59-T	07-26524-MB44J						X
ID-58-SD	07-26525-MB44K	X	X	X	X	X	X
ID-55-SD	07-26526-MB44L	X	X	X	X	X	X
ID-04-SD	07-26527-MB44M	X	X	X	X	X	X
ID-00-RB	07-26528-MB44N	X	X	X	X	X	
ID-00-ER	07-26529-MB44O	X	X	X	X	X	

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Semivolatiles by EPA Method 8270C

This report documents the review of analytical data from the analyses of sediment samples, water samples, and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
MB44	12 Sediment & 2 Rinsate Blanks	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

2 Holding Times and Sample Receipt
GC/MS Instrument Performance Check
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Laboratory Blanks
1 Field Blanks
1 Surrogate Compounds
2 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Samples (LCS/LCSD)
Internal Standards
1 Field Duplicates
Target Analyte List
Reporting Limits (MDL and MRL)
Reported Results
Calculation Verification (Full validation only)

---

[1] *Quality control results are discussed below, but no data were qualified*
[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Receipt

Seven (7) samples (listed below) were extracted three (3) days outside of the holding time criteria of 14 days. The positive results and reporting limits were qualified as estimated (J/UJ-1) in these samples.

ID-50-SD
ID-51-SD
ID-52-SD
ID-53-SD
ID-54-SD
ID-56-SD
ID-57-SD

Field Blanks

Laboratory method blanks are used to evaluate all associated field blanks. Any remaining positive results in the field blanks are used to evaluate the associated samples.

Two rinsate blanks, ID-00-RB and ID-00-ER, were included in this data package. There was a positive result for benzyl alcohol in the rinsate blank ID-00-RB. There were no positive results for this compound in the associated samples. No qualifiers were required.

Surrogate Compounds

All surrogate percent recovery (%R) values were acceptable, with the exceptions noted below. Note that one surrogate outlier per fraction is permitted.

The %R values for d14-p-terphenyl and 2,4,6-tribromophenol were greater than the upper control limits in Sample ID-53-SD. As one surrogate outlier per fraction is permitted, no qualifiers were required.

The %R value for 2,4,6-tribromophenol was greater than the upper control limit in the laboratory control sample (LCS) extracted on 12/17/07. No action is taken for QC samples.

Matrix Spike/Matrix Spike Duplicates

There was no recovery for benzyl alcohol for the matrix spike/ matrix spike duplicates (MS/MSD) performed on Sample ID-58-SD. Benzyl alcohol was not detected in this sample; the reporting limit was rejected (R-8) due to the extremely low bias.

Field Duplicates

Note that the relative percent difference (RPD) value is used to assess precision only if both sample results are greater than 5x the reporting limit for a given analyte, otherwise the difference between the two results is used to evaluate precision. For solid matrices, the RPD control limit is 50% or the difference must be less than 2x the reporting limit.

One set of field duplicates were submitted with this SDG: ID-59-SD & ID-59-D. All field precision criteria were met.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, MS/MSD, and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the MS/MSD, LCS/LCSD, and field duplicate RPD values.

Data were estimated because of exceeded holding times and a continuing calibration percent difference outlier.

One result for benzyl alcohol was rejected based on MS/MSD %R values less than 10%.

Data that has been rejected should not be used for any purpose. All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Selected Semivolatiles by EPA Method 8270C-SIM

This report documents the review of analytical data from the analyses of sediment samples, water samples, and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
MB44	12 Sediment & 2 Rinsate Blank	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

- 2 Holding Times and Sample Receipt
- GC/MS Instrument Performance Check
- Initial Calibration (ICAL)
- 2 Continuing Calibration (CCAL)
- Laboratory Blanks
- 1 Field Blanks
- Surrogate Compounds
- 2 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
- Laboratory Control Samples (LCS/LCSD)
- Internal Standards
- 1 Field Duplicates
- Target Analyte List
- Reporting Limits (MDL and MRL)
- Reported Results
- Calculation Verification (Full validation only)

---

[1] *Quality control results are discussed below, but no data were qualified*

[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Receipt

Seven (7) samples (listed below) were extracted three (3) days outside of the holding time criteria of 14 days. The positive results and reporting limits were qualified as estimated (J/UJ-1) in these samples.

ID-50-SD	ID-51-SD	ID-52-SD	ID-53-SD
ID-54-SD	ID-56-SD	ID-57-SD	

Continuing Calibration (CCAL)

All relative response factor (RRF) values were greater than the 0.05 minimum control limit. The percent difference (%D) values were within the ±25% control limit, with the exceptions noted below. Positive results and reporting limits in samples associated with %D outliers were estimated (J/UJ-5B).

- CCAL 12/21/07 Instrument NT2: benzyl alcohol (low response)

Field Blanks

Laboratory method blanks are used to evaluate all associated field blanks. Any remaining positive results in the field blanks are used to evaluate the associated samples.

Two rinsate blanks, ID-00-RB and ID-00-ER, were included in this SDG. There were positive results for benzyl alcohol in both rinsate blanks. There were no positive results for these compounds in the associated samples. No qualifiers were required.

Matrix Spike/Matrix Spike Duplicates

There was no recovery for benzyl alcohol for the matrix spike/ matrix spike duplicates (MS/MSD) performed on Sample ID-58-SD. Benzyl alcohol was not detected in this sample; the reporting limit was rejected (R-8) due to the extremely low bias.

Field Duplicates

One set of field duplicates were submitted with this SDG: ID-59-SD & ID-59-D. There were no positive results for either sample. Field precision was acceptable.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, MS/MSD, and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) percent recovery (%R) values, with the exceptions noted above. Precision was also acceptable as demonstrated by the MS/MSD, LCS/LCSD and field duplicate relative percent difference values.

Data were estimated because of holding time outliers and a continuing calibration %D outlier.

One result for benzyl alcohol was rejected based on MS/MSD %R values less than 10%.

Data that has been rejected should not be used for any purpose. All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
PCB Aroclors by Method SW8082

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
MB44	12 Sediment & 2 Rinsate Blanks	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverables (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

2 Holding Times and Sample Receipt
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Laboratory Blanks
1 Field Blanks
2 Surrogate Compounds
Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Samples (LCS/LCSD)
1 Field Duplicates
Target Analyte List
Reporting Limits (MDL and MRL)
Compound Identification
Calculation Verification (Full validation only)

---

[1] *Quality control results are discussed below, but no data were qualified*
[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Receipt

Sample ID-50-SD was re-extracted and re-analyzed 28 days outside of the holding time criteria of 14 days for sediment samples. Both results were reported by the laboratory. The results from the original analysis were labeled do-not-report (DNR-11). The results from the re-extraction were estimated (UJ-1).

Six (6) samples (listed below) were extracted five (5) days outside of the holding time criteria of 14 days. The positive results and reporting limits were estimated (J/UJ-1) in these samples:

ID-51-SD	ID-52-SD	ID-53-SD
ID-54-SD	ID-56-SD	ID-57-SD

Field Blanks

Method blanks are used to evaluate all associated samples, including field blanks. Any remaining positive results in the field blanks are used to evaluate all samples.

Two rinsate blanks, ID-00-RB and ID-00-ER, were included in this SDG. There were no positive results for either blank. No qualifiers were required.

Surrogate Compounds

The percent recovery (%R) values for decachlorobiphenyl (DCB) and tetrachlorometaxylene (TMX) were less than 10% in Sample ID-50-SD. The sample was re-extracted and re-analyzed with successful surrogate results. The results from the original analysis for this sample were labeled as (DNR-11). Only the results from the re-extraction should be used.

Field Duplicates

One set of field duplicates were submitted with this SDG: ID-59-SD & ID-59-D. There were no positive results for either sample. Field precision was acceptable.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) %R values. Precision was also acceptable as demonstrated by the field duplicate, MS/MSD and LCS/LCSD relative percent difference values.

Data were estimated because of exceeded holding times.

Data were labeled as do-not-report (DNR) to indicate which data should be used when multiple sets of data were reported.

Data that has been labeled DNR should not be used for any purpose. All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Diesel and Residual Range Hydrocarbons by Method NWTPH-Dx

This report documents the review of analytical data from the analyses of sediment samples, water samples, and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the **Sample Index** for a list of the individual samples.

SDG	Number of Samples	Validation Level
MB44	12 Sediment & 2 Rinsate Blanks	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

Holding Times and Sample Receipt
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Blanks (Method)
1 Field Blanks
Surrogate Compounds
Matrix Spike/Matrix Spike Duplicates (MS/MSD)

Laboratory Control Samples (LCS/LCSD)
1 Field Duplicates
Target Analyte List
Reporting Limits (MDL and MRL)
1 Compound Identification and Quantification
Calculation Verification (Full validation only)

---

[1] *Quality control results are discussed below, but no data were qualified.*

[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Field Blanks

Laboratory method blanks are used to evaluate all associated field blanks. Any remaining positive results in the field blanks are then used to evaluate the associated samples.

Two rinsate blanks, ID-00-RB and ID-00-ER, were included in this data package. There were no positive results detected in either blank. No qualifiers were required.

Field Duplicates

One set of field duplicates were submitted with this SDG: ID-59-SD & ID-59-D. There were no positive results for either sample. Field precision was acceptable.

Compound Identification and Quantification

All samples were sulfuric acid/silica gel "cleaned" prior to analysis to reduce the effects of biogenic interference in the samples.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) %R values. Precision was also acceptable as demonstrated by the field duplicate, MS/MSD and LCS/LCSD relative percent difference values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxic Cleanup
Irondale RI/FS
Metals by Methods SW6010B, 7470A, and 7471A

This report documents the review of analytical data from the analyses of water, soil, and tissue samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington.

SDG	Number of Samples	Validation Level
MB44	12 Sediment and 2 Field Blanks	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
CRDL Standards
Laboratory Blanks
1 Field Blanks
Laboratory Control Samples (LCS)
2 Matrix Spikes (MS)
Laboratory Duplicates
Interference Check Samples
1 Field Duplicates
Serial Dilutions
Reported Results
Calculation Verification (Full validation only)

---

[1] *Quality control results are discussed below, but no data were qualified.*
[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Field Blanks

Two field blanks, ID-00-RB and ID-00-ER, were submitted with this SDG. Zinc was detected in Sample ID-00-ER at a level greater than the method detection limit (MDL). In order to establish the effect on the field samples, an action level of five times the blank concentration was established. All associated samples were greater than the action level, therefore no qualification of data was necessary.

Matrix Spikes

Matrix spike samples (MS) were analyzed at the proper frequency of one per 20 samples or one per batch; whichever was more frequent. The percent recovery (%R) values were within the control limits of 75%-125% with the following exceptions.

The MS %R values for chromium (70%) and zinc (67%) were less than the lower control limit of 75%. All associated results were estimated (J-8) to indicate a potential low bias.

Field Duplicates

Note that the relative percent difference (RPD) value is used to assess precision only if both sample results are greater than 5x the reporting limit for a given analyte, otherwise the difference between the two results is used to evaluate precision. For solid matrices, the RPD control limit is 50% or the difference must be less than 2x the reporting limit.

One set of field duplicates were submitted with this SDG: ID-59-SD & ID-59-D. All field precision criteria were met.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory and field duplicate RPD values indicated acceptable precision. Accuracy was also acceptable, as demonstrated by the MS and laboratory control sample %R values, except as previously noted.

Data were estimated based on MS %R outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxic Cleanup
Irondale RI/FS
Conventional Parameter Analyses

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington.

SDG	Number of Samples	Validation Level
MB44	13 Sediment	Summary

The analytical tests that were performed are summarized below:

Parameter	Method
Total Solids (TS)	160.3
Grain Size (GS)	PSEP 1986
Total Organic Carbon (TOC)	9060M
Total Volatile Solids (TVS)	160.4
Ammonia as Nitrogen	350.1
Total Sulfides	9030M

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

2 Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
Laboratory Blanks

Laboratory Control Samples (LCS)
2 Matrix Spikes (MS)
2 Laboratory Replicates
Field Replicates

---

[1] *Quality control results are discussed below, but no data were qualified.*
[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Preservation

The samples collected on 11/30/07 were analyzed for total volatile solids and sulfide after the 7 day holding time. These results were estimated (J-1).

Matrix Spikes

Matrix spike samples (MS) were analyzed at the proper frequency of one per 20 samples or one per batch; whichever was more frequent. The percent recovery (%R) values were within the control limits of 75%-125% with the following exceptions:

The MS %R value for total organic carbon (62%) was less than the lower control limit of 75%. All associated results were estimated (J-8) to indicate a potential low bias. The MS %R value for sulfide (135%) was greater than the upper control limit of 125%. All associated results were estimated (J-8) to indicate a potential high bias.

Field Replicates

Note that the percent relative standard deviation (%RSD) value is used to assess precision only if the sample results are greater than 5x the reporting limit for a given analyte, otherwise the difference between the results is used to evaluate precision. For solid matrices, the %RSD control limit is 50% or the difference must be less than 2x the reporting limit.

One set of field replicates were submitted with this SDG: ID-59-SD, ID-59-D, and ID-59-T. The %RSD for the 72-32 micron grain size fraction (69%) was greater than the control limit. The parent samples were estimated (J-9).

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory and field replicate relative percent difference (RPD) and %RSD values indicated acceptable precision, except as previously noted. Accuracy was also acceptable, as demonstrated by the MS and laboratory control sample recovery values, except as noted above.

Data were estimated based on exceeded holding times, MS/MSD % R outliers, and a field replicate %RSD outlier.

All data, as qualified, are acceptable for use.

EcoChem, INC.
Environmental Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS, REASON CODES, AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with "R" and "DNR" only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C **(EcoChem PJ)**	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	Water: J(+)/UJ(-) if ext. > 7 and < 21 days J(+)/R(-) if ext > 21 days **(EcoChem PJ)** Solids/Wastes: J(+)/UJ(-) if ext. > 14 and < 42 days J(+)/R(-) if ext. > 42 days **(EcoChem PJ)** J(+)/UJ(-) if analysis >40 days	1
Tuning	DFTPP Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	**(EcoChem PJ, see TM-06)** If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	**(EcoChem PJ, see TM-06)** J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	**(EcoChem PJ, see TM-06)** If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	**(EcoChem PJ, see TM-06)** If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Field Blanks (Not Required)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% **PJ if only one %R outlier**	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS **low conc. H2O SVOA**	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS **regular SVOA (H2O & solid)**	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R <LCL J(+)/R(-) if %R < 10% **(EcoChem PJ)**	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Minimum of 3 acid and 3 base/neutral compounds Use method acceptance criteria	Do not qualify if only 1 acid and/or 1 B/N surrogate is out unless <10% J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10%	13
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT>30 seconds, **narrate and Notify PM**	19
Field Duplicates	**Use QAPP limits. If no QAPP:** Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project **(EcoChem PJ)**	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants **See Technical Director for ID issues**	4
Quantitation/ Identification	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	**See Technical Director if outliers**	14 21 (false +)

DATA VALIDATION CRITERIA

Table No.: NFG-Pest PCB
Revision No.: 4
Last Rev. Date: 8/23/07
Page: 1 of 2

EcoChem Validation Guidelines for Pesticides/PCBs by GC/ECD (Based on Organic NFG 1999 & EPA SW-846 Method 8081/8082)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C **(EcoChem PJ)**	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext/analyzed > HT J(+)/R(-) if ext/analyzed > 3X HT **(EcoChem PJ)**	1
Resolution Check	Beginning of ICAL Sequence Within RTW Resolution >90%	Narrate (Use Professional Judgement to qualify)	14
Instrument Performance (Breakdown)	DDT Breakdown: < 20% Endrin Breakdown: <20% Combined Breakdown: <30% Compounds within RTW	J(+) DDT NJ(+) DDD and/or DDE R(-) DDT - If (+) for either DDE or DDD J(+) Endrin NJ(+) EK and/or EA R(-) Endrin - If (+) for either EK or EA	5A
Retention Times	Surrogates: TCX (+/- 0.05); DCB (+/- 0.10) Target compounds: elute before heptachlor epoxide (+/- 0.05) elute after heptachlor epoxide (+/- 0.07)	NJ(+)/R(-) results for analytes with RT shifts **For full DV, use PJ based on examination of raw data**	5B
Initial Calibration	Pesticides: Low=CRQL, Mid=4X, High=16X Multiresponse - one point Calibration %RSD<20% %RSD<30% for surr; two comp. may exceed if <30% Resolution in Mix A and Mix B >90%	J(+)/UJ(-)	5A
Continuing Calibration	Alternating PEM standard and INDA/INDB standards every 12 hours (each preceeded by an inst. Blank) %D < 25% Resolution >90% in IND mixes; 100% for PEM	J(+)/UJ(-) J(+)R(-) if %D > 90% **PJ for resolution**	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample result is < CRQL and < 5X rule (raise sample value to CRQL) U(+) if sample result is > or equal to CRQL and < 5X rule (at reported sample value)	7
Instrument Blanks	Analyzed at the beginning of every 12 hour sequence No analyte > 1/2 CRQL	Same as Method Blank	7
Field Blanks	Not addressed by NFG No results > CRQL	Apply 5X rule; U(+) < action level	6

EcoChem Validation Guidelines for Pesticides/PCBs by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Method 8081/8082)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One set per matrix per batch Method Acceptance Criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% **PJ if only one %R outlier**	8
MS/MSD (RPD)	One set per matrix per batch Method Acceptance Criteria	J(+) in parent sample if RPD > CL	9
LCS	One per SDG Method Acceptance Criteria	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	TCX and DCB added to every sample %R = 30-150%	J(+)/UJ(-) if both %R = 10 - 60% J(+) if both >150% J(+)/R(-) if any %R <10%	13
Quantitation/ Identification	Quantitated using ICAL calibration factor (CF) RPD between columns <40%	J(+) if RPD = 40 - 60% NJ(+) if RPD >60% **EcoChem PJ - See TM-08**	3
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used to avoid reporting two results for one sample	11
Sample Clean-up	GPC required for soil samples Florisil required for all samples Sulfur is optional Clean-up standard check %R within CLP limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL	14
Field Duplicates	**Use QAPP limits. If no QAPP:** Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate **(Qualify if required by project QAPP)**	9

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range
(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X **(EcoChem PJ)**	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if $R^2 < 0.990$ J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 85% to 115%	Narrate if frequency not met. J(+)/UJ(-) if %R < 85% J(+) if %R >115%	5B
Method Blank	At least one per batch (≤10 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. **Use PJ if only one %R outlier**	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% **(EcoChem PJ)**	10

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range
(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. **(EcoChem PJ)**	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP **EcoChem default:** water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. **(See TM-04)**	11

DATA VALIDATION CRITERIA

Table No.: NFG-ICP
Revision No.: draft
Last Rev. Date: draft

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration Tissues: Frozen	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r > 0.995	J(+)/UJ(-) if r < 0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		(Refer to TM-02 for additional information)
			7

Reporting Limit Standard	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+) < 2x RL if %R <50% (< 30% Sb, Pb, Tl) J(+) < 2x RL, UJ(-) if %R 50-69% (30-49% Sb, Pb,Tl) J(+) < 2x RL if %R 130-180% (150-200% Sb, Pb, Tl) R(+) < 2x RL if %R > 180% (200% Sb, Pb, Tl)	14
Interference Check Samples (ICSA/ICSAB)	ICSAB %R 80 - 120% for all spiked elements | ICSA | < MDL for all unspiked elements except: K, Na	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R= 50 to 79% Use Professional Judgment for ICSA to determine if bias is present see **TM-09** for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7

DATA VALIDATION CRITERIA

Table No.: NFG-ICP
Revision No.: draft
Last Rev. Date: draft
Page: 2 of 2

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spikes	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R > 125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R < 30% **or** J(+)/UJ(-) if Post Spike %R 75-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples >RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2x RL for solids) qualify all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample conc. > 50x MDL	J(+)/UJ(-) if %D >10% qualify all samples in batch	16
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

DATA VALIDATION CRITERIA

Table No.: NFG-HG
Revision No.: draft
Last Rev. Date: draft
Page: 1 of 2

EcoChem Validation Guidelines for Mercury Analysis by CVAA (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	28 days from date sampled Frozen tissues: HT extended to 6 months	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + 4 standards, one at RL r > 0.995	J(+)/UJ(-) if r<0.995	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	after each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to **TM-02** for additional details
			7

Reporting Limit Standard (CRA)	conc at RL - analyzed beginning of run %R = 70-130%	R(-),(+)<2xRL if %R <50% J(+)<2x RL, UJ(-) if %R 50-69% J(+) <2x RL if %R 130-180% R(+)<2x RL if %R>180%	14
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 5% frequency 75-125% for samples less than 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% all samples in batch	8
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Mercury Analysis by CVAA
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5x RL: Water: Diff<RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9

DATA VALIDATION CRITERIA

Table No.: Eco-Conv
Revision No.: 0
Last Rev. Date: FINAL DRAFT
Page: 1 of 2

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler Temperature 4°C ±2°C Preservation: Method Specific	Use Professional Judgment to qualify based to qualify for coole temp outliers J(+)/UJ(-) if preservation requirements not met	1
Holding Time	Method Specific	Professional Judgment J(+)/UJ(-) if holding time exceeded J(+)/R(-) if HT exceeded by > 3X	1
Initial Calibration	Method specific r>0.995	**Use professional judgment** J(+)/UJ(-) for r < 0.995	5A
Initial Calibration Verification (ICV)	Where applicable to method Independent source analyzed immediately after calibration %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5A
Continuing Cal Verification (CCV)	Where applicable to method Every ten samples, immed. following ICV/ICB and end of run %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5B

Initial and Continuing Cal Blanks (ICB/CCB)	Where applicable to method
	After each ICV and CCV every ten samples and end of run
	| blank| < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Method Blank	One per matrix per batch
	(not to exceed 20 samples)
	blank < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blk value, U(+) results < action level
		For (-) blk value, J(+)/UJ(-) results < action level
			7

Laboratory Control Sample	Waters: One per matrix per batch %R (80-120%)	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	Soils: One per matrix per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Matrix Spike	One per matrix per batch; 5% frequency 75-125% for samples less than 4 x spike level	J(+) if %R > 125% or < 75% UJ(-) if %R = 30-74% R(+/-) results < IDL if %R < 30%	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (may use RPD < 35%, Diff < 2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff<RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9

EcoChem, INC.
Environmental Data Quality

APPENDIX B
QUALIFIED DATA SUMMARY TABLE

DATA QUALIFIER SUMMARY
Irondale

METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
ASTM D422	07-26522-MB44H	ID-59-SD	Percent retained 32 micron	34.2	%		J	9
ASTM D422	07-26523-MB44I	ID-59-D	Percent retained 32 micron	12.0	%		J	9
ASTM D422	07-26524-MB44J	ID-59-T	Percent retained 32 micron	10.8	%		J	9
E160.4	07-26515-MB44A	ID-50-SD	Total Volatile Solids	2.32	Percent		J	1
E160.4	07-26516-MB44B	ID-51-SD	Total Volatile Solids	2.34	Percent		J	1
E160.4	07-26517-MB44C	ID-52-SD	Total Volatile Solids	1.66	Percent		J	1
E160.4	07-26518-MB44D	ID-53-SD	Total Volatile Solids	2.93	Percent		J	1
E160.4	07-26519-MB44E	ID-54-SD	Total Volatile Solids	1.37	Percent		J	1
E160.4	07-26520-MB44F	ID-56-SD	Total Volatile Solids	3.27	Percent		J	1
E160.4	07-26521-MB44G	ID-57-SD	Total Volatile Solids	2.28	Percent		J	1
E376.2	07-26515-MB44A	ID-50-SD	Sulfide	126	mg/kg		J	1,8
E376.2	07-26516-MB44B	ID-51-SD	Sulfide	371	mg/kg		J	1,8
E376.2	07-26517-MB44C	ID-52-SD	Sulfide	690	mg/kg		J	1,8
E376.2	07-26518-MB44D	ID-53-SD	Sulfide	73.7	mg/kg		J	1,8
E376.2	07-26519-MB44E	ID-54-SD	Sulfide	1130	mg/kg		J	1,8
E376.2	07-26520-MB44F	ID-56-SD	Sulfide	290	mg/kg		J	1,8
E376.2	07-26521-MB44G	ID-57-SD	Sulfide	201	mg/kg		J	1,8
E376.2	07-26522-MB44H	ID-59-SD	Sulfide	110	mg/kg		J	8
E376.2	07-26523-MB44I	ID-59-D	Sulfide	54.1	mg/kg		J	8
E376.2	07-26524-MB44J	ID-59-T	Sulfide	139	mg/kg		J	8
E376.2	07-26525-MB44K	ID-58-SD	Sulfide	131	mg/kg		J	8
E376.2	07-26526-MB44L	ID-55-SD	Sulfide	148	mg/kg		J	8
E376.2	07-26527-MB44M	ID-04-SD	Sulfide	707	mg/kg		J	8
NWTPHD-Cleaned	07-26515-MB44A	ID-50-SD	Diesel Range Hydrocarbons		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26515-MB44A	ID-50-SD	Motor Oil		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26516-MB44B	ID-51-SD	Diesel Range Hydrocarbons		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26516-MB44B	ID-51-SD	Motor Oil		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26517-MB44C	ID-52-SD	Diesel Range Hydrocarbons		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26517-MB44C	ID-52-SD	Motor Oil		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26518-MB44D	ID-53-SD	Diesel Range Hydrocarbons		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26518-MB44D	ID-53-SD	Motor Oil		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26519-MB44E	ID-54-SD	Diesel Range Hydrocarbons		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26519-MB44E	ID-54-SD	Motor Oil		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26520-MB44F	ID-56-SD	Diesel Range Hydrocarbons		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26520-MB44F	ID-56-SD	Motor Oil		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26521-MB44G	ID-57-SD	Diesel Range Hydrocarbons		mg/kg	U	UJ	1
NWTPHD-Cleaned	07-26521-MB44G	ID-57-SD	Motor Oil		mg/kg	U	UJ	1
Plumb,1981	07-26515-MB44A	ID-50-SD	Total Organic Carbon	1.51	Percent		J	8
Plumb,1981	07-26516-MB44B	ID-51-SD	Total Organic Carbon	1.18	Percent		J	8
Plumb,1981	07-26517-MB44C	ID-52-SD	Total Organic Carbon	0.564	Percent		J	8
Plumb,1981	07-26518-MB44D	ID-53-SD	Total Organic Carbon	1.63	Percent		J	8
Plumb,1981	07-26519-MB44E	ID-54-SD	Total Organic Carbon	1.06	Percent		J	8
Plumb,1981	07-26520-MB44F	ID-56-SD	Total Organic Carbon	2.15	Percent		J	8
Plumb,1981	07-26521-MB44G	ID-57-SD	Total Organic Carbon	1.13	Percent		J	8
Plumb,1981	07-26522-MB44H	ID-59-SD	Total Organic Carbon	0.736	Percent		J	8
Plumb,1981	07-26523-MB44I	ID-59-D	Total Organic Carbon	1.29	Percent		J	8
Plumb,1981	07-26524-MB44J	ID-59-T	Total Organic Carbon	0.909	Percent		J	8
Plumb,1981	07-26525-MB44K	ID-58-SD	Total Organic Carbon	1.18	Percent		J	8
Plumb,1981	07-26526-MB44L	ID-55-SD	Total Organic Carbon	0.379	Percent		J	8
Plumb,1981	07-26527-MB44M	ID-04-SD	Total Organic Carbon	0.388	Percent		J	8

DATA QUALIFIER SUMMARY
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METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
PSDDA SW8082	07-26515-MB44A	ID-50-SD	Aroclor 1016		ug/kg	U	DNR	11
PSDDA SW8082	07-26515-MB44A	ID-50-SD	Aroclor 1221		ug/kg	U	DNR	11
PSDDA SW8082	07-26515-MB44A	ID-50-SD	Aroclor 1232		ug/kg	U	DNR	11
PSDDA SW8082	07-26515-MB44A	ID-50-SD	Aroclor 1242		ug/kg	U	DNR	11
PSDDA SW8082	07-26515-MB44A	ID-50-SD	Aroclor 1248		ug/kg	U	DNR	11
PSDDA SW8082	07-26515-MB44A	ID-50-SD	Aroclor 1254		ug/kg	U	DNR	11
PSDDA SW8082	07-26515-MB44A	ID-50-SD	Aroclor 1260		ug/kg	U	DNR	11
PSDDA SW8082	07-26515-MB44ARE	ID-50-SD	Aroclor 1016		ug/kg	U	UJ	1
PSDDA SW8082	07-26515-MB44ARE	ID-50-SD	Aroclor 1221		ug/kg	U	UJ	1
PSDDA SW8082	07-26515-MB44ARE	ID-50-SD	Aroclor 1232		ug/kg	U	UJ	1
PSDDA SW8082	07-26515-MB44ARE	ID-50-SD	Aroclor 1242		ug/kg	U	UJ	1
PSDDA SW8082	07-26515-MB44ARE	ID-50-SD	Aroclor 1248		ug/kg	U	UJ	1
PSDDA SW8082	07-26515-MB44ARE	ID-50-SD	Aroclor 1254		ug/kg	U	UJ	1
PSDDA SW8082	07-26515-MB44ARE	ID-50-SD	Aroclor 1260		ug/kg	U	UJ	1
PSDDA SW8082	07-26516-MB44B	ID-51-SD	Aroclor 1016		ug/kg	U	UJ	1
PSDDA SW8082	07-26516-MB44B	ID-51-SD	Aroclor 1221		ug/kg	U	UJ	1
PSDDA SW8082	07-26516-MB44B	ID-51-SD	Aroclor 1232		ug/kg	U	UJ	1
PSDDA SW8082	07-26516-MB44B	ID-51-SD	Aroclor 1242		ug/kg	U	UJ	1
PSDDA SW8082	07-26516-MB44B	ID-51-SD	Aroclor 1248		ug/kg	U	UJ	1
PSDDA SW8082	07-26516-MB44B	ID-51-SD	Aroclor 1254		ug/kg	U	UJ	1
PSDDA SW8082	07-26516-MB44B	ID-51-SD	Aroclor 1260		ug/kg	U	UJ	1
PSDDA SW8082	07-26517-MB44C	ID-52-SD	Aroclor 1016		ug/kg	U	UJ	1
PSDDA SW8082	07-26517-MB44C	ID-52-SD	Aroclor 1221		ug/kg	U	UJ	1
PSDDA SW8082	07-26517-MB44C	ID-52-SD	Aroclor 1232		ug/kg	U	UJ	1
PSDDA SW8082	07-26517-MB44C	ID-52-SD	Aroclor 1242		ug/kg	U	UJ	1
PSDDA SW8082	07-26517-MB44C	ID-52-SD	Aroclor 1248		ug/kg	U	UJ	1
PSDDA SW8082	07-26517-MB44C	ID-52-SD	Aroclor 1254		ug/kg	U	UJ	1
PSDDA SW8082	07-26517-MB44C	ID-52-SD	Aroclor 1260		ug/kg	U	UJ	1
PSDDA SW8082	07-26518-MB44D	ID-53-SD	Aroclor 1016		ug/kg	U	UJ	1
PSDDA SW8082	07-26518-MB44D	ID-53-SD	Aroclor 1221		ug/kg	U	UJ	1
PSDDA SW8082	07-26518-MB44D	ID-53-SD	Aroclor 1232		ug/kg	U	UJ	1
PSDDA SW8082	07-26518-MB44D	ID-53-SD	Aroclor 1242		ug/kg	U	UJ	1
PSDDA SW8082	07-26518-MB44D	ID-53-SD	Aroclor 1248		ug/kg	U	UJ	1
PSDDA SW8082	07-26518-MB44D	ID-53-SD	Aroclor 1254		ug/kg	U	UJ	1
PSDDA SW8082	07-26518-MB44D	ID-53-SD	Aroclor 1260		ug/kg	U	UJ	1
PSDDA SW8082	07-26519-MB44E	ID-54-SD	Aroclor 1016		ug/kg	U	UJ	1
PSDDA SW8082	07-26519-MB44E	ID-54-SD	Aroclor 1221		ug/kg	U	UJ	1
PSDDA SW8082	07-26519-MB44E	ID-54-SD	Aroclor 1232		ug/kg	U	UJ	1
PSDDA SW8082	07-26519-MB44E	ID-54-SD	Aroclor 1242		ug/kg	U	UJ	1
PSDDA SW8082	07-26519-MB44E	ID-54-SD	Aroclor 1248		ug/kg	U	UJ	1
PSDDA SW8082	07-26519-MB44E	ID-54-SD	Aroclor 1254		ug/kg	U	UJ	1
PSDDA SW8082	07-26519-MB44E	ID-54-SD	Aroclor 1260		ug/kg	U	UJ	1
PSDDA SW8082	07-26520-MB44F	ID-56-SD	Aroclor 1016		ug/kg	U	UJ	1
PSDDA SW8082	07-26520-MB44F	ID-56-SD	Aroclor 1221		ug/kg	U	UJ	1
PSDDA SW8082	07-26520-MB44F	ID-56-SD	Aroclor 1232		ug/kg	U	UJ	1
PSDDA SW8082	07-26520-MB44F	ID-56-SD	Aroclor 1242		ug/kg	U	UJ	1
PSDDA SW8082	07-26520-MB44F	ID-56-SD	Aroclor 1248		ug/kg	U	UJ	1
PSDDA SW8082	07-26520-MB44F	ID-56-SD	Aroclor 1254		ug/kg	U	UJ	1
PSDDA SW8082	07-26520-MB44F	ID-56-SD	Aroclor 1260		ug/kg	U	UJ	1
PSDDA SW8082	07-26521-MB44G	ID-57-SD	Aroclor 1016		ug/kg	U	UJ	1

DATA QUALIFIER SUMMARY
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METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
PSDDA SW8082	07-26521-MB44G	ID-57-SD	Aroclor 1221		ug/kg	U	UJ	1
PSDDA SW8082	07-26521-MB44G	ID-57-SD	Aroclor 1232		ug/kg	U	UJ	1
PSDDA SW8082	07-26521-MB44G	ID-57-SD	Aroclor 1242		ug/kg	U	UJ	1
PSDDA SW8082	07-26521-MB44G	ID-57-SD	Aroclor 1248		ug/kg	U	UJ	1
PSDDA SW8082	07-26521-MB44G	ID-57-SD	Aroclor 1254		ug/kg	U	UJ	1
PSDDA SW8082	07-26521-MB44G	ID-57-SD	Aroclor 1260		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	1,3-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	1-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	2-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	2-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	4-Methylphenol	28	ug/kg		J	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Acenaphthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Acenaphthylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Benzo(a)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Benzo(a)pyrene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Benzo(b)fluoranthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Benzo(g,h,i)perylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Benzo(k)fluoranthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Benzoic Acid		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Benzyl Alcohol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	bis(2-Ethylhexyl)phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Chrysene	23	ug/kg		J	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Dibenzofuran		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Diethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Dimethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Di-n-Butylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Di-n-Octyl phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Fluoranthene	33	ug/kg		J	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Fluorene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Hexachlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Indeno(1,2,3-cd)pyrene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Naphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Pentachlorophenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Phenanthrene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Phenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26515-MB44A	ID-50-SD	Pyrene	33	ug/kg		J	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	1,3-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	1-Methylnaphthalene		ug/kg	U	UJ	1

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METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	2-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	2-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	4-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Acenaphthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Acenaphthylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Benzo(a)anthracene	39	ug/kg		J	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Benzo(a)pyrene	41	ug/kg		J	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Benzo(b)fluoranthene	29	ug/kg		J	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Benzo(g,h,i)perylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Benzo(k)fluoranthene	32	ug/kg		J	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Benzoic Acid		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Benzyl Alcohol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	bis(2-Ethylhexyl)phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Chrysene	50	ug/kg		J	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Dibenzofuran		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Diethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Dimethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Di-n-Butylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Di-n-Octyl phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Fluoranthene	87	ug/kg		J	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Fluorene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Hexachlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Indeno(1,2,3-cd)pyrene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Naphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Pentachlorophenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Phenanthrene	57	ug/kg		J	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Phenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26516-MB44B	ID-51-SD	Pyrene	100	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	1,3-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	1-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	2-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	2-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	4-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Acenaphthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Acenaphthylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Anthracene	38	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Benzo(a)anthracene	88	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Benzo(a)pyrene	92	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Benzo(b)fluoranthene	66	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Benzo(g,h,i)perylene	36	ug/kg		J	1

DATA QUALIFIER SUMMARY
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METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Benzo(k)fluoranthene	69	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Benzoic Acid		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Benzyl Alcohol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	bis(2-Ethylhexyl)phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Chrysene	90	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Dibenzofuran		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Diethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Dimethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Di-n-Butylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Di-n-Octyl phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Fluoranthene	230	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Fluorene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Hexachlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Indeno(1,2,3-cd)pyrene	35	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Naphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Pentachlorophenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Phenanthrene	150	ug/kg		J	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Phenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26517-MB44C	ID-52-SD	Pyrene	230	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	1,3-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	1-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	2-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	2-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	4-Methylphenol	52	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Acenaphthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Acenaphthylene	20	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Anthracene	38	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Benzo(a)anthracene	94	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Benzo(a)pyrene	100	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Benzo(b)fluoranthene	94	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Benzo(g,h,i)perylene	24	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Benzo(k)fluoranthene	100	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Benzoic Acid		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Benzyl Alcohol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	bis(2-Ethylhexyl)phthalate	87	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Chrysene	110	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Dibenzofuran		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Diethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Dimethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Di-n-Butylphthalate	24	ug/kg		J	1

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METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Di-n-Octyl phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Fluoranthene	240	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Fluorene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Hexachlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Indeno(1,2,3-cd)pyrene	27	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Naphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Pentachlorophenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Phenanthrene	140	ug/kg		J	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Phenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26518-MB44D	ID-53-SD	Pyrene	250	ug/kg		J	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	1,3-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	1-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	2-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	2-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	4-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Acenaphthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Acenaphthylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Benzo(a)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Benzo(a)pyrene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Benzo(b)fluoranthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Benzo(g,h,i)perylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Benzo(k)fluoranthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Benzoic Acid		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Benzyl Alcohol		ug/kg	U	R	8
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	bis(2-Ethylhexyl)phthalate	20	ug/kg		J	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Chrysene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Dibenzofuran		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Diethylphthalate	20	ug/kg		J	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Dimethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Di-n-Butylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Di-n-Octyl phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Fluoranthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Fluorene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Hexachlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Indeno(1,2,3-cd)pyrene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Naphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Pentachlorophenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Phenanthrene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Phenol		ug/kg	U	UJ	1

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METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
PSDDA SW8270D	07-26519-MB44E	ID-54-SD	Pyrene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	1,3-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	1-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	2-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	2-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	4-Methylphenol	69	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Acenaphthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Acenaphthylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Anthracene	53	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Benzo(a)anthracene	230	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Benzo(a)pyrene	250	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Benzo(b)fluoranthene	250	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Benzo(g,h,i)perylene	70	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Benzo(k)fluoranthene	180	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Benzoic Acid		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Benzyl Alcohol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	bis(2-Ethylhexyl)phthalate	67	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Chrysene	240	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Dibenzofuran		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Diethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Dimethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Di-n-Butylphthalate	26	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Di-n-Octyl phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Fluoranthene	510	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Fluorene	32	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Hexachlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Indeno(1,2,3-cd)pyrene	72	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Naphthalene	42	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Pentachlorophenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Phenanthrene	240	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Phenol	97	ug/kg		J	1
PSDDA SW8270D	07-26520-MB44F	ID-56-SD	Pyrene	490	ug/kg		J	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	1,3-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	1-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	2-Methylnaphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	2-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	4-Methylphenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Acenaphthene		ug/kg	U	UJ	1

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METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Acenaphthylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Benzo(a)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Benzo(a)pyrene	21	ug/kg		J	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Benzo(b)fluoranthene	24	ug/kg		J	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Benzo(g,h,i)perylene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Benzo(k)fluoranthene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Benzoic Acid		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Benzyl Alcohol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	bis(2-Ethylhexyl)phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Chrysene	21	ug/kg		J	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Dibenzofuran		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Diethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Dimethylphthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Di-n-Butylphthalate	77	ug/kg		J	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Di-n-Octyl phthalate		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Fluoranthene	42	ug/kg		J	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Fluorene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Hexachlorobenzene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Indeno(1,2,3-cd)pyrene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Naphthalene		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Pentachlorophenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Phenanthrene	20	ug/kg		J	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Phenol		ug/kg	U	UJ	1
PSDDA SW8270D	07-26521-MB44G	ID-57-SD	Pyrene	47	ug/kg		J	1
SW6010B	07-26515-MB44A	ID-50-SD	Chromium	16.0	mg/kg		J	8
SW6010B	07-26515-MB44A	ID-50-SD	Zinc	30	mg/kg		J	8
SW6010B	07-26516-MB44B	ID-51-SD	Chromium	14.7	mg/kg		J	8
SW6010B	07-26516-MB44B	ID-51-SD	Zinc	29	mg/kg		J	8
SW6010B	07-26517-MB44C	ID-52-SD	Chromium	17.6	mg/kg		J	8
SW6010B	07-26517-MB44C	ID-52-SD	Zinc	35	mg/kg		J	8
SW6010B	07-26518-MB44D	ID-53-SD	Chromium	15.1	mg/kg		J	8
SW6010B	07-26518-MB44D	ID-53-SD	Zinc	28	mg/kg		J	8
SW6010B	07-26519-MB44E	ID-54-SD	Chromium	8.4	mg/kg		J	8
SW6010B	07-26519-MB44E	ID-54-SD	Zinc	16	mg/kg		J	8
SW6010B	07-26520-MB44F	ID-56-SD	Chromium	16.9	mg/kg		J	8
SW6010B	07-26520-MB44F	ID-56-SD	Zinc	36	mg/kg		J	8
SW6010B	07-26521-MB44G	ID-57-SD	Chromium	9.6	mg/kg		J	8
SW6010B	07-26521-MB44G	ID-57-SD	Zinc	19	mg/kg		J	8
SW6010B	07-26522-MB44H	ID-59-SD	Chromium	22.1	mg/kg		J	8
SW6010B	07-26522-MB44H	ID-59-SD	Zinc	39	mg/kg		J	8
SW6010B	07-26523-MB44I	ID-59-D	Chromium	23.7	mg/kg		J	8
SW6010B	07-26523-MB44I	ID-59-D	Zinc	36	mg/kg		J	8
SW6010B	07-26525-MB44K	ID-58-SD	Chromium	11.8	mg/kg		J	8
SW6010B	07-26525-MB44K	ID-58-SD	Zinc	21	mg/kg		J	8
SW6010B	07-26526-MB44L	ID-55-SD	Chromium	10.6	mg/kg		J	8

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METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
SW6010B	07-26526-MB44L	ID-55-SD	Zinc	18	mg/kg		J	8
SW6010B	07-26527-MB44M	ID-04-SD	Chromium	18.5	mg/kg		J	8
SW6010B	07-26527-MB44M	ID-04-SD	Zinc	68	mg/kg		J	8
SW8270D SIM	07-26515-MB44A	ID-50-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	2-Methylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	Benzyl Alcohol		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	Hexachlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
SW8270D SIM	07-26515-MB44A	ID-50-SD	Pentachlorophenol		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	2-Methylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	Benzyl Alcohol		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	Dibenz(a,h)anthracene	12	ug/kg		J	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	Hexachlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
SW8270D SIM	07-26516-MB44B	ID-51-SD	Pentachlorophenol		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	2-Methylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	Benzyl Alcohol		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	Dibenz(a,h)anthracene	9.2	ug/kg		J	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	Hexachlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
SW8270D SIM	07-26517-MB44C	ID-52-SD	Pentachlorophenol		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	2-Methylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	Benzyl Alcohol		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	Dibenz(a,h)anthracene	14	ug/kg		J	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	Hexachlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
SW8270D SIM	07-26518-MB44D	ID-53-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1

DATA QUALIFIER SUMMARY
Irondale

METHOD	LAB ID	SAMPLE ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
SW8270D SIM	07-26518-MB44D	ID-53-SD	Pentachlorophenol		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	2-Methylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	Benzyl Alcohol		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	Hexachlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
SW8270D SIM	07-26519-MB44E	ID-54-SD	Pentachlorophenol		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	2-Methylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	Benzyl Alcohol		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	Dibenz(a,h)anthracene	7.2	ug/kg		J	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	Hexachlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
SW8270D SIM	07-26520-MB44F	ID-56-SD	Pentachlorophenol		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	1,2,4-Trichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	1,2-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	1,4-Dichlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	2,4-Dimethylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	2-Methylphenol		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	Benzyl Alcohol		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	Butylbenzylphthalate		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	Dibenz(a,h)anthracene		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	Hexachlorobenzene		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	Hexachlorobutadiene		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	N-Nitrosodiphenylamine		ug/kg	U	UJ	1
SW8270D SIM	07-26521-MB44G	ID-57-SD	Pentachlorophenol		ug/kg	U	UJ	1
SW8270D SIM	07-26525-MB44K	ID-58-SD	Benzyl Alcohol		ug/kg	U	R	8
SW8270D SIM	07-26526-MB44L	ID-55-SD	Benzyl Alcohol		ug/kg	U	UJ	5B
SW8270D SIM	07-26527-MB44M	ID-04-SD	Benzyl Alcohol		ug/kg	U	UJ	5B

APPENDIX D
SAIC BIOASSAY FIELD REPORT

Irondale Iron and Steel Plant
Intertidal Sediment Quality Investigation
Irondale, WA

Data Report

DRAFT

Prepared for

DEPARTMENT OF
ECOLOGY
State of Washington

Washington State Department of Ecology
Toxics Cleanup Program
300 Desmond Drive
Lacey, WA 98504

Prepared by

SAIC®
From Science to Solutions

Science Applications International Corporation
18912 North Creek Parkway, Suite 101
Bothell, WA 98011

April 14, 2009

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List of Acronyms

ARI	Analytical Resources, Inc.
CSL	contaminant screening level
DGPS	differential Global Positioning System
DMMP	Dredged Material Management Program
DW	dry weight
Ecology	Washington State Department of Ecology
GPS	Global Positioning System
HPAH	high molecular weight polycyclic aromatic hydrocarbon
JCHHS	Jefferson County Health and Human Services
LPAH	low molecular weight polycyclic aromatic hydrocarbon
MIG	mean individual growth rate
MTCA	Model Toxics Control Act
NAD	North American Datum
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
ppt	parts per thousand
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance/quality control
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SMARM	Sediment Management Annual Review Meeting
SMS	Sediment Management Standards
SQS	sediment quality standard
SVOC	semi-volatile organic compound
TCP	Toxics Cleanup Program
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency

1.0 Introduction

Irondale Iron and Steel (Irondale) has been identified by the Washington State Department of Ecology (Ecology) under the Toxics Cleanup Program's (TCP) Puget Sound Initiative for focused cleanup and source control (Figure 1–1). Previous investigations (Hart Crowser 1996; JCHHS 2001) have indicated that plant operations have resulted in the contamination of soil, sediment, and groundwater with total petroleum hydrocarbons (TPH) and metals (Ecology 2007). This report includes the results of the characterization of the intertidal sediment quality at the Irondale Iron and Steel former operations as described in the Irondale Iron and Steel Plant Intertidal Sediment Quality Investigation Irondale, WA, Sampling and Analysis Plan (SAP) dated December 30, 2008.

1.1 Site History

A detailed description of the site, operational history, and summary of previous investigations is provided in the *Remedial Investigation/Feasibility Study Workplan, Irondale Iron and Steel Plant, Irondale, Washington* (GeoEngineers 2007).

1.2 Project Scope and Work Plan Objectives

The scope of this Intertidal Sediment Investigation was limited geographically to the TPH-impacted intertidal areas in the vicinity of the former Irondale plant facilities and wharf.

The results of this sediment characterization will be used to determine whether potential cleanup action(s) are warranted and sufficient to minimize the potential for adverse impacts to the biotic community. The specific objectives of this sediment investigation include the following:

- Conduct a sampling and analysis effort to characterize the intertidal sediment quality.
- Collect, process, and analyze representative intertidal sediment data to characterize the site in accordance with protocols, timing, and quality assurance/quality control (QA/QC) requirements outlined by Washington State Sediment Management Standards (SMS) protocols, Puget Sound Estuary Program (PSEP) protocols, and subsequent Sediment Management Annual Review Meetings (SMARM) updates.
- Compare the intertidal sediment chemistry results to Washington State SMS, sediment quality standard (SQS), and contaminant screening level (CSL), and TPH (NWTPH-Dx extended).
- Collect sediments from 10 locations to get a representative range of TPH concentrations.
- Determine the relative toxicity of TPH to benthic organisms by conducting a suite of sediment toxicity tests on synoptic intertidal sediment samples across a range of TPH concentrations and any that exceed the SQS chemical criteria. The suite of toxicity tests will include a larval development bioassay, an amphipod mortality bioassay, a juvenile polychaete growth bioassay, and Microtox® luminescence bioassay. In addition, due to the intertidal nature of the site and the presence of TPH, bioassays will be conducted using full-spectrum lighting (Ecology 2008).

- Compare any toxicological response due to TPH to the Model Toxics Control Act (MTCA) cleanup standard for TPH and determine whether this standard is protective of benthic invertebrates in intertidal sediments.

1.3 Document Organization

This Data Report summarizes and evaluates the results of the Irondale Intertidal Sediment Investigation within the context of the project scope and study objectives as outlined in Section 1.0. Section 2.0 of this document describes the study design and the methods for sample collection, analysis, and biological testing, as well as any deviations from the SAP (SAIC 2008). The results of the chemical analysis and biological testing are presented in Section 3.0. Section 4.0 discusses the suitability of whether the MTCA cleanup standard for TPH in soil is also protective of benthic invertebrates in intertidal sediments. References are provided in Section 5.0. The appendices include:

- Appendix A. Intertidal Sediment and Sample Container Logbooks
- Appendix B. Chemistry Laboratory Reports, Chain-of-Custody Forms, and Data Validation
- Appendix C. Biological Laboratory Report

Washington State Plane North NAD83

Figure 1-1. Irondale Iron and Steel Study Area

L.Delwiche SAIC, Bothell

2.0 Data Collection and Analytical Methods

This section describes the study design, sample collection methodology, and the methods for chemical and biological testing. A full description of the methods can be found in the SAP (SAIC 2008).

2.1 Study Design

The major component of this study was to characterize the nature and extent of intertidal sediment contamination at Irondale through the use of the SMS interpretive criteria. In addition, a toxicological investigation was conducted to determine any potential adverse impacts to benthic biota from TPH contamination. Results of this toxicological investigation will help to establish whether the MTCA cleanup standard for TPH in soil is also protective of benthic invertebrates.

2.2 Sampling and Handling Methods

Intertidal sediment samples were collected at eight locations (Figure 2–1) on January 8, 2009. All samples were collected during a low tide to assure beach access. The position of all beach locations was recorded using a differential Global Positioning System (DGPS). Location coordinates are listed in Table 2–1.

Table 2–1. Sample Locations

Location ID	Latitude[1]	Longitude[1]	Northing[2]	Easting[2]
ID-100-15-21-SD	48.042537	122.766059	1167686	386223
ID-101-8-14-SD	48.042548	122.766015	1167697	386228
ID-102-9-15-SD	48.042535	122.765978	1167705	386222
ID-103-11-17-SD	48.042449	122.766011	1167697	386189
ID-104-13-19-SD	48.042356	122.765975	1167705	386155
ID-106-13-19-SD	48.042274	122.765949	1167712	386127
ID-107-8-14-SD	48.042182	122.765888	1167724	386125
ID-108-12-18-SD	48.042118	122.765821	1167726	386091
SB-REF-ID-01	48.076298	123.020736	1106077	400259
SB-REF-ID-02	48.082231	123.02870	1104191	402478

1. WGS 1984 (decimal degrees)
2. NAD 83, State Plane North

Hand shovels were used to make the initial excavations at a given location, and stainless steel scoops or spoons were used to collect the actual sample material. Sediment characteristics, including texture, color, odor, and presence of biological organisms, contamination, or debris were recorded in the field logbook (Appendix A). Care was taken to avoid collecting sediment that was in contact with the hand shovel. A sufficient volume of intertidal sediment was collected and composited at each location to provide for chemical analysis and toxicity testing.

Sediment to be analyzed for total sulfides was taken directly from the excavation and preserved with zinc acetate.

The homogenized sediment was placed in pre-cleaned jars and then labeled. Samples were identified based on their location, sample type, and depth interval such that sample ID-108-12-18-SD was collected at location 108 between 12 and 18 inches depth.

The R/V *Growler*, owned and operated by Science Applications International Corporation (SAIC), was used to collect two reference samples from Sequim Bay, WA, on January 29, 2009. Sediment sampling locations were logged using the onboard Global Positioning System (GPS). The reference samples (0 to 5 inches) were collected using a stainless steel petit ponar grab. Sediment was collected and homogenized at each of the reference locations to provide sufficient volume for chemical analysis and toxicity testing.

An aliquot of sediment from each reference location was wet-sieved in the field to separate the coarse and fine-grained material in order to match the appropriate test and reference locations for toxicity testing. A 63-micron sieve was used to separate the silt and clay (fines) from the sand and gravel portion of the sediment sample.

2.3 Chemical Analyses

All chemical analyses were conducted by Analytical Resources, Inc. (ARI), of Tukwila, WA. All procedures were performed in accordance with the PSEP guidelines. All samples were analyzed for sediment conventionals and TPH. Five samples were analyzed for SMS chemistry. The specific analyses conducted on each sample are presented in Table 2–2.

The analyses for semi-volatile organic compounds (SVOCs) and polycyclic aromatic hydrocarbons (PAHs) were conducted using method 8270. The analysis for most of the metals was conducted using method 6010B, while mercury was analyzed using method 7471A. For the sediment conventionals, grain size was analyzed using PSEP methods, total organic carbon (TOC) using Plumb 1981, total volatile solids using method 160.4, total solids using method 160.3, total sulfides by method EPA 376.2, and ammonia using method EPA 350.1. Analysis of oil range hydrocarbons followed the NWTPH-Dx Method. Polychlorinated biphenyls (PCBs) were not analyzed as part of this investigation.

The chemical results are compared to the SMS SQS and CSL numeric criteria. The SMS provides a regulatory basis, management goal, and decision process for the characterization and cleanup of contaminated sediments (Ecology 1995).

Table 2–2. Surface Sediment Sample Types Collected

Sample Location	Sediment Conventionals[1]	Total Sulfides	NWTPH-Dx extended	SVOCs	Metals; Mercury	Archive	Toxicity Testing[2]
ID-100-15-21-SD	X	X	X	X	X	A	X
ID-101-8-14-SD	X	X	X	X	X	A	X
ID-102-9-15-SD	X	X	X	X	X	A	X
ID-103-11-17-SD	X	X	X		X	A	
ID-103-11-17-D	X		X				
ID-103-11-17-T	X						
ID-104-13-19-SD	X	X	X			A	
ID-106-13-19-SD	X	X	X			A	
ID-107-8-14-SD	X	X	X			A	
ID-108-12-18-SD	X	X	X	X	X	A	X
ID-000-MIX[3]	X		X	X	X		X
Reference Samples							
REF-ID-01	X	X	X				X
REF-ID-02	X	X	X				X

X = sample collected and submitted for analysis/testing; A: sample collected and archived; -: no sample collected at this location

1. Sediment conventional parameters include grain size distribution, total solids, total volatile solids, total organic carbon, and ammonia.
2. Toxicity testing includes amphipod mortality; larval development; polychaete growth; Microtox® luminescence.
3. ID-MIX-000 is a 4:1 blend of ID-103 and ID-107.

2.4 Biological Analyses

Additional sediment at each location was collected and archived for toxicity testing. Potential bioassay samples were stored at 4°C with no headspace under a nitrogen atmosphere pending completion of chemical analyses. These samples were delivered directly to the NewFields biological laboratory in Port Gamble, WA, upon the completion of the sample collection effort.

Intertidal surface sediment collected from five site and two reference locations were submitted for confirmatory biological testing across a range of TPH concentrations (Table 2-2). The primary objective of this study was to conduct toxicity tests on intertidal sediment across a range of TPH concentrations. To accomplish this objective, an additional sample was created by mixing four parts ID-103-11-17-SD with one part ID-107-8-14-SD in an effort to produce a mid-range TPH concentration for biological testing. The sediment TPH concentrations submitted for biological testing ranged from 30 to 690 mg/kg. Two reference sediment samples from Sequim Bay were also run for toxicity testing. The suite of toxicity tests for all seven samples included amphipod mortality (*Eohaustorius estuarius*), larval development (*Mytilus galloprovincialis*), juvenile polychaete growth (*Neanthes arenaceodentata*), and Microtox bioluminescence (*Vibrio fischeri)*. All biological testing was in strict compliance with Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments (PSEP 1995). Due to the intertidal nature of the site and the presence of TPH, bioassays were conducted using full-spectrum lighting (Ecology 2008). Further details on the toxicity testing methodology are provided in the SAP (SAIC 2008). The results of the toxicity testing are provided in Section 3.3.

Aerial Photo from Jefferson County (http:maps.co.jefferson.wa.us)

Figure 2-1. Intertidal Sampling Locations

L.Delwiche SAIC Bothell

3.0 Data Results

This section summarizes the results of the chemical analyses and toxicity testing conducted as a part of the Irondale Intertidal Sediment Quality Investigation.

3.1 Surface Sediment Chemistry

All nine intertidal sediment samples and both reference samples were analyzed for TPH and sediment conventionals. Five intertidal sediment samples were analyzed for SMS chemistry. All SMS chemical results are discussed relative to the SQS and the CSL. TPH are discussed in terms of concentrations present and spatial distribution. While the combined sample ID-000-MIX is included in this discussion, the sample is not representative of a specific location.

Results for the five samples analyzed for SMS chemistry are listed in Table 3–1. In this table, all undetected concentrations are represented by the method reporting limit. There were no exceedances of SQS or CSL criteria within the five intertidal samples analyzed for SMS chemistry. In addition, none of the reporting limits associated with the undetected values exceeded the SQS criteria.

Sample ID-000-MIX, a 4:1 combination of ID-103 and ID-107, was analyzed twice for SMS chemistry to test the homogeneity of the sediment. Data from the second analysis, ID-000-MIX-D1, have been qualified do not report (DNR) to denote that these data are to be used for comparison purposes only. Only two analytes, pyrene and chrysene, were detected in both samples. The RPD for pyrene was 27%. The RPD for chrysene was 55%, however detected concentrations were less than twice the reporting limit.

TPH results for all samples, including reference locations, are presented in Table 3–2. For the intertidal samples, motor oil concentrations ranged from 21 mg/kg at ID-100-15-24-SD to 3,600 mg/kg at ID-104-13-19-SD. Diesel range hydrocarbons ranged from 9.1 mg/kg at ID-100-15-24-SD to 5,400 mg/kg at ID-104-13-19-SD. Locations 104, 106, and 107 at the center of the Irondale intertidal sampling area had the highest concentrations of both motor oil and diesel range hydrocarbons. Portions of the sampling to the north and south of these three locations had concentrations 10 to 100 times lower. Concentrations of both TPH analytes were undetected at the two reference locations.

The initial sample of ID-000-MIX analyzed on February 4th, 2009, had concentrations of 330 and 360 mg/kg for motor oil and diesel range hydrocarbons, respectively. ID-000-MIX was reanalyzed as three separate samples on February 17th, 2009 (Table 3-2). The RPD between ID-00-MIX and ID-000-MIX-D1 was 32% for both motor oil and diesel range hydrocarbons. The RSD for all four samples was 21% for motor oil, and 25% for diesel range hydrocarbons. This degree of precision suggests homogeneity of the mixed sample.

Table 3–1. SMS Chemistry Results

SampleID	**WA**	**WA**	**ID-100-15-21-SD**			**ID-101-8-14-SD**			**ID-102-9-15-SD**			**ID-108-12-18-SD**			**ID-000-MIX**			**ID-MIX-000-D1***		
Collection Date	**SQS**	**CSL**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**
Metals in mg/kg DW																				
Arsenic	57	93	10	U	U	20	U	U	20	U	U	6	U	U	6	U	U			
Cadmium	5.1	6.7	0.6	U	U	0.6	U	U	0.6	U	U	0.2	U	U	0.2	U	U			
Chromium	—	—	17			16			14			20.1			18.4					
Copper	390	390	113			112			76.7			19.7			30.4					
Lead	450	530	25			17			10			4			8					
Mercury	0.41	0.59	0.06			0.07			0.05			0.05	U	U	0.04	U	U			
Silver	6.1	6.1	0.9	U	U	0.9	U	U	0.9	U	U	0.3	U	U	0.4	U	U			
Zinc	410	960	144			99			57			29			124					
LPAH in mg/kg TOC																				
Naphthalene	99	170	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Acenaphthylene	66	66	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Acenaphthene	16	57	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Fluorene	23	79	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Phenanthrene	100	480	0.99	U	U	0.24	J	J	0.65			0.43	J	J	0.23	U	J	0.47	U	DNR
Anthracene	220	1200	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
1-Methylnaphthalene	—	—	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
2-Methylnaphthalene	38	64	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Total LPAH	960	5300	0.99	U	U	0.24	J	J	0.65			0.43	J	J	0.45	U	U	0.47	U	DNR
HPAH in mg/kg TOC																				
Fluoranthene	160	1200	0.94	J	J	0.58			1.06			0.39	J	J	0.49	U		0.47	U	DNR
Pyrene	1000	1400	0.94	J	J	0.77			1.44			0.35	J	J	0.89			0.68		DNR
Benzo(a)anthracene	110	270	0.99	U	U	0.34	J	J	0.67			0.71	U	U	0.35	U	J	0.47	U	DNR
Chrysene	110	460	0.54	J	J	0.48			1.38			0.71	U	U	0.87			0.49		DNR
Benzo(b)fluoranthene	—	—	0.99	U	U	0.34	J	J	0.50	J	J	0.71	U	U	0.31	U	J	0.47	U	DNR
Benzo(k)fluoranthene	—	—	0.99	U	U	0.29	J	J	0.62			0.71	U	U	0.45	U	U	0.47	U	DNR
Benzofluoranthenes	230	450	0.99	U	U	0.63	J	J	1.11	J	J	0.71	U	U	0.45	U	U	0.47	U	DNR
Benzo(a)pyrene	99	210	0.99	U	U	0.29	J	J	0.38	J	J	0.71	U	U	0.45	U	U	0.47	U	DNR
Indeno(1,2,3-cd)pyrene	34	88	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Dibenz(a,h)anthracene	12	33	0.30	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR

Table 3–1. SMS Chemistry Results (Continued)

SampleID	WA	WA	ID-100-15-21-SD			ID-101-8-14-SD			ID-102-9-15-SD			ID-108-12-18-SD			ID-000-MIX			ID-MIX-000-D*		
Collection Date	**SQS**	**CSL**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/8/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**	**1/29/2009**	**LQ**	**VQ**
Benzo(g,h,i)perylene	31	78	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Total HPAH	960	5300	2.41	J	J	3.08	J	J	6.04	J	J	0.74	J	J	2.25			1.17		
Chlorinated Aromatics in mg/kg TOC																				
1,3-Dichlorobenzene	—	—	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
1,4-Dichlorobenzene	3.1	9	0.30	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
1,2-Dichlorobenzene	2.3	2.3	0.30	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
1,2,4-Trichlorobenzene	0.81	1.8	0.30	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
Hexachlorobenzene	0.38	2.3	0.30	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
Phthalate Esters in mg/kg TOC																				
Dimethylphthalate	53	53	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Diethylphthalate	61	110	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Di-n-Butylphthalate	220	1700	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Butylbenzylphthalate	4.9	64	0.74	U	U	0.36	U	U	0.47	U	U	0.57	U	U	0.35	U	U	0.35	U	DNR
bis(2-Ethylhexyl) phthalate	47	78	0.99	U	U	0.31	J	J	0.59	U	U	0.46	J	J	0.45	U	U	0.47	U	DNR
Di-n-Octylphthalate	58	4500	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Phenols in µg/kg DW																				
Phenol	420	1200	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
2-Methylphenol	63	63	6.1	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.2	U	U	6.1	U	DNR
4-Methylphenol	670	670	20	U	U	20	U	U	20	U	U	20	U	U	19	U	U	20	U	DNR
2,4-Dimethylphenol	29	29	6.1	U	U	6.2	U	U	6.8			6.2	U	U	6.2	U	U	6.1	U	DNR
Pentachlorophenol	360	690	30	U	U	31	U	U	31	U	U	31	U	U	31	U	U	30	U	DNR
Miscellaneous Extractables in mg/kg TOC																				
Benzyl Alcohol (µg/kg DW)	57	73	30	U	U	31	U	U	31	U	U	31	U	U	19	U	R	30	U	DNR
Benzoic Acid (µg/kg DW)	650	650	200	U	U	200	U	U	200	U	U	200	U	U	190	U	U	200	U	DNR
Dibenzofuran	15	58	0.99	U	U	0.48	U	U	0.59	U	U	0.71	U	U	0.45	U	U	0.47	U	DNR
Hexachlorobutadiene	3.9	6.2	0.30	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR
N-Nitrosodiphenylamine	28	130	0.30	U	U	0.15	U	U	0.18	U	U	0.22	U	U	0.15	U	U	0.14	U	DNR

DW = dry weight; HPAH = high molecular weight polycyclic aromatic hydrocarbon; LPAH = low molecular weight polycyclic aromatic hydrocarbon
U = undetected values listed at reporting limit; DNR = do not report, use results for original ID-000-MIX sample; * = ID-000-MIX-D normalized using TOC from ID-000-MIX

Table 3–2. Total Petroleum Hydrocarbon Results

SampleID	Collection Date	Motor Oil (mg/kg)	LQ	VQ	Diesel Range Hydrocarbons (mg/kg)	LQ	VQ
ID-100-15-21-SD	1/8/09	21			9.1		
ID-101-8-14-SD	1/8/09	150			85		
ID-102-9-15-SD	1/8/09	410			280		
ID-103-11-17-SD	1/8/09	38			20		
ID-104-13-19-SD	1/8/09	3600			5400		
ID-106-13-19-SD	1/8/09	2600			3600		
ID-107-8-14-SD	1/8/09	3100			4000		
ID-108-12-18-SD	1/8/09	94			42		
ID-000-MIX	1/29/09	330			360		
ID-000-MIX-D1	1/29/09	240		DNR	260		DNR
ID-000-MIX-D2	1/29/09	230		DNR	230		DNR
ID-000-MIX-D3	1/29/09	210		DNR	210		DNR
SB-REF-ID-01	1/29/09	13	U	U	6.6	U	U
SB-REF-ID-02	1/29/09	12	U	U	6.2	U	U

3.2 Sediment Conventionals

The results of the sediment conventionals are listed in Table 3–3. Intertidal sediments consisted primarily of gravel and sand. Gravel constituted from 12.1 to 34.6 percent of the grain size fraction. Sand constituted 63.7 to 85.8 percent of grain size fraction. Total fines had a maximum concentration of 3.8 percent at ID-104-13-19-SD.

TOC concentrations range from 1.35 to 5.57 percent dry weight (DW). Though no definitive pattern was present, locations with higher concentrations of TPH tended to have greater TOC concentrations.

Total sulfide concentrations ranged from 4.26 to 2,170 mg/kg DW. The highest total sulfides concentration was found at location ID-101-8-14-SD, while the lowest was ID-106-13-19-SD. Ammonia concentrations were more consistent. Ammonia was undetected in four of the intertidal samples. Detected concentrations ranged from 0.13 to 0.6 mg-N/kg DW.

The reference sediment had a lower percentage of the gravel grain size fraction, but concentrations of total fines in the reference sediment fell within the same range as the intertidal samples. TOC was lower in the reference sediment, averaging 0.3 percent TOC. Reference ammonia concentrations were higher than the intertidal sediment, averaging 3.6 mg-N/kg DW.

Table 3–3. Sediment Conventional Parameters

SampleID	**ID-100-15-21-SD**	**ID-101-8-14-SD**	**ID-102-9-15-SD**	**ID-103-11-17-SD**	**ID-104-13-19-SD**	**ID-106-13-19-SD**
Collection Date	**1/8/2009**	**1/8/2009**	**1/8/2009**	**1/8/2009**	**1/8/2009**	**1/8/2009**
Total Organic Carbon (%)	2.03	4.16	3.41	1.35	5.57	3.91
Total Volatile Solids (%)	1.75	6.94	9.32	3.07	3.81	4.56
Total Solids (%)	77.2	69.8	71	72.7	73.1	74.2
Preserved Total Solids (%)	75.1	68.9	70.2	75.6	70	68.7
N-Ammonia (mg-N/kg)	0.61	0.21	0.6	0.13	0.13	0.13
Sulfide (mg/kg)	343	2170	742	13	706	4.26
Grain Size (%)						
Gravel	17.6	29.3	18	16	20	14.3
Very Coarse Sand	10.3	10.3	18.3	4.2	15.8	11.1
Coarse Sand	15.4	15	14.1	15.4	17.5	18.2
Medium Sand	35.5	22.8	24.1	41.6	29.7	33.3
Fine Sand	14.5	11.5	19.4	20.1	11.3	17.1
Very Fine Sand	3.3	4.1	4.5	1.9	1.9	3.3
Total Fines	3.4	7	1.7	1	3.8	2.7

SampleID	**ID-107-8-14-SD**	**ID-108-12-18-SD**	**ID-000-MIX**	**SB-REF-ID-01**	**SB-REF-ID-02**
Collection Date	**1/8/2009**	**1/8/2009**	**1/29/2009**	**1/29/2009**	**01/29/09**
Total Organic Carbon (%)	4.81	2.82	4.26	0.232	0.354
Total Volatile Solids (%)	4.68	1.79	1.95	0.74	0.79
Total Solids (%)	74.1	70.7	74.6	76.6	73.3
Preserved Total Solids (%)	70.8	74.6		76.7	74.5
N-Ammonia (mg-N/kg)	0.16	0.13	0.32	4.68	2.57
Sulfide (mg/kg)	299	498		1.5	1.33
Grain Size (%)					
Gravel	34.6	12.1	14.1	0.7	0.5
Very Coarse Sand	10.1	4.3	4.7	0.7	0.8
Coarse Sand	18	17.9	17	7.7	3.7
Medium Sand	26.1	51.1	41.4	54.4	55.5
Fine Sand	9.1	11.1	18.7	32	37.6
Very Fine Sand	1.2	1.4	2	3.5	0.9
Total Fines	0.9	2	2	0.9	0.9

3.3 Biological Testing Results

The biological testing was performed on a total of five sediment samples from the intertidal area of the Irondale site (Table 3–4) and two reference sediments (Sequim Bay). The bioassays conducted included the following:

- 10-day amphipod mortality (*Eohaustorius estuarius*),
- 48-hour larval development (*Mytilus* sp.),
- 20-day juvenile polychaete growth (*Neanthes arenaceodentata*), and
- 15-minute Microtox bioluminescence (*Vibrio fischeri*).

NewFields (Port Gamble, WA) conducted the amphipod mortality, larval development, and juvenile polychaete growth bioassays. Nautilus Environmental (Fife, WA) conducted the Microtox bioluminescence bioassay. The following sections summarize the results of the confirmatory biological testing. The bioassay laboratory reports are provided in Appendix C.

3.3.1 Bioassay Water Quality Results

The water quality test condition protocols and summary of daily measurements are presented in Table 3–4. The temperature, salinity, DO, and pH were all within control limits and acceptable ranges throughout the tests, with one minor exception. The salinity exceeded the control limits for the juvenile polychaete growth bioassays. However, this water quality deviation is not believed to have had a significant effect on the test results. Water quality is not monitored as part of the Microtox bioluminescence bioassay as the 100 percent porewater extract of the sediment sample is pH, dissolved oxygen, and salinity-adjusted prior to testing.

The water quality measurements for ammonia (interstitial and overlying) and sulfides (interstitial) are presented in Table 3–5. The total ammonia and sulfide concentrations were all below levels of potential concern in bioassay test results (DMMP 2002; DMMP 2004). Based on the water quality measurements, there is no reason to believe there were any adverse effects on test organisms due to laboratory test conditions.

Table 3–4. Water Quality Test Results Compared to Test Control Limits

Test (Test Species)	**Control Limits/ Test Results**	**Temperature**	**Salinity**	**DO**	**pH[3]**
Amphipod Mortality (*E. estuarius*)	Control Limits	15 ± 1°C	28 ± 2 ppt	n/a[2]	---
	Test Results[1]	15.3 to 16.4 °C	26 – 29 ppt	6.7-8.7 mg/L	7.6 – 8.3
Larval Development (*M. galloprovincialis*)	Control Limits	16 ± 1°C	28 ± 1 ppt	>60% saturation	---
	Test Results[1]	15.2 to 16.7 °C	27 – 28 ppt	6.9 – 9.3 mg/L	7.3 – 8.0
Juvenile Polychaete Growth (*N. arenaceodentata*)	Control Limits	20 ± 1°C	28 ± 2 ppt	n/a[2]	---
	Test Results[1]	19.3 to 21.1°C	26 – 32 ppt	6.1 – 7.8 mg/L	7.4 – 8.2
Microtox Bioluminescence (*V. fischeri*)	n/a[4]	15 °C[4,5]	20 ± 2 ppt[4]	50 – 100% saturation[4]	7.9 – 8.2[4]

Source: Ecology 2008.

ppt = parts per thousand; n/a = not applicable

1. Water quality test results are for reference and test sediment parameters only; does not include negative control results.
2. Continuous aeration is required by the protocol, so the DO should not be a cause of concern.
3. pH is required for water quality monitoring but does not have explicit control limits.
4. The 100 percent porewater extract of the sediment sample is adjusted for temperature, pH, dissolved oxygen, and salinity.
5. Temperature is maintained at 15°C in an incubator during testing.

Table 3–5. Water Quality Measurements of Total Ammonia and Sulfides

Test (Test Species)	**Batch**	**Interstitial Ammonia Total NH_3 (mg/L)**	**Overlying Ammonia Total NH_3 (mg/L)**	**Sulfides (mg/L)**
Amphipod Mortality (*E. estuarius*)	1	<0.5– 3.87[1]	<0.5 – 1.99[1]	0.072 – 1.652
Larval Development (*M. galloprovincialis*)	1	n/a	<0.5	<0.01 – 0.091[3]
Juvenile Polychaete Growth (*N. arenaceodentata*)	1	<0.5 – 4.18[1]	<0.5 – 13.8[1]	0.087 – 0.720[2]
Microtox Bioluminescence (*V. fischeri*)	1	n/a	n/a	n/a

n/a = not applicable

1. Highest two concentrations of ammonia were measured in reference sediment samples
2. Sulfides measurement is interstitial water.
3. Sulfides measurement is overlying water.

3.3.2 Negative Control and Reference Sediment Performance Results

The reference sediments are used in comparison with test sediments for interpreting the results of the bioassays. Two locations, from Sequim Bay were sampled for comparison to the test sediments collected for the Irondale Intertidal Sediment Characterization. Sequim Bay is recognized as a suitable reference area for the collection of sediments for interpreting bioassay results.

The percent fines, the total of the silt and clay grain size fractions, are used for paring the appropriate reference sediment with a given test sediment (Table 3–6). Since all the test sediments and reference sediments had less than 7 percent fines, either reference sediment is deemed suitable for comparison and result interpretation. The TOC results for reference and test sediments are included in Table 3–6 for comparison.

The performance results of the negative control and reference sediments for each bioassay are presented in Table 3–7. The negative control performance standards were met for all four bioassays. Therefore, the test results for the amphipod mortality, larval development, and juvenile polychaete bioassays should be considered valid for the purposes of the SMS confirmatory biological tests. The interpretation of the amphipod mortality, larval development, and juvenile polychaete growth bioassays are presented in Tables 3–9, 3–10, and 3–11, respectively. One of the reference sediments (SB-REF-ID01) did not meet the performance criteria for the Microtox bioassay; therefore all the results of this test are compared to SB-REF-ID02. The interpretation of the Microtox bioluminescence bioassay results are presented in Section 3.3.7, Microtox Bioluminescence Bioassay.

Table 3–6. Grain Size and TOC Results for Determining Reference Sediments Comparisons

Sample ID	Percent Fines (silt + clay)	TOC (%)	Reference Sediment for Comparison[1]
Reference SB-REF-ID-01	0.9	0.232	n/a
Reference SB-REF-ID-02	0.9	0.354	n/a
ID-100	3.4	2.03	Either Reference
ID-101	7.0	4.16	Either Reference
ID-102	1.7	3.41	Either Reference
ID-108	2.0	2.82	Either Reference
ID-MIX	2.0	4.26	Either Reference

1. Due to the similar physical nature of the reference sediments and test sediment relative to percent fines, either reference can be used for comparison with test sediments. It should be noted that the reference sediment samples had notably lower concentrations of TOC, but should not affect the overall interpretation of the test sediment bioassay results.

Table 3–7. Negative Control Performance Standards and Test Results

Test (Test Species)	Negative Control Performance Standard		Reference Sediment Performance Standard	
Amphipod Mortality (*E. estuarius)*	$M_C \leq 10\%$	0%	$M_R \leq 25\%$	SB-REF-ID01: 10% SB-REF-ID02: 4%
Larval Development (*M. galloprovincialis*)	$N_C \div I \geq 0.70$	0..958	$N_R \div N_C \geq 65\%$	SB-REF-ID01: 84.4% SB-REF-ID02: 88.5%
Juvenile Polychaete Growth (*N. arenaceodentata*)	$M_C \leq 10\%$ and $MIG_C \geq 0.38$[1]	0%; 0.86	$MIG_R \div MIG_C \geq 0.80$	SB-REF-ID01: 1.15 SB-REF-ID02: 1.16
Microtox Bioluminescence (*V. fischeri*)	$M_C > 80\%$[2]	82-85%[3]	$M_R > 80\%$[2]	**SB-REF-ID01: 66-77%** SB-REF-ID02: 109-115%

Bold Font: Performance criteria not met

M = mean mortality; N = mean normal development survival in seawater control; I = initial count (250);

MIG = mean individual growth rate (mg/individual/day)

Subscripts: R = reference; C = negative control

1. Target MIGc is 0.72 mg/individual/day; the test is considered to be failed if the Control MIG is less than 0.38 mg/individual/day.
2. Percent mean light output of final control or reference relative to initial control or reference.

3.3.3 Positive Control Results

The results of the reference toxicant tests for the bioassays are provided in Table 3–8. The LC50 values for all the bioassays fell within the acceptable range of mean ± two standard deviations for historical reference toxicant data generated by the NewFields Northwest biological laboratory for the amphipod mortality, larval development, and juvenile polychaete growth bioassays; and Nautilus Environmental for the Microtox bioassay. The reference toxicant results indicate the test organisms appeared to be sufficiently sensitive for demonstrating a toxic response and sufficiently robust for laboratory testing. The reference control charts with both the current and running means and standard deviations are provided in Appendix C.

Table 3–8. Reference Toxicant Results

Test (Test Species)	Reference Toxicant	Endpoint	Test Batch	LC50	Laboratory Historical Range (mean ± 2SD)
Amphipod Mortality (*E. estuarius)*	Cadmium chloride	96-hour survival	1	6.3 mg/L Cd	4.6 – 12.7 mg/L Cd
Larval Development (*M. galloprovincialis*)	Copper chloride	normality	1	11.3 µg/L Cu	3.9 – 16.7 µg/L Cu
Juvenile Polychaete Growth (*N. arenaceodentata*)	Cadmium chloride	96-hour survival	1	9.9 mg/L Cd	2.9 – 17.3 mg/L Cd
Microtox Bioluminescence (*V. fischeri*)	Phenol	luminescence	1	33.0 mg/L phenol	26.9 – 71.1

3.3.4 Amphipod Mortality Bioassay

The amphipod mortality tests were initiated on February 10, 2009, using test organisms (*E. estuarius*) obtained from Northwest Aquatic Sciences, Newport, OR. The results of the amphipod mortality bioassay are presented in Table 3–9. The amphipod mean mortality ranged from 1 to 85 percent in the test sediments. One of the test sediments (ID-MIX) failed both the SMS SQS and CSL biological effects interpretive criteria for the amphipod mortality bioassay.

Table 3–9. Amphipod Mortality Bioassay (*E. estuarius*) Results and Evaluation Guidelines

Sample ID	**Percent Mortality**[1]	**Mean Mortality**[2]	**Reference Sediment**[3]	**Comparison to Reference**[4]		**SQS**	**CSL**
				MT – MR;	**MT vs. MR SD; p = 0.05: significant? (test)**	**MT – MR >25% and MT vs. MR SD (p = 0.05)**	**MT – MR >30% and MT vs. MR SD (p = 0.05)**
						Pass/Fail	**Pass/Fail**
Control	0 0 0 0 0	0 ± 0.0	n/a	n/a	n/a	n/a	n/a
Reference SB-REF-ID01	20 10 0 15 5	10 ± 7.9	n/a	n/a	n/a	n/a	n/a
Reference SB-REF-ID012	10 0 0 0 10	4 ± 5.5	n/a	n/a	n/a	n/a	n/a
ID-100	0 5 5 0 0	2 ± 2.7	SB-REF-ID02	-2	No[5]; (Approximate t-test)	Pass	Pass
ID-101	0 10 5 0 0	3 ± 4.5	SB-REF-ID02	-1	No; (Mann-Whitney)	Pass	Pass
ID-102	0 20 10 5 5	8 ± 7.6	SB-REF-ID02	4	No; (Student's t-test)	Pass	Pass
ID-108	0 5 0 0 0	1 ± 2.2	SB-REF-ID02	-3	No[5]; (Approximate t-test)	Pass	Pass

Table 3–9. Amphipod Mortality Bioassay (*E. estuarius*) Results and Evaluation Guidelines (Continued)

Sample ID	Percent Mortality[1]	Mean Mortality[2]	Reference Sediment[3]	Comparison to Reference[4]		SQS	CSL
				MT – MR;	MT vs. MR SD; p = 0.05: significant? (test)	MT – MR >25% and MT vs. MR SD (p = 0.05)	MT – MR >30% and MT vs. MR SD (p = 0.05)
						Pass/Fail	Pass/Fail
ID-MIX	70 95 75 95 90	85 ± 11.7	SB-REF-ID02	81	Yes; (Mann-Whitney)	**Fail**	**Fail**

M = mortality; SD = statistically different; Pass = meet SMS interpretive criteria;
Fail = exceed SMS interpretive criteria; n/a = not applicable
Subscripts: R = reference; C = negative control; T = test sediment

🟨 Pale yellow shading indicates an SQS failure
🟥 Rose shading indicates a CSL failure

1. Percent mortality observed in individual replicates.
2. Mean percent mortality ± standard deviation observed in test sample.
3. Reference, background, or control sediment used for comparison. Since the reference sediments were comparable, the one which performed best, in this case SB-REF-ID02, was used for comparative purposes as a conservative measure.
4. Comparison to reference includes the numeric result for the comparative criteria, the result of the statistical test, and the statistical test used. All statistics were conducted using BioStat (DMMP/SMS Bioassay Statistics Program; Beta v4.1). All amphipod mortality data were arcsine transformed for statistical analysis, unless noted otherwise.
5. Rankit transformation used due to non-normality and non-homoscedasticity.

3.3.5 Larval Development Bioassay

The larval development tests were initiated on February 13, 2009, using test organisms (*Mytilus galloprovincialis*) provided by Carlsbad Aquafarms, Carlsbad, CA. The results of the larval development bioassay are presented in Table 3–10. The results for the larval development bioassay ranged from 11.0 to 95.7 mean percent normal survival for the test sediments. Two of the seventeen test sediments failed the CSL criteria when compared to the reference sediment SB-REF-ID02, whereas only one failed the CSL when compared to the reference sediment SB-REF-ID01. A total of 3 test sediments fail the SQS when compared to the reference sediment SB-REF-ID02.

Table 3–10. Batch 1: Larval Development Bioassay (*Mytilus sp.*) Results and Evaluation Guidelines

Sample ID	Percent Normal Survival[1]	Mean Normal Survival[2]	Reference Sediment[3]	Comparison to Reference[4]		SQS	CSL
				$N_T \div N_R$	N_T vs. N_R SD; $p = 0.10$: significant? (test)	N_T vs. N_R SD ($p = 0.10$); $N_T \div N_R < 0.85$;	N_T vs. N_R SD ($p = 0.10$); $N_T \div N_R < 0.70$;
						Pass/ Fail	Pass/ Fail
Sea Water Control[2,5]	94.0 93.2 88.4 100.0 100.0	95.1 ± 4.9	n/a	n/a	n/a	n/a	n/a
Reference SB-REF-ID01	80.6 82.7 75.2 95.2 88.1	84.4 ± 7.6	n/a	n/a	n/a	n/a	n/a
Reference SB-REF-ID02	95.2 85.2 86.9 79.4 95.7	88.5 ± 7.0	n/a	n/a	n/a	n/a	n/a
ID-100	88.1 95.2 100.0 100.0 95.2	95.7 ± 4.9	SB-REF-ID02	1.08	No; (Approximate t-test)	Pass	Pass
ID-101	12.1 13.8 7.5 12.5 9.2	11.0 ± 2.6	SB-REF-ID02	0.12	Yes; (Approximate t-test)	**Fail**	**Fail**

Table 3–10. Batch 1: Larval Development Bioassay (*Mytilus sp.*) Results and Evaluation Guidelines (Continued)

Sample ID	**Percent Normal Survival**[1]	**Mean Normal Survival**[2]	**Reference Sediment**[3]	**Comparison to Reference**[4]		**SQS**	**CSL**
				$N_T \div N_R$	**N_T vs. N_R SD; p = 0.10: significant? (test)**	**N_T vs. N_R SD (p = 0.10); $N_T \div N_R$ <0.85;**	**N_T vs. N_R SD (p = 0.10); $N_T \div N_R$ <0.70;**
						Pass/ Fail	**Pass/ Fail**
ID-102	69.3 60.2 74.8 91.9 73.5	73.9 ± 11.6	SB-REF-ID02	0.84	Yes; (Students t-test)	**Fail**	Pass
ID-108	77.7 81.0 81.0 79.8 78.9	79.7 ± 1.4	SB-REF-ID02	0.90	Yes; (Approximate t-test)	Pass	Pass
ID-MIX	55.1 52.2 76.4 51.0 66.8	60.3 ± 11.0	SB-REF-ID02; (SB-REF-ID01)[5]	0.68; (71.4)[5]	Yes; (Students t-test)[6]	**Fail**	**Fail;** (Pass)[5]

N = normal development; SD = statistically different; n/a = not applicable
Subscripts: R = reference; T = test sediment
🟨 Pale yellow shading indicates an SQS failure
🟥 Rose shading indicates a CSL failure
🟦 Light blue shading indicates a discrepancy between the interpretive comparisons

1. Percent normal survivors observed in individual replicates.
2. Mean percent normal survivors ± standard deviation observed in test sample.
3. Reference, background, or control sediment used for comparison. Since the reference sediments were comparable, the one which performed best, in this case SB-REF-ID02, was used for comparative purposes as a conservative measure.
4. Comparison to reference includes the numeric result for the comparative criteria, the result of the statistical test, and the statistical test used. All statistics were conducted using BioStat (DMMP/SMS Bioassay Statistics Program; Beta v4.1). All larval development data were arcsine transformed for statistical analysis, unless indicated otherwise.
5. The test sediment ID-MIX was compared to both reference sediments due to the fact it fails the CSL interpretive criteria when compared to SB-REF-ID02, but passes when compared to SB-REF-ID01.
6. Statistical outcome was the same for both reference sediment comparisons.

3.3.6 Juvenile Polychaete Growth Bioassay

The juvenile polychaete growth tests were initiated on February 12, 2009, using the test organism (*N. arenaceodentata*) obtained from Dr. Donald Reish, California State University, Long Beach, CA. The results of the juvenile polychaete growth bioassay are presented in Table 3–11. The results of the juvenile polychaete growth bioassay ranged from 0.563 to 0.767 mean individual growth (mg/individual/day) for the test sediments. One of the five test sediments (ID-MIX) failed the SQS biological interpretive criteria for the juvenile polychaete growth test. All of the test sediments met the CSL biological interpretive criteria for the juvenile polychaete growth test.

Table 3–11. Juvenile Polychaete Growth Bioassay (*N. arenaceodentata*) Results and Evaluation Guidelines

Sample ID	MIG [1]	Mean MIG[2]	Reference Sediment[3]	Comparison to Reference[4]		SQS	CSL
				MIG_T/ MIG_R	MIG_T vs. MIG_R SD; p = 0.05: significant?; (test)	MIG_T vs. MIG_R SD (p = 0.05); $\text{MIG}_T/\text{MIG}_R$ <0.70	MIG_T vs. MIG_R SD (p = 0.05); $\text{MIG}_T/\text{MIG}_R$ <0.50
						Pass/ Fail	Pass/ Fail
Negative Control	0.840 0.866 0.834 1.019 0.731	0.858 ± 0.10	n/a	n/a	n/a	n/a	n/a
Reference SB-REF-ID01	0.899 1.041 0.861 1.107 1.023	0.986 ± 0.10	n/a	n/a	n/a	n/a	n/a
Reference SB-REF-ID02	1.258 1.157 0.887 0.914 0.743	0.992 ± 0.21	n/a	n/a	n/a	n/a	n/a
ID-100	0.625 0.564 0.809 0.726 0.881	0.721 ± 0.13	SB-REF-ID02	0.72	Yes; (Student's t-test)	Pass	Pass
ID-101	0.773 0.715 0.787 0.715 0.845	0.767 ± 0.05	SB-REF-ID02	0.77	Yes; (Approximate t-test)	Pass	Pass

Table 3–11. Juvenile Polychaete Growth Bioassay (*N. arenaceodentata*) Results and Evaluation Guidelines (Continued)

Sample ID	MIG [1]	Mean MIG[2]	Reference Sediment[3]	Comparison to Reference[4]		SQS	CSL
				MIG_T/ MIG_R	MIG_T vs. MIG_R SD; p = 0.05: significant?; (test)	MIG_T vs. MIG_R SD (p = 0.05); MIG_T/MIG_R <0.70	MIG_T vs. MIG_R SD (p = 0.05); MIG_T/MIG_R <0.50
						Pass/ Fail	Pass/ Fail
ID-102	0.712 0.679 0.959 0.556 0.774	0.736 ± 0.15	SB-REF-ID02	0.74	Yes; (Student's t-test)	Pass	Pass
ID-108	0.746 0.775 0.853 0.720 0.647	0.748 ± 0.08	SB-REF-ID02	0.75	Yes; (Approximate t-test)	Pass	Pass
ID-MIX	0.556 0.655 0.614 0.514 0.477	0.563 ± 0.07	SB-REF-ID02	0.57	Yes; (Approximate t-test)	**Fail**	Pass

MIG = mean individual growth rate (mg/individual/day); SD = statistically different; n/a = not applicable
Subscripts: R = reference; T = test sediment
🟨 Pale yellow shading indicates an SQS failure

1. Mean individual growth per replicate (mg/individual/day).
2. Mean individual growth ± standard deviation for sample (mg/individual/day).
3. Reference sediment used for comparison. Since the reference sediments were comparable, the one which performed best, in this case SB-REF-ID02, was used for comparative purposes as a conservative measure.
4. Comparison to reference includes the numeric result for the comparative criteria, the result of the statistical test, and the statistical test used. All statistics were conducted using BioStat (DMMP/SMS Bioassay Statistics Program; Beta v4.1). All juvenile polychaete growth data were log10 transformed for statistical analysis unless otherwise noted.

3.3.7 Microtox Bioluminescence Bioassay

The Microtox bioluminescence bioassays were run in two different batches on February 10, 2009, at the Nautilus Environmental biological laboratory, in Fife, WA, using the test organism (*V. fischeri*) obtained from Strategic Diagnosis, Inc. The results of the Microtox bioassay are presented in Table 3–12. The results of the Microtox bioluminescence bioassay ranged from 0.87 to 1.10 mean change in light output after 15 minutes for the test sediments. None of the five test sediments passed the SQS biological interpretive criteria for Microtox bioluminescence test. No SMS criteria exist for CSL comparison using Microtox data.

Table 3–12. Microtox Bioluminescence Bioassay (*V. fisheri*) Results and Evaluation Guidelines

Sample ID	**I_{15}[1]**	**Mean I_{15}[2]**	**Reference Sediment[3]**	**Comparison to Reference[4]**		**SQS[5]**
				TI_{15}/RI_{15}	**TI_{15} vs. RI_{15} SD; p = 0.05: significant?; (test)**	**TI_{15} vs. RI_{15} SD (p = 0.05); TI_{15}/RI_{15} <0.80** **Pass/ Fail**
Batch 1						
Negative Control	0.90 0.92 0.99 1.04 0.96	0.96	n/a	n/a	n/a	n/a
Reference SB-REF-ID01	0.68 0.76 0.77 0.77 0.68	0.67	n/a	n/a	n/a	n/a
Reference SB-REF-ID02	1.12 0.98 0.99 0.96 1.10	0.94	n/a	n/a	n/a	n/a
ID-100	1.25 1.05 1.11 1.04 1.07	1.10	SB-REF-ID02	1.17	No; (Student's t-test)	Pass
ID-101	0.94 0.95 0.93 1.09 0.86	0.98	SB-REF-ID02	1.04	No; (Student's t-test)	Pass
ID-102	1.12 1.00 0.92 0.97 1.03	0.99	SB-REF-ID02	1.05	No; (Student's t-test)	Pass

Table 3–12. Microtox Bioluminescence Bioassay (*V. fisheri*) Results and Evaluation Guidelines (Continued)

Sample ID	I_{15}[1]	Mean I_{15}[2]	Reference Sediment[3]	Comparison to Reference[4]		SQS[5]
				TI_{15}/RI_{15}	TI_{15} vs. RI_{15} SD; p = 0.05: significant?; (test)	TI_{15} vs. RI_{15} SD (p = 0.05); $TI_{15}/RI_{15} <0.80$
						Pass/ Fail
Batch 2						
Negative Control	0.97 0.91 0.86 0.91 0.98	0.93	n/a	n/a	n/a	n/a
Reference SB-REF-ID01	0.60 0.61 0.62 0.60 0.64	0.63	n/a	n/a	n/a	n/a
Reference SB-REF-ID02	0.92 0.89 0.97 0.94 0.90	0.91	n/a	n/a	n/a	n/a
ID-108	0.84 0.84 0.80 0.86 0.80	0.91	SB-REF-ID02	1.00	Yes; (Student's t-test)	Pass
ID-MIX	0.78 0.82 0.85 0.76 0.78	0.87	SB-REF-ID02	0.96	Yes; (Student's t-test)	Pass

I = change in light output; I_{15}= change in light output after 15 minutes; T =Test sediment; R = Reference sediment
SD = statistically different; n/a = not applicable

1. Replicate change in light output after 15 minutes.
2. Mean change in light output after 15 minutes ± standard deviation for sample.
3. Reference sediment used for comparison as selected by laboratory. Since the reference sediments were comparable, the one which performed best, in this case SB-REF-ID02, was used for comparative purposes as a conservative measure.
4. Comparison to reference includes the numeric result for the comparative criteria, the result of the statistical test, and the statistical test used. All statistics were conducted using BioStat (DMMP/SMS Bioassay Statistics Program; Beta v4.1). All Microtox data were arcsine transformed for statistical analysis, unless indicated otherwise.
5. No SMS criteria exist for CSL comparison using Microtox data.
6. Data may be skewed due to excessive turbidity in the sample.

3.3.8 Summary of Bioassay Results

A summary of the results for the suite of four bioassays is presented in Table 3–13. If all four bioassays pass the SMS biological interpretive criteria (SQS and CSL), the location is considered to have passed the SMS standards. If one of four bioassays fails the SQS biological interpretive criteria, the location is considered to have failed SMS SQS criteria. If two or more bioassays fail the SQS biological interpretive criteria or one or more bioassays fail the CSL biological interpretive criteria, the location is considered to have failed the SMS CSL criteria. As a result of the biological testing, two of the five locations passed the SMS criteria, one location failed the SQS criteria, and two locations failed the CSL criteria. The summary table defaults to the more conservative interpretation for the final SMS determination. The TPH concentration for each test sediment is also included in Table 3–13.

Table 3–13. Summary of Bioassay Results

Station ID	Amphipod Mortality	Larval Development	Juvenile Polychaete Growth	Microtox Bioluminescence	SMS Results[1]	TPH Concentration
ID-100	Pass	Pass	Pass	Pass	Pass	30.1
ID-101	Pass	**Fails CSL**	Pass	Pass	**Fails CSL**	**235**
ID-102	Pass	**Fails SQS**	Pass	Pass	**Fails SQS**	690
ID-108	Pass	Pass	Pass	Pass	Pass	136
ID-MIX	**Fails CSL**	**Fails CSL**	**Fails SQS**	Pass	**Fails CSL**	**4602**

🟨 Pale yellow shading indicates an SQS failure
🟥 Rose shading indicates a CSL failure
🟦 Light blue shading indicates a discrepancy between the interpretive comparisons

The SMS results column provides a summary of the results for the suite of three bioassays. ‘Pass’ indicates all four bioassays pass the SMS biological interpretive criteria. If one of four bioassays fails the SQS biological interpretive criteria, the location fails SQS. If two or more bioassays fail the SQS biological interpretive criteria or one or more bioassays fail the CSL biological interpretive criteria, the location fails the CSL.

The TPH concentration for ID-MIX is the mean of three replicate analyses with TPH concentrations of 420, 460, and 500.

4.0 MTCA Cleanup Standard for TPH in Soil

The major component of this study was to characterize the nature and extent of intertidal sediment contamination at Irondale through the use of the SMS interpretive criteria. In addition, a toxicological investigation was conducted to determine any potential adverse impacts to benthic biota from TPH contamination. The results of the toxicological investigation were used to determine whether the MTCA cleanup standard for TPH in soil (2000 mg/kg) is also protective of benthic invertebrates.

None of the intertidal sediment had contaminant concentrations that exceeded the SMS interpretive criteria. Sediment samples were submitted for biological testing with TPH concentrations ranging from 30.1 to 690 mg/kg. The three samples with observable toxic effects had TPH concentrations ranging from 235 to 690 mg/kg. The two samples that passed all four bioassay tests had TPH concentrations ranging from 30.1 to 136 mg/kg, the lowest two concentrations of the sediments submitted for biological testing. Therefore, the results of the toxicity testing are consistent relative to the fact that effects were observed at higher concentrations and no effects were observed at lower concentrations. Based on the results of this site-specific dataset, the No Observable Effect Concentration for TPH would be 136 mg/kg. Based on these data, a TPH concentration of 136 mg/kg or less in intertidal sediments would not be expected to have an adverse impact to benthic receptors, whereas for a TPH concentration of 235 mg/kg or greater observable adverse impacts to benthic receptors would be expected.

Therefore, the MTCA cleanup standard for soil is not sufficiently protective of benthic invertebrates. Intertidal sediments with TPH concentration less than 136 mg/kg should be considered protective of benthic invertebrates based on the results of this investigation.

5.0 References

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Appendix A
Intertidal Sediment and Sample Container Logbooks

SURFACE SEDIMENT
FIELD COLLECTION LOGBOOK

2009 IRONDALE IRON AND STEEL PLANT SEDIMENT QUALITY INVESTIGATION
IRONDALE, WA

January 2009

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Sediment Collection Form

Project: Irondale Sediment Quality Investigation
Station: 101
Sampling Event:
Date: 1/8/09
Crew: Ron Bek, Jasper, TIM

Grab #: 1	Depth Interval: 8"-14"	Penetration Depth:	Time: 1705
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:*** seepage @ 11", Slight sheen/odor @ 11", very slight sheen slight odor in Soil. caving from 11" to 14"
Cobble	Drab olive	None	
Gravel	Brown	[✓ Slight]	
Sand C [✓ M] F	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
[✓ Shell debris]		[✓ Petroleum]	

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Recorded By: Ron Bek

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Sediment Collection Form

Project: Irondale Sediment Quality Investigation
Station: 102
Sampling Event:
Date: 1/8/09
Crew: Same

Grab #: 1	Depth Interval: 9"-15"	Penetration Depth:	Time: 1740
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:*** seepage @ 11", slight organic like sheen on water, caving 11" to 15" no petroleum odor, slight organic sheen on soil
Cobble Gravel Sand [✓ C] [✓ M] F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface [✓ Gray] Black Other:	[✓ None] Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	

Recorded By: Ron Bek

SAIC
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Sediment Collection Form

Project: Irondale Sediment Quality Investigation
Station: 103
Sampling Event:
Date: 1/8/09

Crew: Sam

Grab #: 1	Depth Interval: 11"–17"	Penetration Depth:	Time: 1810
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:*** Seepage @ 12", Caving 12"-17". Bricks 0 to 11", no sheen or odor (petroleum) in sample
Cobble Gravel Sand C [✓ M] F Silt/clay Organic matter Woody debris [✓ Shell debris]	Drab olive [✓ Brown] Brown surface [✓ Gray] Black Other:	[✓ None] Slight Moderate Strong Overwhelming [✓ H2S] Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	

Recorded By: Ron Bek

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Sediment Collection Form

Project: Irondale Sediment Quality Investigation **Station:** 104
Sampling Event:
Date: 1/8/09
Crew: Same

Grab #: 1	Depth Interval: 13"-19"	Penetration Depth:	Time: 1845
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:*** 16" free product blebs @ 16" on water, heavy sheen, odor in soil
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C [✓ M] F	Brown surface	Moderate	
Silt/clay	[✓ Gray] dark	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		[✓ Petroleum]	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Recorded By: Ron Bek

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Sediment Collection Form

Project: Irondale Sediment Quality Investigation
Station: 105
Sampling Event:
Date: 1/8/09
Crew: Same

Grab #: No sample	Depth Interval:	Penetration Depth:	Time: 1930
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Brick	Drab olive	[✓ None]	refusal @ 18" on brick, 0-18" = brick w/ some sand very slight sheen in soil
Gravel	[✓ Brown]	Slight	
Sand [✓ C] M F	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

bad

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Recorded By: Ron Bek

SAIC
From Science to Solutions

Sediment Collection Form

Project: Irondale Sediment Quality Investigation
Station: 100
Sampling Event:
Date: 4/8/09
Crew: Same

Grab #: 1	Depth Interval: 15"-21"	Penetration Depth:	Time: 1940
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:*** Seepage at 12". Biogenic sheen on water. No sheen in soil sample.
Cobble Gravel Sand C [✓ M] F Silt/clay Organic matter Woody debris [✓ Shell debris]	Drab olive Brown Brown surface [✓ Gray] Black Other:	[✓ None] Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	

Recorded By: Ron Bek

SAIC
From Science to Solutions

Sediment Collection Form

Project: Irondale Sediment Quality Investigation
Station: 106
Sampling Event:
Date: 1/8/09
Crew: Same

Grab #: 1	Depth Interval: 13"-19"	Penetration Depth:	Time: 2000
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:*** brick surface, sheen & seepage @ 17" product on water. moderate to heavy sheen, and product blebs in soil
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C [✓ M] F	Brown surface	Moderate	
Silt/clay	[✓ Gray] dark	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		[✓ Petroleum]	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Recorded By: Ron Bek

SAIC
From Science to Solutions

Sediment Collection Form

Project: Irondale Sediment Quality Investigation
Station: 107
Sampling Event:
Date: 1/8/09
Crew: Same

Grab #: 1	Depth Interval: 8"-14"	Penetration Depth:	Time: 2023
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:*** Cobbles w/ tar-like TPH @ 8" product on water. Heavy sheen in soil with product blebs
[✓ Cobble]	Drab olive	None	
Gravel	Brown	Slight	
Sand C [✓ M] F	Brown surface	Moderate	
Silt/clay	[✓ Gray dark]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
[✓ Shell debris]		[✓ Petroleum]	

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Recorded By: Ron Bek

SAIC
From Science to Solutions

Sediment Collection Form

Project: Irondale Sediment Quality Investigation
Station: 108
Sampling Event:
Date: 1/8/09
Crew: Same

Grab #: 1	Depth Interval: 12 – 18	Penetration Depth:	Time: 2100
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:*** very slight sheen (organic?) & no odor in sample. Some cobbles. Seepage @ 16"
Cobble Gravel Sand C [✓ M] F Silt/clay Organic matter Woody debris [✓ Shell debris]	Drab olive [✓ Brown] Brown surface Gray Black Other:	[✓ None] Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris	Drab olive Brown Brown surface Gray Black Other:	None Slight Moderate Strong Overwhelming H2S Petroleum	

Recorded By: Ron Bek

SAIC
From Science to Solutions

Sediment Collection Form

Project: Irondale Sediment Quality Investigation **Station:**____________________
Sampling Event:____________________ **Date:**____________________

Crew:____

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Recorded By:____________________

SAIC
From Science to Solutions

Sediment Collection Form

Project: Irondale Sediment Quality Investigation **Station:**__________________________

Sampling Event:____________________ **Date:**____________________________

Crew:____

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Recorded By:____________________________

48° 04.589 N
123° 01.167 W
Ponar Grab

SAIC
From Science to Solutions

Sediment Collection Form

Project: Irondale Sediment Quality Investigation **Station:** SB-REFID-01
Sampling Event: Reference Sediment **Date:** 1/29/08
Crew: T.A, J.B

Grab #: 1	Depth ~~Interval~~: 7'	Penetration Depth: 5cm	Time: 1032
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	[✓ None]	eelgrass & shell debris
Gravel	Brown	Slight	
[✓ Sand] C M [✓ F]	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #: 2	Depth Interval: 6'	Penetration Depth: 5cm	Time: 1034
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	[✓ None]	Sand lance
Gravel	Brown	Slight	
[✓ Sand] C [✓ M F]	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #: 3	Depth Interval: 5'	Penetration Depth:	Time: 1040
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	[✓ None]	sand dollar
Gravel	Brown	Slight	
[✓ Sand] C [✓ M F]	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #: 4	Depth Interval: 5'	Penetration Depth:	Time: 1044
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	[✓ None]	shell debris
Gravel	Brown	Slight	
[✓ Sand] C [✓ M F]	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

75ml sieved
72ml retained
96% coarse
w/o fines

wet sieve

launched boat 10:00AM John Wayne Marina

Recorded By:

48° 04'.945 N
123° 01'.645 W

Ponar Grab

SAIC
From Science to Solutions

Sediment Collection Form

Project: Irondale Sediment Quality Investigation
Station: SB-REF-IW-02
Sampling Event: Reference
Date: 1/29/09
Crew: TH, JB

Grab #: 1	Depth ~~Interval~~: 5.4'	Penetration Depth: 5cm	Time: 1100
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	[✓ None]	eelgrass
Gravel	Brown	Slight	
[✓ Sand] C M [✓ F]	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #: 2	Depth ~~Interval~~: 4'	Penetration Depth: 5cm	Time: 1102
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	[✓ None]	
Gravel	Brown	Slight	
[✓ Sand] C M [✓ F]	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
[✓ Shell debris]		Petroleum	
Grab #: 3	Depth ~~Interval~~: 3'	Penetration Depth: 5cm	Time: 1104
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	[✓ None]	shell debris
Gravel	Brown	Slight	
[✓ Sand] C M [✓ F]	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
[✓ Shell debris]		Petroleum	
Grab #: 4	Depth ~~Interval~~: 3'	Penetration Depth: 5cm	Time: 1106
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	[✓ None]	
Gravel	Brown	Slight	
[✓ Sand] C M [✓ F]	Brown surface	Moderate	
Silt/clay	[✓ Gray]	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
[✓ Shell debris]		Petroleum	

97.3% coarse
2.7% fines

75 ml sieved
73 ml retained

Wet Sieve

Recorded By:

From Science to Solutions

Sediment Collection Form

Project: Irondale Sediment Quality Investigation **Station:**________________________

Sampling Event:____________________ **Date:**__________________________

Crew:____

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Recorded By:__________________________

Sediment Collection Form

Project: Irondale Sediment Quality Investigation **Station:**____________________________

Sampling Event:____________________ **Date:**____________________________

Crew:____

Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	
Grab #:	Depth Interval:	Penetration Depth:	Time:
Sediment type:	***Sediment color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H2S	
Shell debris		Petroleum	

Recorded By:________________________

SAMPLE CONTAINER LOGBOOK

2009 IRONDALE IRON AND STEEL PLANT SEDIMENT QUALITY INVESTIGATION
IRONDALE, WA

January 2009

SAIC®

From Science to Solutions

2009 Irondale Sediment Investigation	ID-108
Project Number:	**Time Collected:** 2050
Crew: JB, TH, RB	**Date:** 1/8/97
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
T.H. ~~ID-108~~ 11476	ID-108-12-18-SD	T. Sulfides	ARI
11477	"	TPH-dx	"
1147~~8~~9 T.H	"	Conventionals	"
1147~~9~~8 TH	"	SVOCs	"
11480	"	Metals, Hg	"
11481	"	Archive	"
11482	ID-108-12-18-Tx	Bioassay	Newfields

Notes

JB: Jasper Boas
TH: Tim Hammermeister
RB: Ron Bek

Completed by:

2009 Irondale Sediment Investigation ID-101-8-14-SD	
Project Number:	**Time Collected:** 1705
Crew: TH, JB, RB	**Date:** 1.8.9
Comments:	

Sample Container Tag Number	Sample ID T.#	Analysis	Laboratory
11420	ID-100-8-14-SD	T. Sulfides	ARI
11421	"	Conventionals	"
11422	"	NWTPH-Dx-Extended	"
11423	"	SVOCs / PCBs	"
11424	"	Metals/Mercury	"
11425	"	Archive	"
11426	ID-101-8-14-TX	Bioassays	NewFields

Notes

Completed by:

2009 Irondale Sediment Investigation	ID-102-9-15-
Project Number:	**Time Collected:** 1735
Crew: TH, JB, RB	**Date:** 1.8.9
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
11427	ID-102-9-15-SD	T. Sulfides	ARI
11428	"	Conventionals	"
11429	"	TPH	"
11430	"	SVOCs/PCBs	"
11431	"	metals/Hg	"
11432	"	Archive	"
11433	ID-102-9-15- TX	Bioassays	Newfields

Notes

Completed by:

2009 Irondale Sediment Investigation	ID-103
Project Number:	**Time Collected:** 1805
Crew: TH, JB, RB	**Date:** 1-8-9
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
11434	ID-103-11-17-SD	T. Sulfides	ARI
11435	"	Conventionals	"
11436	"	TPH-DX	"
11437	"	SVOCs	"
11438	"	Metals/Hg	"
11439	"	Archive	"
11440	ID-103-11-17-TX	Bioassay	Newfields
11441	ID-103-11-17-D	TPH-DX	ARI
11442	"	metal/Hg	"
11443	"	SVOCs	"
11444	"	Conventionals	"
11445	ID-103-11-17-T	"	"

← Run Triplicate

Notes QA/QC samples

** Run triplicates from single jar for T. sulfides.

Completed by:

2009 Irondale Sediment Investigation	ID-104
Project Number:	**Time Collected:** 18:45
Crew: JB, TH, RB	**Date:** 1/8/09
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
11446	ID-104-13-19-SD	T. Sulfides	ARI
11447	"	TPH-Dx	"
11448	"	Conventionals	"
11449	"	SVOCs	"
11450	"	Metals/Hg	"
11451	"	Archive	"
11452	"	Bioassay	Newfields
11453	ID-104-R	SVOCs/TPH	ARI
11454	"	Metals/Hg	"

Equipment Rinseates

Notes

*** 8 oz archive

* insufficient DI for RB

Completed by:

2009 Irondale Sediment Investigation	ID-~~105~~ 100-15-21 T.H.
Project Number:	Time Collected: ~~1700~~ T.H.
Crew: TH, JB, RB	Date: 1.8.9
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
11455	ID ~~105~~ 100 -15-21	T. Sulfides	ARI
11456	"	TPH-Dx	"
11457	"	Conventionals	"
11458	"	SVOCs	"
11459	"	Metals/Hg	"
11460	"	Archive	"
11461	~~ID-105~~	Bioassays	Newfields
	ID-100-15-21-Tx		

Notes

Station 105: no sediment; brick/refusal @ 18"

Completed by:

2009 Irondale Sediment Investigation	ID-106
Project Number:	**Time Collected:** 20:00
Crew: JB, TH, RB	**Date:** 1/8/09
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
11462	ID-106-13-19-SD	T. Sulfides	ARI
11463	"	TPH-dx	"
11464	"	Conventionals	"
11465	"	SVOCs	"
11466	"	Metals/Hg	"
11467	"	Archive	"
11468	ID-106-13-19-TC	Bioassays	NewFields

Notes

Completed by:____________________

2009 Irondale Sediment Investigation	ID-107-8-14
Project Number:	**Time Collected:** 2020
Crew: TH, JB, RB	**Date:** 18.9
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
11469	ID-107-8-14-SD	T. Sulfides	ARI
11470	"	TPH-Dx	"
11471	"	Conventionals	"
11472	"	SVOCs	"
11473	"	Metals/Hg	"
11474	"	Archive	"
11475	ID-107-8-14-TX	Bioassays	Newfields

Notes

Completed by:

2009 Irondale Sediment Investigation

Project Number:	**Time Collected:** 1030
Crew: T.H. J.B	**Date:** 1/29/09
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
11483	SB-REF-IO-01	Bioassays	~~11483~~ Newfields
11489	"	Sulfides	ARI
11490	"	SMS Conventionals + TPH	ARI

Notes

Completed by:

2009 Irondale Sediment Investigation

Project Number:	**Time Collected:** 1100
Crew: TH, JB	**Date:** 1·29·09
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory
11484	SB-REF-ID-02	Bioassay	Newfields
11491	"	Sulfides	ARI
11492	"	SMS Conventionals+TPH	ARI

Notes

Completed by:

2009 Irondale Sediment Investigation	ID-000-MIX
Project Number:	**Time Collected:** 1805, 2020
Crew: T.H. J.B.	**Date:** 1.8.9 (collected)
Comments:	1-29-09 (blended) 13:30

Sample Container Tag Number	Sample ID	Analysis	Laboratory
11485	ID-000-MIX	Bioassays	Newfields
11486	↓	Metals / TPH	ARI
11487	↓	SVOCs, Pesticides,	↓
11488	↓	Conventionals	↓

Notes Sample is a 4:1 blend of ID-103 and ID-107

Completed by:

Appendix B
Chemistry Laboratory Reports, Chain-of-Custody Forms, and Data Validation

Analytical Resources, Incorporated
Analytical Chemists and Consultants

February 16, 2009

Neil Morton
GeoEngineers, Inc.
Plaza 600 Building
600 Stewart Suite 1700
Seattle, WA 98101

RE: Project: Irondale Sediment Quality Investigation
ARI Job No.: OH26

Dear Mr. Morton:

Please find enclosed original Chain-of-Custody (COC) record, sample receipt documentation, and the data package for samples from the project referenced above.

Sample receipt and details of these analyses are discussed in the Case Narrative.

Please note that current ARI control limits are available at www.arilabs.com.

An electronic copy of this package will remain on file with ARI. Should you have any questions or problems, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Susan D. Dunnihoo
Client Services Manager
206-695-6207
sue@arilabs.com

Enclosures

cc: eFile OH26

SD/co

Chain of Custody Documentation

prepared
for

Science Applications, Intl.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OH26

prepared
by

Analytical Resources, Inc.

0H26

SAIC
From Science to Solutions

18912 North Creek Parkway, Suite 101
Bothell, Washington 98011
TEL: 425.485.5800 • FAX: 425.485.5566

CHAIN OF CUSTODY RECORD

Project No.:
Project Mgr: Tim Hammermeister
Project Name: Irondale Sediment Quality Investigation
Project Location: Irondale, WA
Sample Collectors: JB, TH, RB
Client Name: Washington State DOE

Shipping Information

Number of Shipping Containers:
Date Shipped:
Carrier:
Waybill No.:

						Analyses / Tests									
Sample ID	Depth	Matrix	Date	Time	# of Containers	TPH-Dx extended	T. Sulfides	Sediment Conventionals	SVOCs ARCHIVE	Metals ARCHIVE	Sediment ARCHIVE	SVOCs/TPH/Metal Rinseates				Comments
ID-108-12-18-SD	Intertidal	Sediment	1-8-09	20:50	6	☒	☒	☒	☒	☒	☒					11476, 11477, 11478, 11479 11480, 11481
ID-101-8-14-SD				17:05	6	☒	☒	☒	☒	☒	☒					11420, 11421, 11422, 11423 11424, 11425
ID-102-9-15-SD				17:35	6	☒	☒	☒	☒	☒	☒					11427, 11428, 11429, 11430 11431, 11432
ID-103-11-17-SD				18:05	6	☒	☒	☒	☒	☒	☒					11434, 11435, 11436, 11437 11438, 11439
ID-103-11-17-D				18:05	4	☒		☒	☒	☒						11441, 11442, 11443, 11444
ID-103-11-17-T				18:05	1			☒								11445
ID-104-13-19-SD		↓		18:45	6	☒	☒	☒	☒	☒	☒					11446, 11447, 11448, 11449 11450, 11451
ID-104-R		WATER		18:45	2							☒				
ID-100-15-21-SD				19:40	6	☒	☒	☒	☒	☒	☒					11455, 11456, 11457, 11458 11459, 11460
ID-106-13-19-SD				20:00	6	☒	☒	☒	☒	☒	☒					11462, 11463, 11464, 11465 11466, 11467
ID107-8-~~14~~-SD				20:20	6	☒	☒	☒	☒	☒	☒					11469, 11470, 11471, 11472 11473, 11474
	↓	↓	↓													

RELINQUISHED BY:
Signature:
Date/Time: 12:50 1/9/09
Affiliation: SAIC

RECEIVED BY:
Signature: Jami Hayes
Date/Time: 1/9/09 1250
Affiliation: ARI

RELINQUISHED BY:
Signature:
Date/Time:
Affiliation:

RECEIVED BY:
Signature:
Date/Time:
Affiliation:

• White: Lab Returns to Originator Upon Receipt of Samples • Canary: Lab Retains • Pink: Lab Returns to Project Manager with Final Report • Goldenrod: Retained by Sampler

PRESERVATION VERIFICATION 01/10/09
Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **OH26**

PC: Sue D.
VTSR: 01/09/09

Inquiry Number: NONE
Analysis Requested: 01/10/09
Contact: Hammermeister, Tim
Client: Science Applications, Intl.
Logged by: JH
Sample Set Used: Yes-449
Validatable Package: No
Deliverables:

Project #:
Project: IRONDALE SEDIMENT QUALITY INVESTIGA
Sample Site:
SDG No:
Analytical Protocol: PSDDA

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
09-856 **OH26K**	ID-104-R						TOT ✓					✓								

Checked By JH Date 1/10/09

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: SAIC

COC No:

Assigned ARI Job No: 0H26

Project Name:

Delivered by: Hand

Tracking No:

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]

Were custody papers included with the cooler? .... [✓ YES] NO

Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO

Record cooler temperature (recommended 2.0-6.0 °C for chemistry .... 5.2, 1.2, 0.6 °C

Cooler Accepted by: JH Date: 1/9/09 Time: 1250

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... [✓ YES] NO

What kind of packing material was used? .... Ice

Was sufficient ice used (if appropriate)? .... [✓ YES] NO

Were all bottles sealed in individual plastic bags? .... [✓ YES] NO

Did all bottle arrive in good condition (unbroken)? .... [✓ YES] NO

Were all bottle labels complete and legible? .... [✓ YES] NO

Did all bottle labels and tags agree with custody papers? .... [✓ YES] NO

Were all bottles used correct for the requested analyses? .... [✓ YES] NO

Do any of the analyses (bottles) require preservation? (attach preservation checklist) .... YES [✓ NO]

Were all VOC vials free of air bubbles? .... [✓ NA] YES NO

Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO

Samples Logged by: JH Date: 1/10/09 Time: 8:20

***** Notify Project Manager of discrepancies or concerns *****

Explain discrepancies or negative responses:

By: Date:

Case Narrative

prepared
for

Science Applications, Intl.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OH26

prepared
by

Analytical Resources, Inc.

Case Narrative

Client: GeoEngineers
Project: Irondale Sediment Quality Investigation
Matrix: Sediment
ARI Job No.: OH26

Sample receipt

Ten sediment samples and one water sample were received on January 9, 2009. The cooler temperatures measured by IR thermometer following ARI SOP were 0.6, 1.2, and 5.2° C. The samples were received in good condition with no discrepancies in paperwork. Select sample containers were archived upon receipt pending further instructions, as requested on the COC. For further details regarding sample receipt, please refer to the Cooler Receipt Form.

Semivolatiles by SW8270

The sample was extracted and analyzed within required holding times.

Initial and continuing calibrations were within limits.

The surrogate percent recoveries were within the control limits.

Benzyl Alcohol was present in the sample, the method blank, **MB-011409**, and the LCS, **LCS-011409** at levels that exceeded the calibration range of the instrument and/or fell outside the control limits. This was due to contamination in the laboratory traced to maintenance of the DI water system. As the sample was past the method recommended holding time, no further corrective action was taken.

Bis(2-Ethylhexyl)phthalate was present in the method blank at a level that was greater than the reporting limit. Since the sample was undetected for this compound, no further corrective action was required.

Diesel/Motor Oil Range Hydrocarbons by WDOE NWTPH-Dx

The samples were extracted and extracts analyzed within required holding times.

Initial and continuing calibrations were within limits.

The surrogate percent recoveries were within the control limits.

The method blank was clean at the reporting limits. The LCS percent recovery was within the control limits.

The matrix spike/matrix spike duplicate percent recoveries were within the advisory control limits.

Total Metals

The sample was digested and analyzed within required holding times. .

The method blank was clean at the detection limits. The LCS percent recoveries were within the control limits.

General Chemistry Analyses

The samples was prepped and analyzed within required holding times.

The method blank was clean at the detection limits and the LCS percent recoveries were within the control limits.

The SRM percent recoveries were within control limits.

The matrix spike percent recovery and the RPD of sulfide were outside the control limits for sample **ID-102-9-15-SD** due to lack of sample homogeneity. All other quality control parameters were met for sulfide. No further corrective action was required.

Geotechnical Parameters

A laboratory specific narrative follows.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Client: Science Applications, Intl.	Project No.: OH26
Client Project: Irondale Sediment Quality Investigation	

Case Narrative

1. Ten samples were submitted for grain size analysis according to PSEP methodology.
2. The samples were run in a single batch, and sample ID-108-12-18-SD was chosen for triplicate analysis. The triplicate data is reported on the QA summary.
3. All of the samples, except ID-101-8-14-SD, did not contain the required 5 grams of fines in the pipette portion of the analysis. Our balance has a capacity of about 200 g (by 0.0001) and a sample that would give 5 g of fines could not be split and stay within the capacity of the balance.
4. Samples PG-A1-24-S, PG-A1-10-S, PG-A1-07-S, PG-A1-03-S, PG-A1-01-S, PG-A2-11-S, PG-A2-14-S, and PG-A4-08B-S contained woody or other organic matter, which may have broken down during the sieving process, affecting grain size analysis.
5. Most of the samples contained shells and/or fragments of shells.
6. Samples ID-104-13-19-SD, ID-106-13-19-SD, and ID-107-8-14-SD contained a sticky tar like substance which is inappropriate for the PSEP grain size test.
7. The data is provided in summary tables and plots.
8. There were no other noted anomalies in this project.

Approved by: ______________________ Date: Jan 16, 2009
Lead Technician

Data Reporting Qualifiers

Effective 12/28/04

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
NR	Spiked compound recovery is not reported due to chromatographic interference
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
S	Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte
NA	The flagged analyte was not analyzed for
NS	The flagged analyte was not spiked into the sample

M	Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses
M2	The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
Y	The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
C	The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
P	The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

LCS SOLUTIONS

12/30/08

LABE	SOLN ID	TEST	CONC. UG/ML	SOLVENT	EXP.
1	1549-3	PCB	20	ACETONE	10/10/09
2	1472-3	BCOC PEST	10	ACETONE	07/20/08
3	1517-1	PEST	02/04/20	ACETONE	05/15/09
4	1561-2	LOW PEST	0.2/0.4/2	ACETONE	05/15/09
5	1537-1	EPH	1500	MECL2	08/16/09
6	1559-2	PCP	12.5/125	ACETONE	11/05/09
7	1573-1	ABN	100	ACETONE	08/01/09
8	1566-1	TBT	2.5	MECL2	12/04/09
9	1567-3	PORE TBT	.125/.25	MECL2	12/04/09
10	1554-3	ABN ACID	100/200	MEOH	10/21/09
11	1563-3	TPHD	15000	ACETONE	11/20/09
12	1563-1	ABN BASE	200	ACETONE	06/30/09
13	1573-2	LOW PCB	2	ACETONE	10/10/09
14	1547-1	LOW ABN ACID	10/20	MEOH	04/10/09
15*	1452-1	SIM PNA	15/75	MEOH	04/09/09
16	1502-2	DIOXANE	100	MEOH	02/20/09
17	1516-2	1248 PCB	20	ACETONE	05/07/09
18	1514-4	LOW SIM PNA	1.5/7.5	ACETONE	04/24/09
19	1517-3	AK103	7500	MECL2	12/29/08
20	1572-2	PNA	100	ACETONE	12/26/09
21*	1414-4	SKY/BHT	100	MEOH	04/08/09
22	1570-1	HERB	12.5/12500	MEOH	02/19/09
23	1505-1	LOW ABN BASE	20	MEOH	03/20/09
24	1541-4	LOW ABN	10	ACETONE	08/01/09
25	1481-1	DIPHENYL	100	MEOH	07/20/08
26	1545-2	OP-PEST	25	MEOH	02/14/09
27	1495-1	STEROLS	200	MEOH	12/29/08
28	1494-1	ADD. PEST	4	ACETONE	01/23/09
29	1496-3	DECANES	100	MEOH	02/12/09
30	1497-2	EDB/DBCP	2	ACETONE	02/12/09
31	1510-3	TERPINEOL	100	MEOH	03/21/09

LCS SOLUTIONS

12/30/08

32	1545-3	GUAIACOL	50-200	ACETONE	06/05/09
33	1522-1	RESIN ACID	250	ACETONE	06/11/09
34	1530-2	CONGENERS	1	ACETONE	07/23/09
50	1571-1	FULL RESIN	250	ACETONE	06/10/09
*=REVERIFIED SOLUTION					

SURR SOLUTIONS

12/30/08

LABEL	SOLN ID	TEST	CONC. UG/ML	SOLVENT	EXP.
A	1559-5	ABN	100/150	MEOH	03/13/09
B	1572-1	SIM PNA	15/75	MEOH	08/28/09
C	1559-1	SIM ABN	25/37.5	MEOH	03/13/09
D	1561-3	LOW PCB	0.2	ACETONE	07/31/09
E*	1478-1	HERB	62.5	MEOH	09/21/09
F	1520-3	PCP	12.5	ACETONE	04/18/09
G	1534-1	1,4DIOXANE	100	MEOH	02/20/09
H	1545-1	OP-PEST	25	MEOH	02/14/09
I	1559-4	LOW S. PNA	1.5	MEOH	08/28/09
J	1566-5	TBT-PORE	0.125	MECL2	12/04/09
K	1538-1	MED PCB	20	ACETONE	07/31/09
L	1566-4	TBT	2.5	MECL2	12/04/09
M	1558-2	EPH	1500	MECL2	09/24/09
N	1538-2	PCB	2	ACETONE	07/31/09
O	1567-4	TPH	450	MECL2	09/24/09
P	1560-3	HCID	2250	MECL2	09/24/09
Q	1497-3	EDB	2	ACETONE	02/12/09
R	1521-4	RESIN ACID	250	ACETONE	06/11/09
S	1568-5	PBDE	.25	MEOH	12/11/09
T	*reverified solution				
U					
V					
W					
X					
Y					
Z					

Data Summary Package

prepared
for

Science Applications, Intl.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OH26

prepared
by

Analytical Resources, Inc.

SEMIVOLATILE

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: ID-104-R
SAMPLE

Lab Sample ID: OH26K
LIMS ID: 09-856
Matrix: Water
Data Release Authorized:
Reported: 01/19/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA
NA
Date Sampled: 01/08/09
Date Received: 01/09/09

Date Extracted: 01/14/09
Date Analyzed: 01/17/09 15:44
Instrument/Analyst: NT6/LJR

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
108-95-2	Phenol	1.0	< 1.0 U
111-44-4	Bis-(2-Chloroethyl) Ether	1.0	< 1.0 U
95-57-8	2-Chlorophenol	1.0	< 1.0 U
541-73-1	1,3-Dichlorobenzene	1.0	< 1.0 U
106-46-7	1,4-Dichlorobenzene	1.0	< 1.0 U
100-51-6	**Benzyl Alcohol**	**5.0**	**100 BE**
95-50-1	1,2-Dichlorobenzene	1.0	< 1.0 U
95-48-7	2-Methylphenol	1.0	< 1.0 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	1.0	< 1.0 U
106-44-5	4-Methylphenol	1.0	< 1.0 U
621-64-7	N-Nitroso-Di-N-Propylamine	5.0	< 5.0 U
67-72-1	Hexachloroethane	1.0	< 1.0 U
98-95-3	Nitrobenzene	1.0	< 1.0 U
78-59-1	Isophorone	1.0	< 1.0 U
88-75-5	2-Nitrophenol	5.0	< 5.0 U
105-67-9	2,4-Dimethylphenol	1.0	< 1.0 U
65-85-0	Benzoic Acid	10	< 10 U
111-91-1	bis(2-Chloroethoxy) Methane	1.0	< 1.0 U
120-83-2	2,4-Dichlorophenol	5.0	< 5.0 U
120-82-1	1,2,4-Trichlorobenzene	1.0	< 1.0 U
91-20-3	Naphthalene	1.0	< 1.0 U
106-47-8	4-Chloroaniline	5.0	< 5.0 U
87-68-3	Hexachlorobutadiene	1.0	< 1.0 U
59-50-7	4-Chloro-3-methylphenol	5.0	< 5.0 U
91-57-6	2-Methylnaphthalene	1.0	< 1.0 U
77-47-4	Hexachlorocyclopentadiene	5.0	< 5.0 U
88-06-2	2,4,6-Trichlorophenol	5.0	< 5.0 U
95-95-4	2,4,5-Trichlorophenol	5.0	< 5.0 U
91-58-7	2-Chloronaphthalene	1.0	< 1.0 U
88-74-4	2-Nitroaniline	5.0	< 5.0 U
131-11-3	Dimethylphthalate	1.0	< 1.0 U
208-96-8	Acenaphthylene	1.0	< 1.0 U
99-09-2	3-Nitroaniline	5.0	< 5.0 U
83-32-9	Acenaphthene	1.0	< 1.0 U
51-28-5	2,4-Dinitrophenol	10	< 10 U
100-02-7	4-Nitrophenol	5.0	< 5.0 U
132-64-9	Dibenzofuran	1.0	< 1.0 U
606-20-2	2,6-Dinitrotoluene	5.0	< 5.0 U
121-14-2	2,4-Dinitrotoluene	5.0	< 5.0 U
84-66-2	Diethylphthalate	1.0	< 1.0 U

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: ID-104-R
SAMPLE

Lab Sample ID: OH26K
LIMS ID: 09-856
Matrix: Water
Date Analyzed: 01/17/09 15:44

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA
NA

CAS Number	Analyte	RL	Result
7005-72-3	4-Chlorophenyl-phenylether	1.0	< 1.0 U
86-73-7	Fluorene	1.0	< 1.0 U
100-01-6	4-Nitroaniline	5.0	< 5.0 U
534-52-1	4,6-Dinitro-2-Methylphenol	10	< 10 U
86-30-6	N-Nitrosodiphenylamine	1.0	< 1.0 U
101-55-3	4-Bromophenyl-phenylether	1.0	< 1.0 U
118-74-1	Hexachlorobenzene	1.0	< 1.0 U
87-86-5	Pentachlorophenol	5.0	< 5.0 U
85-01-8	Phenanthrene	1.0	< 1.0 U
86-74-8	Carbazole	1.0	< 1.0 U
120-12-7	Anthracene	1.0	< 1.0 U
84-74-2	Di-n-Butylphthalate	1.0	< 1.0 U
206-44-0	Fluoranthene	1.0	< 1.0 U
129-00-0	Pyrene	1.0	< 1.0 U
85-68-7	Butylbenzylphthalate	1.0	< 1.0 U
91-94-1	3,3'-Dichlorobenzidine	5.0	< 5.0 U
56-55-3	Benzo(a)anthracene	1.0	< 1.0 U
117-81-7	bis(2-Ethylhexyl)phthalate	1.0	< 1.0 U
218-01-9	Chrysene	1.0	< 1.0 U
117-84-0	Di-n-Octyl phthalate	1.0	< 1.0 U
205-99-2	Benzo(b)fluoranthene	1.0	< 1.0 U
207-08-9	Benzo(k)fluoranthene	1.0	< 1.0 U
50-32-8	Benzo(a)pyrene	1.0	< 1.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	1.0	< 1.0 U
53-70-3	Dibenz(a,h)anthracene	1.0	< 1.0 U
191-24-2	Benzo(g,h,i)perylene	1.0	< 1.0 U
90-12-0	1-Methylnaphthalene	1.0	< 1.0 U

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	68.0%	2-Fluorobiphenyl	68.0%
d14-p-Terphenyl	70.0%	d4-1,2-Dichlorobenzene	58.4%
d5-Phenol	63.5%	2-Fluorophenol	64.3%
2,4,6-Tribromophenol	74.1%	d4-2-Chlorophenol	68.5%

SW8270 SEMIVOLATILES WATER SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Client ID	NBZ	FBP	TPH	DCB	PHL	2FP	TBP	2CP	TOT OUT
MB-011409	67.2%	65.6%	82.8%	58.4%	67.2%	65.1%	69.6%	70.4%	0
LCS-011409	69.2%	67.6%	81.2%	62.4%	67.2%	66.7%	78.9%	70.4%	0
ID-104-R	68.0%	68.0%	70.0%	58.4%	63.5%	64.3%	74.1%	68.5%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(54-102)	(40-103)
(FBP) = 2-Fluorobiphenyl	(47-99)	(35-98)
(TPH) = d14-p-Terphenyl	(50-119)	(21-122)
(DCB) = d4-1,2-Dichlorobenzene	(39-86)	(28-85)
(PHL) = d5-Phenol	(45-100)	(32-99)
(2FP) = 2-Fluorophenol	(49-94)	(36-93)
(TBP) = 2,4,6-Tribromophenol	(49-117)	(37-120)
(2CP) = d4-2-Chlorophenol	(54-99)	(40-98)

Prep Method: SW3520C
Log Number Range: 09-856 to 09-856

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: LCS-011409
LAB CONTROL

Lab Sample ID: LCS-011409
LIMS ID: 09-856
Matrix: Water
Data Release Authorized:
Reported: 01/19/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Date Sampled: 01/08/09
Date Received: 01/09/09

Date Extracted: 01/14/09
Date Analyzed: 01/17/09 12:25
Instrument/Analyst: NT6/LJR
GPC Cleanup: NO

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

Analyte	Lab Control	Spike Added	Recovery
Phenol	16.7	25.0	66.8%
Bis-(2-Chloroethyl) Ether	16.2	25.0	64.8%
2-Chlorophenol	17.4	25.0	69.6%
1,3-Dichlorobenzene	13.1	25.0	52.4%
1,4-Dichlorobenzene	13.1	25.0	52.4%
Benzyl Alcohol	251 E	50.0	502%
1,2-Dichlorobenzene	14.1	25.0	56.4%
2-Methylphenol	17.3	25.0	69.2%
2,2'-Oxybis(1-Chloropropane)	15.6	25.0	62.4%
4-Methylphenol	37.0	50.0	74.0%
N-Nitroso-Di-N-Propylamine	16.5	25.0	66.0%
Hexachloroethane	11.3	25.0	45.2%
Nitrobenzene	17.6	25.0	70.4%
Isophorone	18.2	25.0	72.8%
2-Nitrophenol	20.3	25.0	81.2%
2,4-Dimethylphenol	17.2	25.0	68.8%
Benzoic Acid	53.0	75.0	70.7%
bis(2-Chloroethoxy) Methane	17.8	25.0	71.2%
2,4-Dichlorophenol	19.0	25.0	76.0%
1,2,4-Trichlorobenzene	15.0	25.0	60.0%
Naphthalene	17.0	25.0	68.0%
4-Chloroaniline	40.7	60.0	67.8%
Hexachlorobutadiene	13.0	25.0	52.0%
4-Chloro-3-methylphenol	20.0	25.0	80.0%
2-Methylnaphthalene	17.7	25.0	70.8%
Hexachlorocyclopentadiene	49.2	75.0	65.6%
2,4,6-Trichlorophenol	18.5	25.0	74.0%
2,4,5-Trichlorophenol	18.6	25.0	74.4%
2-Chloronaphthalene	17.4	25.0	69.6%
2-Nitroaniline	18.6	25.0	74.4%
Dimethylphthalate	19.3	25.0	77.2%
Acenaphthylene	18.0	25.0	72.0%
3-Nitroaniline	55.8	64.0	87.2%
Acenaphthene	18.4	25.0	73.6%
2,4-Dinitrophenol	100	75.0	133%
4-Nitrophenol	17.0	25.0	68.0%
Dibenzofuran	18.8	25.0	75.2%

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: LCS-011409
LAB CONTROL

Lab Sample ID: LCS-011409
LIMS ID: 09-856
Matrix: Water
Date Analyzed: 01/17/09 12:25

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Analyte	**Lab Control**	**Spike Added**	**Recovery**
2,6-Dinitrotoluene	21.7	25.0	86.8%
2,4-Dinitrotoluene	22.4	25.0	89.6%
Diethylphthalate	20.2	25.0	80.8%
4-Chlorophenyl-phenylether	18.2	25.0	72.8%
Fluorene	19.4	25.0	77.6%
4-Nitroaniline	19.1	25.0	76.4%
4,6-Dinitro-2-Methylphenol	46.0	75.0	61.3%
N-Nitrosodiphenylamine	19.5	25.0	78.0%
4-Bromophenyl-phenylether	19.8	25.0	79.2%
Hexachlorobenzene	19.9	25.0	79.6%
Pentachlorophenol	20.0	25.0	80.0%
Phenanthrene	20.9	25.0	83.6%
Carbazole	21.8	25.0	87.2%
Anthracene	20.2	25.0	80.8%
Di-n-Butylphthalate	21.2	25.0	84.8%
Fluoranthene	21.2	25.0	84.8%
Pyrene	20.9	25.0	83.6%
Butylbenzylphthalate	21.1	25.0	84.4%
3,3'-Dichlorobenzidine	44.7	64.0	69.8%
Benzo(a)anthracene	20.2	25.0	80.8%
bis(2-Ethylhexyl)phthalate	21.2	25.0	84.8%
Chrysene	19.7	25.0	78.8%
Di-n-Octyl phthalate	20.5	25.0	82.0%
Benzo(b)fluoranthene	20.5	25.0	82.0%
Benzo(k)fluoranthene	21.4	25.0	85.6%
Benzo(a)pyrene	17.0	25.0	68.0%
Indeno(1,2,3-cd)pyrene	22.0	25.0	88.0%
Dibenz(a,h)anthracene	19.5	25.0	78.0%
Benzo(g,h,i)perylene	18.4	25.0	73.6%
1-Methylnaphthalene	19.4	25.0	77.6%

Semivolatile Surrogate Recovery

d5-Nitrobenzene	69.2%
2-Fluorobiphenyl	67.6%
d14-p-Terphenyl	81.2%
d4-1,2-Dichlorobenzene	62.4%
d5-Phenol	67.2%
2-Fluorophenol	66.7%
2,4,6-Tribromophenol	78.9%
d4-2-Chlorophenol	70.4%

Results reported in µg/L

4B
SEMIVOLATILE METHOD BLANK SUMMARY

BLANK NO.

OH26MBW1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SAIC

ARI Job No: OH26

Project: IRONDALE SEDIMENT QU

Lab File ID: OH26MB

Date Extracted: 01/14/09

Instrument ID: NT6

Date Analyzed: 01/17/09

Matrix: LIQUID

Time Analyzed: 1153

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	OH26LCSW1	OH26LCSW1	OH26SB	01/17/09
02	ID-104-R	OH26K	OH26K	01/17/09
03				
04				
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06				
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COMMENTS:

page 1 of 1

FORM IV SV

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: MB-011409
METHOD BLANK

Lab Sample ID: MB-011409
LIMS ID: 09-856
Matrix: Water
Data Release Authorized:
Reported: 01/19/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA
NA
Date Sampled: NA
Date Received: NA

Date Extracted: 01/14/09
Date Analyzed: 01/17/09 11:53
Instrument/Analyst: NT6/LJR

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
108-95-2	Phenol	1.0	< 1.0 U
111-44-4	Bis-(2-Chloroethyl) Ether	1.0	< 1.0 U
95-57-8	2-Chlorophenol	1.0	< 1.0 U
541-73-1	1,3-Dichlorobenzene	1.0	< 1.0 U
106-46-7	1,4-Dichlorobenzene	1.0	< 1.0 U
100-51-6	**Benzyl Alcohol**	**5.0**	**220 E**
95-50-1	1,2-Dichlorobenzene	1.0	< 1.0 U
95-48-7	2-Methylphenol	1.0	< 1.0 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	1.0	< 1.0 U
106-44-5	4-Methylphenol	1.0	< 1.0 U
621-64-7	N-Nitroso-Di-N-Propylamine	5.0	< 5.0 U
67-72-1	Hexachloroethane	1.0	< 1.0 U
98-95-3	Nitrobenzene	1.0	< 1.0 U
78-59-1	Isophorone	1.0	< 1.0 U
88-75-5	2-Nitrophenol	5.0	< 5.0 U
105-67-9	2,4-Dimethylphenol	1.0	< 1.0 U
65-85-0	Benzoic Acid	10	< 10 U
111-91-1	bis(2-Chloroethoxy) Methane	1.0	< 1.0 U
120-83-2	2,4-Dichlorophenol	5.0	< 5.0 U
120-82-1	1,2,4-Trichlorobenzene	1.0	< 1.0 U
91-20-3	Naphthalene	1.0	< 1.0 U
106-47-8	4-Chloroaniline	5.0	< 5.0 U
87-68-3	Hexachlorobutadiene	1.0	< 1.0 U
59-50-7	4-Chloro-3-methylphenol	5.0	< 5.0 U
91-57-6	2-Methylnaphthalene	1.0	< 1.0 U
77-47-4	Hexachlorocyclopentadiene	5.0	< 5.0 U
88-06-2	2,4,6-Trichlorophenol	5.0	< 5.0 U
95-95-4	2,4,5-Trichlorophenol	5.0	< 5.0 U
91-58-7	2-Chloronaphthalene	1.0	< 1.0 U
88-74-4	2-Nitroaniline	5.0	< 5.0 U
131-11-3	Dimethylphthalate	1.0	< 1.0 U
208-96-8	Acenaphthylene	1.0	< 1.0 U
99-09-2	3-Nitroaniline	5.0	< 5.0 U
83-32-9	Acenaphthene	1.0	< 1.0 U
51-28-5	2,4-Dinitrophenol	10	< 10 U
100-02-7	4-Nitrophenol	5.0	< 5.0 U
132-64-9	Dibenzofuran	1.0	< 1.0 U
606-20-2	2,6-Dinitrotoluene	5.0	< 5.0 U
121-14-2	2,4-Dinitrotoluene	5.0	< 5.0 U
84-66-2	Diethylphthalate	1.0	< 1.0 U

FORM I

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: MB-011409
METHOD BLANK

Lab Sample ID: MB-011409
LIMS ID: 09-856
Matrix: Water
Date Analyzed: 01/17/09 11:53

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA
NA

CAS Number	Analyte	RL	Result
7005-72-3	4-Chlorophenyl-phenylether	1.0	< 1.0 U
86-73-7	Fluorene	1.0	< 1.0 U
100-01-6	4-Nitroaniline	5.0	< 5.0 U
534-52-1	4,6-Dinitro-2-Methylphenol	10	< 10 U
86-30-6	N-Nitrosodiphenylamine	1.0	< 1.0 U
101-55-3	4-Bromophenyl-phenylether	1.0	< 1.0 U
118-74-1	Hexachlorobenzene	1.0	< 1.0 U
87-86-5	Pentachlorophenol	5.0	< 5.0 U
85-01-8	Phenanthrene	1.0	< 1.0 U
86-74-8	Carbazole	1.0	< 1.0 U
120-12-7	Anthracene	1.0	< 1.0 U
84-74-2	Di-n-Butylphthalate	1.0	< 1.0 U
206-44-0	Fluoranthene	1.0	< 1.0 U
129-00-0	Pyrene	1.0	< 1.0 U
85-68-7	Butylbenzylphthalate	1.0	< 1.0 U
91-94-1	3,3'-Dichlorobenzidine	5.0	< 5.0 U
56-55-3	Benzo(a)anthracene	1.0	< 1.0 U
117-81-7	**bis(2-Ethylhexyl)phthalate**	**1.0**	**1.7**
218-01-9	Chrysene	1.0	< 1.0 U
117-84-0	Di-n-Octyl phthalate	1.0	< 1.0 U
205-99-2	Benzo(b)fluoranthene	1.0	< 1.0 U
207-08-9	Benzo(k)fluoranthene	1.0	< 1.0 U
50-32-8	Benzo(a)pyrene	1.0	< 1.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	1.0	< 1.0 U
53-70-3	Dibenz(a,h)anthracene	1.0	< 1.0 U
191-24-2	Benzo(g,h,i)perylene	1.0	< 1.0 U
90-12-0	1-Methylnaphthalene	1.0	< 1.0 U

Reported in µg/L (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	67.2%	2-Fluorobiphenyl	65.6%
d14-p-Terphenyl	82.8%	d4-1,2-Dichlorobenzene	58.4%
d5-Phenol	67.2%	2-Fluorophenol	65.1%
2,4,6-Tribromophenol	69.6%	d4-2-Chlorophenol	70.4%

NWTPHDx

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1
Matrix: Water

QC Report No: OH26-Science Applications, Intl
Project: IRONDALE SEDIMENT QUALITY INVES

Data Release Authorized:
Reported: 01/15/09

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range	RL	Result
MB-011309	Method Blank	01/13/09	01/14/09	1.00	Diesel	0.25	< 0.25 U
09-856	HC ID: ---		FID4A	1.0	Motor Oil	0.50	< 0.50 U
					o-Terphenyl		92.7%
OH26K	ID-104-R	01/13/09	01/14/09	1.00	Diesel	0.25	< 0.25 U
09-856	HC ID: ---		FID4A	1.0	Motor Oil	0.50	< 0.50 U
					o-Terphenyl		98.9%

Reported in mg/L (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel quantitation on total peaks in the range from C12 to C24.
Motor Oil quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Client ID	OTER	TOT OUT
MB-011309	92.7%	0
LCS-011309	104%	0
ID-104-R	98.9%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(49-118)	(45-112)

Prep Method: SW3510C
Log Number Range: 09-856 to 09-856

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1

Sample ID: LCS-011309
LAB CONTROL

Lab Sample ID: LCS-011309
LIMS ID: 09-856
Matrix: Water
Data Release Authorized:
Reported: 01/15/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Date Sampled: 01/08/09
Date Received: 01/09/09

Date Extracted: 01/13/09
Date Analyzed: 01/14/09 20:17
Instrument/Analyst: FID/PKC

Sample Amount: 500 mL
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00

Range	**Lab Control**	**Spike Added**	**Recovery**
Diesel	3.07	3.00	102%

TPHD Surrogate Recovery	
o-Terphenyl	104%

Results reported in mg/L

FORM III

4

TPH METHOD BLANK SUMMARY

BLANK NO.

OH26MBW1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SCIENCE APPLICATIONS, INTL.

SDG No.: OH26

Project No.: IRONDALE SEDIMENT QUALITY

Date Extracted: 01/13/09

Matrix: LIQUID

Date Analyzed : 01/14/09

Instrument ID : FID4A

Time Analyzed : 2003

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS, and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED
01	OH26LCSW1	OH26LCSW1	01/14/09
02	ID-104-R	OH26K	01/14/09
03			
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FORM IV TPH

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1
Matrix: Sediment

QC Report No: OH26-Science Applications, Intl
Project: IRONDALE SEDIMENT QUALITY INVES

Data Release Authorized:
Reported: 01/16/09

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range	RL	Result
MB-011309	Method Blank	01/13/09	01/15/09	1.00	Diesel	5.0	< 5.0 U
09-846	HC ID: ---		FID4A	1.0	Motor Oil	10	< 10 U
					o-Terphenyl		76.9%
OH26A	ID-108-12-18-SD	01/13/09	01/15/09	1.00	**Diesel**	**6.2**	**42**
09-846	HC ID: **DRO/MOTOR OIL**		FID4A	1.0	**Motor Oil**	**12**	**94**
					o-Terphenyl		79.3%
OH26B	ID-101-8-14-SD	01/13/09	01/15/09	1.00	**Diesel**	**32**	**85**
09-847	HC ID: **DRO/MOTOR OIL**		FID4A	5.0	**Motor Oil**	**64**	**150**
					o-Terphenyl		76.3%
OH26C	ID-102-9-15-SD	01/13/09	01/15/09	1.00	**Diesel**	**32**	**280**
09-848	HC ID: **DRO/MOTOR OIL**		FID4A	5.0	**Motor Oil**	**64**	**410**
					o-Terphenyl		82.7%
OH26D	ID-103-11-17-SD	01/13/09	01/15/09	1.00	**Diesel**	**6.1**	**20**
09-849	HC ID: **DRO/MOTOR OIL**		FID4A	1.0	**Motor Oil**	**12**	**38**
					o-Terphenyl		82.2%
OH26E	ID-103-11-17-D	01/13/09	01/15/09	1.00	**Diesel**	**6.2**	**18**
09-850	HC ID: **DRO/MOTOR OIL**		FID4A	1.0	**Motor Oil**	**12**	**32**
					o-Terphenyl		80.4%
OH26G	ID-104-13-19-SD	01/13/09	01/16/09	1.00	**Diesel**	**310**	**5400**
09-852	HC ID: **DRO/MOTOR OIL**		FID4A	50	**Motor Oil**	**620**	**3600**
					o-Terphenyl		D
OH26H	ID-100-15-21-SD	01/13/09	01/16/09	1.00	**Diesel**	**6.1**	**9.1**
09-853	HC ID: **DRO/MOTOR OIL**		FID4A	1.0	**Motor Oil**	**12**	**21**
					o-Terphenyl		76.9%
OH26I	ID-106-13-19-SD	01/13/09	01/16/09	1.00	**Diesel**	**320**	**3600**
09-854	HC ID: **DRO/MOTOR OIL**		FID4A	50	**Motor Oil**	**650**	**2600**
					o-Terphenyl		D
OH26J	ID-107-8-14-SD	01/13/09	01/16/09	1.00	**Diesel**	**320**	**4000**
09-855	HC ID: **DRO/MOTOR OIL**		FID4A	50	**Motor Oil**	**640**	**3100**
					o-Terphenyl		D

Reported in mg/kg (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel quantitation on total peaks in the range from C12 to C24.
Motor Oil quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Client ID	OTER	TOT OUT
MB-011309	76.9%	0
LCS-011309	82.4%	0
ID-108-12-18-SD	79.3%	0
ID-108-12-18-SD MS	77.8%	0
ID-108-12-18-SD MSD	73.1%	0
ID-101-8-14-SD	76.3%	0
ID-102-9-15-SD	82.7%	0
ID-103-11-17-SD	82.2%	0
ID-103-11-17-D	80.4%	0
ID-104-13-19-SD	D	0
ID-100-15-21-SD	76.9%	0
ID-106-13-19-SD	D	0
ID-107-8-14-SD	D	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(62-118)	(49-125)

Prep Method: SW3550B
Log Number Range: 09-846 to 09-855

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1

Sample ID: ID-108-12-18-SD
MS/MSD

Lab Sample ID: OH26A
LIMS ID: 09-846
Matrix: Sediment
Data Release Authorized:
Reported: 01/16/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted MS/MSD: 01/13/09

Date Analyzed MS: 01/15/09 22:38
MSD: 01/15/09 22:52
Instrument/Analyst MS: FID/PKC
MSD: FID/PKC

Sample Amount MS: 8.13 g-dry-wt
MSD: 8.06 g-dry-wt
Final Extract Volume MS: 1.0 mL
MSD: 1.0 mL
Dilution Factor MS: 1.0
MSD: 1.0
Percent Moisture: 20.0%

Range	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Diesel	41.8	173	185	70.9%	161	186	64.1%	7.2%

TPHD Surrogate Recovery

	MS	**MSD**
o-Terphenyl	77.8%	73.1%

Results reported in mg/kg
RPD calculated using sample concentrations per SW846.

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1

Sample ID: LCS-011309
LAB CONTROL

Lab Sample ID: LCS-011309
LIMS ID: 09-846
Matrix: Sediment
Data Release Authorized:
Reported: 01/16/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 01/13/09
Date Analyzed: 01/15/09 22:10
Instrument/Analyst: FID/PKC

Sample Amount: 10.0 g
Final Extract Volume: 1.0 mL
Dilution Factor: 1.0

Range	**Lab Control**	**Spike Added**	**Recovery**
Diesel	121	150	80.7%

TPHD Surrogate Recovery	
o-Terphenyl	82.4%

Results reported in mg/kg

4

TPH METHOD BLANK SUMMARY

BLANK NO.

OH26MBS1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SCIENCE APPLICATIONS, INTL.

SDG No.: OH26

Project No.: IRONDALE SEDIMENT QUALITY

Date Extracted: 01/13/09

Matrix: SOLID

Date Analyzed : 01/15/09

Instrument ID : FID4A

Time Analyzed : 2142

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS, and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED
01	OH26LCSS1	OH26LCSS1	01/15/09
02	ID-108-12-18	OH26A	01/15/09
03	ID-108-12-18	OH26AMS	01/15/09
04	ID-108-12-18	OH26AMSD	01/15/09
05	ID-101-8-14-	OH26B	01/15/09
06	ID-102-9-15-	OH26C	01/15/09
07	ID-103-11-17	OH26D	01/15/09
08	ID-103-11-17	OH26E	01/15/09
09	ID-104-13-19	OH26G	01/16/09
10	ID-100-15-21	OH26H	01/16/09
11	ID-106-13-19	OH26I	01/16/09
12	ID-107-8-14-	OH26J	01/16/09
13			
14			
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16			
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21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

METALS

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: ID-104-R
SAMPLE

Lab Sample ID: OH26K
LIMS ID: 09-856
Matrix: Water
Data Release Authorized
Reported: 01/27/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Date Sampled: 01/08/09
Date Received: 01/09/09

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L	Q
3010A	01/19/09	6010B	01/22/09	7440-38-2	Arsenic	0.05	0.05	U
3010A	01/19/09	6010B	01/22/09	7440-43-9	Cadmium	0.002	0.002	U
3010A	01/19/09	6010B	01/22/09	7440-47-3	Chromium	0.005	0.005	U
3010A	01/19/09	6010B	01/22/09	7440-50-8	Copper	0.002	0.002	U
3010A	01/19/09	6010B	01/22/09	7439-92-1	Lead	0.02	0.02	U
7470A	01/19/09	7470A	01/23/09	7439-97-6	Mercury	0.0001	0.0001	U
3010A	01/19/09	6010B	01/22/09	7440-22-4	Silver	0.003	0.003	U
3010A	01/19/09	6010B	01/22/09	7440-66-6	Zinc	0.01	0.01	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: OH26LCS
LIMS ID: 09-856
Matrix: Water
Data Release Authorized:
Reported: 01/27/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	6010B	1.99	2.00	99.5%	
Cadmium	6010B	0.497	0.500	99.4%	
Chromium	6010B	0.480	0.500	96.0%	
Copper	6010B	0.480	0.500	96.0%	
Lead	6010B	1.95	2.00	97.5%	
Mercury	7470A	0.0019	0.0020	95.0%	
Silver	6010B	0.521	0.500	104%	
Zinc	6010B	0.49	0.50	98.0%	

Reported in mg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: OH26MB
LIMS ID: 09-856
Matrix: Water
Data Release Authorized:
Reported: 01/27/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L	Q
3010A	01/19/09	6010B	01/22/09	7440-38-2	Arsenic	0.05	0.05	U
3010A	01/19/09	6010B	01/22/09	7440-43-9	Cadmium	0.002	0.002	U
3010A	01/19/09	6010B	01/22/09	7440-47-3	Chromium	0.005	0.005	U
3010A	01/19/09	6010B	01/22/09	7440-50-8	Copper	0.002	0.002	U
3010A	01/19/09	6010B	01/22/09	7439-92-1	Lead	0.02	0.02	U
7470A	01/19/09	7470A	01/23/09	7439-97-6	Mercury	0.0001	0.0001	U
3010A	01/19/09	6010B	01/22/09	7440-22-4	Silver	0.003	0.003	U
3010A	01/19/09	6010B	01/22/09	7440-66-6	Zinc	0.01	0.01	U

U-Analyte undetected at given RL
RL-Reporting Limit

GENERAL CHEMISTRY

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-108-12-18-SD
ARI ID: 09-846 OH26A

Analyte	Date	Method	Units	RL	Sample	
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	70.70	
Preserved Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	74.60	
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	1.79	
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.13	< 0.13	U
Sulfide	01/13/09 011309#1	EPA 376.2	mg/kg	64.7	498	
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	2.82	

RL	Analytical reporting limit
U	Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-101-8-14-SD
ARI ID: 09-847 OH26B

Analyte	**Date**	**Method**	**Units**	**RL**	**Sample**
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	69.80
Preserved Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	68.90
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	6.94
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.14	0.21
Sulfide	01/13/09 011309#1	EPA 376.2	mg/kg	139	2,170
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	4.16

RL	Analytical reporting limit
U	Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-102-9-15-SD
ARI ID: 09-848 OH26C

Analyte	Date	Method	Units	RL	Sample
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	71.00
Preserved Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	70.20
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	9.32
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.14	0.60
Sulfide	01/13/09 011309#1	EPA 376.2	mg/kg	66.9	742
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	3.41

RL Analytical reporting limit
U Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-103-11-17-SD
ARI ID: 09-849 OH26D

Analyte	Date	Method	Units	RL	Sample	
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	72.70	
Preserved Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	75.60	
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	3.07	
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.13	< 0.13	U
Sulfide	01/13/09 011309#1	EPA 376.2	mg/kg	13.0	< 13.0	U
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	1.35	

RL	Analytical reporting limit
U	Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-103-11-17-D
ARI ID: 09-850 OH26E

Analyte	**Date**	**Method**	**Units**	**RL**	**Sample**
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	71.70
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	2.48
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.13	< 0.13 U
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	1.78

RL Analytical reporting limit
U Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-103-11-17-T
ARI ID: 09-851 OH26F

Analyte	**Date**	**Method**	**Units**	**RL**	**Sample**	
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	74.20	
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	2.13	
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.12	< 0.12	U
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	1.46	

RL	Analytical reporting limit
U	Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-104-13-19-SD
ARI ID: 09-852 OH26G

Analyte	Date	Method	Units	RL	Sample	
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	73.10	
Preserved Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	70.00	
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	3.81	
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.13	< 0.13	U
Sulfide	01/13/09 011309#1	EPA 376.2	mg/kg	70.2	706	
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	5.57	

RL	Analytical reporting limit
U	Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-100-15-21-SD
ARI ID: 09-853 OH26H

Analyte	Date	Method	Units	RL	Sample	
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	77.20	
Preserved Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	75.10	
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	1.75	
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.61	< 0.61	U
Sulfide	01/13/09 011309#1	EPA 376.2	mg/kg	25.4	343	
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	2.03	

RL	Analytical reporting limit
U	Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-106-13-19-SD
ARI ID: 09-854 OH26I

Analyte	Date	Method	Units	RL	Sample
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	74.20
Preserved Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	68.70
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	4.56
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.13	0.13
Sulfide	01/13/09 011309#1	EPA 376.2	mg/kg	1.42	4.26
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	3.91

RL	Analytical reporting limit
U	Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Client ID: ID-107-8-14-SD
ARI ID: 09-855 OH26J

Analyte	Date	Method	Units	RL	Sample
Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	74.10
Preserved Total Solids	01/12/09 011209#1	EPA 160.3	Percent	0.01	70.80
Total Volatile Solids	01/12/09 011209#1	EPA 160.4	Percent	0.01	4.68
N-Ammonia	01/14/09 011409#3	EPA 350.1M	mg-N/kg	0.13	0.16
Sulfide	01/13/09 011309#1	EPA 376.2	mg/kg	27.3	299
Total Organic Carbon	01/16/09 011609#1	Plumb,1981	Percent	0.020	4.81

RL Analytical reporting limit
U Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

MS/MSD RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Analyte	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: OH26A Client ID: ID-108-12-18-SD						
Total Organic Carbon	01/16/09	Percent	2.82	5.45	3.07	85.5%
ARI ID: OH26C Client ID: ID-102-9-15-SD						
Sulfide	01/13/09	mg/kg	742	672	170	-41.2%

REPLICATE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: OH26A Client ID: ID-108-12-18-SD					
Total Solids	01/12/09	Percent	70.70	68.50 67.10	2.6%
Preserved Total Solids	01/12/09	Percent	74.60	72.20 72.70	1.7%
Total Volatile Solids	01/12/09	Percent	1.79	1.54 1.92	11.0%
N-Ammonia	01/14/09	mg-N/kg	< 0.13	< 0.13	NA
Total Organic Carbon	01/16/09	Percent	2.82	2.74 2.80	1.5%
ARI ID: OH26C Client ID: ID-102-9-15-SD					
Sulfide	01/13/09	mg/kg	742	453	48.4%

LAB CONTROL RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: NA
Date Received: NA

Analyte	**Date**	**Units**	**LCS**	**Spike Added**	**Recovery**
Sulfide	01/13/09	mg/kg	135	123	110.1%
Total Organic Carbon	01/16/09	Percent	0.511	0.500	102.2%

METHOD BLANK RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	01/12/09	Percent	< 0.01 U
Preserved Total Solids	01/12/09	Percent	< 0.01 U
Total Volatile Solids	01/12/09	Percent	< 0.01 U
N-Ammonia	01/14/09	mg-N/kg	< 0.10 U
Sulfide	01/13/09	mg/kg	< 1.00 U
Total Organic Carbon	01/16/09	Percent	< 0.020 U

STANDARD REFERENCE RESULTS-CONVENTIONALS
OH26-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 01/22/09

Project: IRONDALE SEDIMENT QUALITY IN
Event: NA
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	**Date**	**Units**	**SRM**	**True Value**	**Recovery**
N-Ammonia SPEX 28-24AS	01/14/09	mg-N/kg	96.6	100	96.6%
Total Organic Carbon NIST #8704	01/16/09	Percent	3.44	3.35	102.7%

GEOTECH

Science Applications, Intl.
Irondale Sediment Quality Investigation

Apparent Grain Size Distribution Summary
Percent Finer Than Indicated Size

Sample No.	Gravel			Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt				Clay	
Phi Size	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Sieve Size (microns)	3/8"	#4 (4750)	#10 (2000)	#18 (1000)	#35 (500)	#60 (250)	#120 (125)	#230 (63)	31.00	15.60	7.80	3.90	2.00	1.00
ID-108-12-18-SD	100.0	92.1	87.9	83.6	65.7	14.6	3.5	2.0	NA	NA	NA	NA	NA	NA
ID-108-12-18-SD	100.0	90.0	85.1	81.3	63.9	13.3	1.9	0.4	NA	NA	NA	NA	NA	NA
ID-108-12-18-SD	100.0	89.8	84.8	80.8	63.4	19.6	2.4	0.9	NA	NA	NA	NA	NA	NA
ID-101-8-14-SD	100.0	81.0	70.7	60.4	45.4	22.6	11.1	7.0	2.4	1.8	1.4	1.1	1.0	0.8
ID-102-9-15-SD	100.0	94.2	82.0	63.7	49.7	25.6	6.2	1.7	NA	NA	NA	NA	NA	NA
ID-103-11-17-SD	100.0	88.6	84.0	79.9	64.5	23.0	2.9	1.0	NA	NA	NA	NA	NA	NA
ID-103-11-17-D	100.0	84.7	79.6	74.9	59.0	20.9	3.4	1.7	NA	NA	NA	NA	NA	NA
ID-103-11-17-T	100.0	75.6	71.8	67.6	53.5	18.9	3.4	1.9	NA	NA	NA	NA	NA	NA
ID-104-13-19-SD	100.0	95.2	80.0	64.2	46.7	17.0	5.8	3.8	NA	NA	NA	NA	NA	NA
ID-100-15-21-SD	100.0	91.6	82.4	72.0	56.6	21.1	6.7	3.4	1.3	1.0	0.9	0.8	0.7	0.7
ID-106-13-19-SD	100.0	97.6	85.7	74.6	56.4	23.1	6.0	2.7	NA	NA	NA	NA	NA	NA
ID-107-8-14-SD	100.0	78.5	65.4	55.3	37.3	11.2	2.1	0.9	NA	NA	NA	NA	NA	NA

Notes to the Testing:

1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

Science Applications, Intl.
Irondale Sediment Quality Investigation

Apparent Grain Size Distribution Summary
Percent Retained in Each Size Fraction

Sample No.	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Medium Silt	Fine Silt	Very Fine Silt	Clay			Total Fines
Phi Size	> -1	-1 to 0	0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	< 10	<4
Sieve Size (microns)	> #10 (2000)	10 to 18 (2000-1000)	18-35 (1000-500)	35-60 (500-250)	60-120 (250-125)	120-230 (125-62)	62.5-31.0	31.0-15.6	15.6-7.8	7.8-3.9	3.9-2.0	2.0-1.0	<1.0	<230 (<62)
ID-108-12-18-SD	12.1	4.3	17.9	51.1	11.1	1.4	NA	NA	NA	NA	NA	NA	NA	2.0
ID-108-12-18-SD	14.9	3.8	17.5	50.6	11.4	1.5	NA	NA	NA	NA	NA	NA	NA	0.4
ID-108-12-18-SD	15.2	4.1	17.4	43.8	17.2	1.5	NA	NA	NA	NA	NA	NA	NA	0.9
ID-101-8-14-SD	29.3	10.3	15.0	22.8	11.5	4.1	4.6	0.7	0.4	0.2	0.2	0.1	0.8	7.0
ID-102-9-15-SD	18.0	18.3	14.1	24.1	19.4	4.5	NA	NA	NA	NA	NA	NA	NA	1.7
ID-103-11-17-SD	16.0	4.2	15.4	41.6	20.1	1.9	NA	NA	NA	NA	NA	NA	NA	1.0
ID-103-11-17-D	20.4	4.6	15.9	38.1	17.5	1.8	NA	NA	NA	NA	NA	NA	NA	1.7
ID-103-11-17-T	28.2	4.2	14.1	34.6	15.5	1.5	NA	NA	NA	NA	NA	NA	NA	1.9
ID-104-13-19-SD	20.0	15.8	17.5	29.7	11.3	1.9	NA	NA	NA	NA	NA	NA	NA	3.8
ID-100-15-21-SD	17.6	10.3	15.4	35.5	14.5	3.3	2.1	0.3	0.1	0.1	0.1	0.0	0.7	3.4
ID-106-13-19-SD	14.3	11.1	18.2	33.3	17.1	3.3	NA	NA	NA	NA	NA	NA	NA	2.7
ID-107-8-14-SD	34.6	10.1	18.0	26.1	9.1	1.2	NA	NA	NA	NA	NA	NA	NA	0.9

Notes to the Testing:
1. Organic matter was not removed *prior to testing*, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

QA SUMMARY

Client:	Science Applications, Intl.	Project No.:	Irondale Sediment Quality Investigation
ARI Trip. Sample ID:	OH26A	Batch No.:	OH26-1
Client Trip. Sample ID:	ID-108-12-18-SD	Page:	1 of 1

Relative Standard Deviation, By Phi Size

Sample ID	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
D-108-12-18-S	100.0	92.1	87.9	83.6	65.7	14.6	3.5	2.0	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
D-108-12-18-S	100.0	90.0	85.1	81.3	63.9	13.3	1.9	0.4	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
D-108-12-18-S	100.0	89.8	84.8	80.8	63.4	19.6	2.4	0.9	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
AVE	NA	90.62	85.95	81.90	64.31	15.82	2.59	1.11	-0.79	-0.79	-0.79	-0.79	-0.79	-0.79
STDEV	NA	1.29	1.68	1.49	1.23	3.30	0.82	0.84	0.01	0.01	0.01	0.01	0.01	0.01
%RSD	NA	1.42	1.96	1.82	1.92	20.87	31.55	75.90	-1.31	-1.31	-1.31	-1.31	-1.31	-1.31

The Triplicate Applies To The Following Samples

Client ID	Date Sampled	Date Extracted	Date Complete	QA Ratio (95-105)	Data Qualifiers	Pipette Portion (5.0-25.0g)
ID-108-12-18-SD	1/10/2009	1/13/2009	1/16/2009	99.6	SS	2.3
ID-108-12-18-SD	1/10/2009	1/13/2009	1/16/2009	97.9	SS	0.4
ID-108-12-18-SD	1/10/2009	1/13/2009	1/16/2009	98.5	SS	1.0
ID-101-8-14-SD	1/10/2009	1/13/2009	1/16/2009	103.9		7.9
ID-102-9-15-SD	1/10/2009	1/13/2009	1/16/2009	99.8	SS	1.9
ID-103-11-17-SD	1/10/2009	1/13/2009	1/16/2009	99.7	SS	1.1
ID-103-11-17-D	1/10/2009	1/13/2009	1/16/2009	100.4	SS	2.0
ID-103-11-17-T	1/10/2009	1/13/2009	1/16/2009	100.7	SS	2.2
ID-104-13-19-SD	1/10/2009	1/13/2009	1/16/2009	101.2	SS	2.6
ID-100-15-21-SD	1/10/2009	1/13/2009	1/16/2009	101.4	SS	4.2
ID-106-13-19-SD	1/10/2009	1/13/2009	1/16/2009	100.4	SS	2.6
ID-107-8-14-SD	1/10/2009	1/13/2009	1/16/2009	98.2	SS	0.6

* ARI Internal QA limits = 95-105%

Notes to the Testing:

1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

TOTAL SOLIDS

Extractions Total Solids-extts
Data By: Jim Hawk
Created: 1/13/09

Worklist: 97
Analyst: RVR
Comments:

Sue

	ARI ID CLIENT ID	Tare Wt (g)	Wet Wt (g)	Dry Wt (g)	% Solids	pH
1.	OH26A 09-846 ID-108-12-18-SD	1.19	12.22	10.01	80.0	NR
2.	OH26B 09-847 ID-101-8-14-SD	1.16	11.96	9.62	78.3	NR
3.	OH26C 09-848 ID-102-9-15-SD	1.19	12.34	9.83	77.5	NR
4.	OH26D 09-849 ID-103-11-17-SD	1.19	11.09	9.14	80.3	NR
5.	OH26E 09-850 ID-103-11-17-D	1.15	13.40	10.94	79.9	NR
6.	OH26G 09-852 ID-104-13-19-SD	1.16	13.97	11.39	79.9	NR
7.	OH26H 09-853 ID-100-15-21-SD	1.15	12.92	10.69	81.1	NR
8.	OH26I 09-854 ID-106-13-19-SD	1.16	13.34	10.48	76.5	NR
9.	OH26J 09-855 ID-107-8-14-SD	1.18	11.49	9.11	76.9	NR

Laboratory Data Package

prepared
for

Science Applications, Intl.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OH26

prepared
by

Analytical Resources, Inc.

Semivolatile Analysis
QC Summary Data

prepared
for

Science Applications, Intl.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OH26

prepared
by

Analytical Resources, Inc.

SW8270 SEMIVOLATILES WATER SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Client ID	NBZ	FBP	TPH	DCB	PHL	2FP	TBP	2CP	TOT OUT
MB-011409	67.2%	65.6%	82.8%	58.4%	67.2%	65.1%	69.6%	70.4%	0
LCS-011409	69.2%	67.6%	81.2%	62.4%	67.2%	66.7%	78.9%	70.4%	0
ID-104-R	68.0%	68.0%	70.0%	58.4%	63.5%	64.3%	74.1%	68.5%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(54-102)	(40-103)
(FBP) = 2-Fluorobiphenyl	(47-99)	(35-98)
(TPH) = d14-p-Terphenyl	(50-119)	(21-122)
(DCB) = d4-1,2-Dichlorobenzene	(39-86)	(28-85)
(PHL) = d5-Phenol	(45-100)	(32-99)
(2FP) = 2-Fluorophenol	(49-94)	(36-93)
(TBP) = 2,4,6-Tribromophenol	(49-117)	(37-120)
(2CP) = d4-2-Chlorophenol	(54-99)	(40-98)

Prep Method: SW3520C
Log Number Range: 09-856 to 09-856

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: LCS-011409
LAB CONTROL

Lab Sample ID: LCS-011409
LIMS ID: 09-856
Matrix: Water
Data Release Authorized:
Reported: 01/19/09

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Date Sampled: 01/08/09
Date Received: 01/09/09

Date Extracted: 01/14/09
Date Analyzed: 01/17/09 12:25
Instrument/Analyst: NT6/LJR
GPC Cleanup: NO

Sample Amount: 500 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Phenol	16.7	25.0	66.8%
Bis-(2-Chloroethyl) Ether	16.2	25.0	64.8%
2-Chlorophenol	17.4	25.0	69.6%
1,3-Dichlorobenzene	13.1	25.0	52.4%
1,4-Dichlorobenzene	13.1	25.0	52.4%
Benzyl Alcohol	251 E	50.0	502%
1,2-Dichlorobenzene	14.1	25.0	56.4%
2-Methylphenol	17.3	25.0	69.2%
2,2'-Oxybis(1-Chloropropane)	15.6	25.0	62.4%
4-Methylphenol	37.0	50.0	74.0%
N-Nitroso-Di-N-Propylamine	16.5	25.0	66.0%
Hexachloroethane	11.3	25.0	45.2%
Nitrobenzene	17.6	25.0	70.4%
Isophorone	18.2	25.0	72.8%
2-Nitrophenol	20.3	25.0	81.2%
2,4-Dimethylphenol	17.2	25.0	68.8%
Benzoic Acid	53.0	75.0	70.7%
bis(2-Chloroethoxy) Methane	17.8	25.0	71.2%
2,4-Dichlorophenol	19.0	25.0	76.0%
1,2,4-Trichlorobenzene	15.0	25.0	60.0%
Naphthalene	17.0	25.0	68.0%
4-Chloroaniline	40.7	60.0	67.8%
Hexachlorobutadiene	13.0	25.0	52.0%
4-Chloro-3-methylphenol	20.0	25.0	80.0%
2-Methylnaphthalene	17.7	25.0	70.8%
Hexachlorocyclopentadiene	49.2	75.0	65.6%
2,4,6-Trichlorophenol	18.5	25.0	74.0%
2,4,5-Trichlorophenol	18.6	25.0	74.4%
2-Chloronaphthalene	17.4	25.0	69.6%
2-Nitroaniline	18.6	25.0	74.4%
Dimethylphthalate	19.3	25.0	77.2%
Acenaphthylene	18.0	25.0	72.0%
3-Nitroaniline	55.8	64.0	87.2%
Acenaphthene	18.4	25.0	73.6%
2,4-Dinitrophenol	100	75.0	133%
4-Nitrophenol	17.0	25.0	68.0%
Dibenzofuran	18.8	25.0	75.2%

FORM III

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: LCS-011409
LAB CONTROL

Lab Sample ID: LCS-011409
LIMS ID: 09-856
Matrix: Water
Date Analyzed: 01/17/09 12:25

QC Report No: OH26-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVESTIGA

Analyte	**Lab Control**	**Spike Added**	**Recovery**
2,6-Dinitrotoluene	21.7	25.0	86.8%
2,4-Dinitrotoluene	22.4	25.0	89.6%
Diethylphthalate	20.2	25.0	80.8%
4-Chlorophenyl-phenylether	18.2	25.0	72.8%
Fluorene	19.4	25.0	77.6%
4-Nitroaniline	19.1	25.0	76.4%
4,6-Dinitro-2-Methylphenol	46.0	75.0	61.3%
N-Nitrosodiphenylamine	19.5	25.0	78.0%
4-Bromophenyl-phenylether	19.8	25.0	79.2%
Hexachlorobenzene	19.9	25.0	79.6%
Pentachlorophenol	20.0	25.0	80.0%
Phenanthrene	20.9	25.0	83.6%
Carbazole	21.8	25.0	87.2%
Anthracene	20.2	25.0	80.8%
Di-n-Butylphthalate	21.2	25.0	84.8%
Fluoranthene	21.2	25.0	84.8%
Pyrene	20.9	25.0	83.6%
Butylbenzylphthalate	21.1	25.0	84.4%
3,3'-Dichlorobenzidine	44.7	64.0	69.8%
Benzo(a)anthracene	20.2	25.0	80.8%
bis(2-Ethylhexyl)phthalate	21.2	25.0	84.8%
Chrysene	19.7	25.0	78.8%
Di-n-Octyl phthalate	20.5	25.0	82.0%
Benzo(b)fluoranthene	20.5	25.0	82.0%
Benzo(k)fluoranthene	21.4	25.0	85.6%
Benzo(a)pyrene	17.0	25.0	68.0%
Indeno(1,2,3-cd)pyrene	22.0	25.0	88.0%
Dibenz(a,h)anthracene	19.5	25.0	78.0%
Benzo(g,h,i)perylene	18.4	25.0	73.6%
1-Methylnaphthalene	19.4	25.0	77.6%

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	69.2%
2-Fluorobiphenyl	67.6%
d14-p-Terphenyl	81.2%
d4-1,2-Dichlorobenzene	62.4%
d5-Phenol	67.2%
2-Fluorophenol	66.7%
2,4,6-Tribromophenol	78.9%
d4-2-Chlorophenol	70.4%

Results reported in µg/L

FORM III

4B

SEMIVOLATILE METHOD BLANK SUMMARY

BLANK NO.

OH26MBW1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SAIC

ARI Job No: OH26

Project: IRONDALE SEDIMENT QU

Lab File ID: OH26MB

Date Extracted: 01/14/09

Instrument ID: NT6

Date Analyzed: 01/17/09

Matrix: LIQUID

Time Analyzed: 1153

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	OH26LCSW1	OH26LCSW1	OH26SB	01/17/09
02	ID-104-R	OH26K	OH26K	01/17/09
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				
16				
17				
18				
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22				
23				
24				
25				
26				
27				
28				
29				
30				

COMMENTS:

5B
SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: ANALYTICAL RESOURCES, INC　Client: SAIC

Instrument ID: NT6　Project: IRONDALE SEDIMENT QU

DFTPP Injection Date: 01/13/09　DFTPP Injection Time: 0842

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	30.0 - 80.0% of mass 198	77.2	
68	Less than 2.0% of mass 69	0.2	(0.2)1
69	Mass 69 relative abundance	92.0	
70	Less than 2.0% of mass 69	0.5	(0.5)1
127	25.0 - 75.0% of mass 198	58.7	
197	Less than 1.0% of mass 198	0.0	
198	Base Peak, 100% relative abundance	100.0	
199	5.0 to 9.0% of mass 198	7.1	
275	10.0 - 30.0% of mass 198	25.0	
365	Greater than 0.75% of mass 198	4.09	
441	Present, but less than mass 443	9.5	
442	40.0 - 110.0% of mass 198	64.6	
443	15.0 - 24.0% of mass 442	12.7	(19.6)2

1-Value is % mass 69　2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	ABN 25	ABN 25	0250113	01/13/09	0842
02	ABN 80	ABN 80	0800113	01/13/09	0915
03	ABN 1	ABN 1	0010113	01/13/09	0948
04	ABN 40	ABN 40	0400113	01/13/09	1021
05	ABN 5	ABN 5	0050113	01/13/09	1054
06	ABN 10	ABN 10	0100113	01/13/09	1127
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

5B

SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: ANALYTICAL RESOURCES, INC Client: SAIC

Instrument ID: NT6 Project: IRONDALE SEDIMENT QU

DFTPP Injection Date: 01/17/09 DFTPP Injection Time: 1047

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	30.0 - 80.0% of mass 198	69.4	
68	Less than 2.0% of mass 69	0.6	(0.7)1
69	Mass 69 relative abundance	81.9	
70	Less than 2.0% of mass 69	0.4	(0.5)1
127	25.0 - 75.0% of mass 198	60.1	
197	Less than 1.0% of mass 198	0.5	
198	Base Peak, 100% relative abundance	100.0	
199	5.0 to 9.0% of mass 198	7.7	
275	10.0 - 30.0% of mass 198	22.5	
365	Greater than 0.75% of mass 198	3.54	
441	Present, but less than mass 443	9.7	
442	40.0 - 110.0% of mass 198	62.4	
443	15.0 - 24.0% of mass 442	12.9	(20.6)2

1-Value is % mass 69 2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	ABN CCAL	ABN 25	CC0117	01/17/09	1047
02	OH26MBW1	OH26MBW1	OH26MB	01/17/09	1153
03	OH26LCSW1	OH26LCSW1	OH26SB	01/17/09	1225
04	ID-104-R	OH26K	OH26K	01/17/09	1544
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

8B
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC
Client: SAIC
ARI Job No: OH26
Project: IRONDALE SEDIMENT QU
Cont. Calib. ID: CC0117
Date Analyzed: 01/17/09
Instrument ID: NT6
Time Analyzed: 1047

		IS1 (DCB) AREA #	RT #	IS2 (NPT) AREA #	RT #	IS3 (ANT) AREA #	RT #
	12 HOUR STD	100391	6.80	362344	8.87	218549	11.70
	UPPER LIMIT	200782	7.30	724688	9.37	437098	12.20
	LOWER LIMIT	50196	6.30	181172	8.37	109274	11.20
	CLIENT SAMP. NO.						
01	OH26MBW1	101223	6.80	375579	8.87	222492	11.70
02	OH26LCSW1	106018	6.80	381102	8.87	230938	11.70
03	ID-104-R	112453	6.80	405209	8.86	225447	11.69
04							
05							
06							
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22							

IS1 (DCB) = 1,4-Dichlorobenzene-d4
IS2 (NPT) = Naphthalene-d8
IS3 (ANT) = Acenaphthene-d10

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

8C
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC
Client: SAIC
ARI Job No: OH26
Project: IRONDALE SEDIMENT QU
Cont. Calib. ID: CC0117
Date Analyzed: 01/17/09
Instrument ID: NT6
Time Analyzed: 1047

		IS4 (PHN) AREA #	RT #	IS5 (CRY) AREA #	RT #	IS6 (PRY) AREA #	RT #
	12 HOUR STD	365794	14.03	337785	18.28	329983	20.39
	UPPER LIMIT	731588	14.53	675570	18.78	659966	20.89
	LOWER LIMIT	182897	13.53	168892	17.78	164992	19.89
	CLIENT SAMP. NO.						
01	OH26MBW1	363640	14.02	343933	18.27	329736	20.39
02	OH26LCSW1	376272	14.03	361835	18.27	347682	20.39
03	ID-104-R	374749	14.02	346521	18.27	341378	20.39
04							
05							
06							
07							
08							
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12							
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15							
16							
17							
18							
19							
20							
21							
22							

IS4 (PHN) = Phenanthrene-d10
IS5 (CRY) = Chrysene-d12
IS6 (PRY) = Perylene-d12

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

8C
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC
Client: SAIC
ARI Job No: OH26
Project: IRONDALE SEDIMENT QU
Cont. Calib. ID: CC0117
Date Analyzed: 01/17/09
Instrument ID: NT6
Time Analyzed: 1047

		IS7 AREA #	RT #	AREA #	RT #	AREA #	RT #
	12 HOUR STD	589020	19.55				
	UPPER LIMIT	1178040	20.05				
	LOWER LIMIT	294510	19.05				
	CLIENT SAMP. NO.						
01	OH26MBW1	582827	19.54				
02	OH26LCSW1	618563	19.54				
03	ID-104-R	601795	19.54				
04							
05							
06							
07							
08							
09							
10							
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18							
19							
20							
21							
22							

IS7 = Di-n-octylphthalate-d4

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

FORM VIII SV-3

Analytical Resources, Incorporated
Analytical Chemists and Consultants

February 26, 2009

Neil Morton
GeoEngineers, Inc.
Plaza 600 Building
600 Stewart Suite 1700
Seattle, WA 98101

RE: Project: Irondale Sediment Quality Investigation
ARI Job No.: OK55

Dear Mr. Morton:

Please find enclosed original Chain-of-Custody (COC) record, sample receipt documentation, and the data package for samples from the project referenced above.

Sample receipt and details of these analyses are discussed in the Case Narrative.

Please note that current ARI control limits are available at www.arilabs.com.

An electronic copy of this package will remain on file with ARI. Should you have any questions or problems, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Susan D. Dunnihoo
Director, Client Services
206-695-6207
sue@arilabs.com

Enclosures

cc: eFile OK55

SD/co

Chain of Custody
Documentation

prepared
for

Science Applications, Intl.

Project: 2009 Irondale Sediment Quality Investigation

ARI JOB NO: OK55

prepared
by

Analytical Resources, Inc.

0K55

SAIC®

18706 North Creek Parkway, Suite 110
Bothell, Washington 98011
TEL: 425.485.5800 • FAX: 425.485.5566

CHAIN OF CUSTODY RECORD

Project No.: ______ Project Mgr: Tim Hammermeister
Project Name: 2009 Irondale Sediment Quality Investigation
Project Location: Irondale, WA
Sample Collectors: TH, JB
Client Name: [redacted] Washington State DOE

						Analyses / Tests										
Sample ID	Depth	Matrix	Date	Time	# of Containers	Sediment Conventionals	Total Sulfides	TPHs	Metals: Mercury	SVOCs	Pesticides					Comments
ID-000-MIX	X	Sediment	1/29/09	13:30	3	X		X	X	X	X					11486, 11487, 11488
SB-REF-ID-01	X	↓	↓	10:30	2	X	X	X								11489, 11490
SB-REF-ID-02	X	↓	↓	11:00	2	X	X	X								11491, 11492

Shipping Information

Number of Shipping Containers:

Date Shipped:

Carrier:

Waybill No.:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature:	Signature:	Signature:	Signature:
Date/Time: 1/30/09 10:25	Date/Time: 1/30/09 1025	Date/Time:	Date/Time:
Affiliation: SAIC	Affiliation: ARI	Affiliation:	Affiliation:

• White: Lab Returns to Originator Upon Receipt of Samples; • Canary: Lab Retains; • Pink: Lab Returns to Project Manager with Final Report; • Goldenrod: Retained by Sampler

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: SAIC
COC No:
Assigned ARI Job No: 0K55

Project Name:
Delivered by: Hand
Tracking No:

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? .... [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO
Record cooler temperature (recommended 2.0-6.0 °C for chemistry .... 5.2 °C

Cooler Accepted by: JW Date: 1/30/09 Time: 1025

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... YES [✓ NO]
What kind of packing material was used? .... Ice
Was sufficient ice used (if appropriate)? .... [✓ YES] NO
Were all bottles sealed in individual plastic bags? .... YES [✓ NO]
Did all bottle arrive in good condition (unbroken)? .... [✓ YES] NO
Were all bottle labels complete and legible? .... [✓ YES] NO
Did all bottle labels and tags agree with custody papers? .... [✓ YES] NO
Were all bottles used correct for the requested analyses? .... [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation checklist) .... YES [✓ NO]
Were all VOC vials free of air bubbles? .... [✓ NA] YES NO
Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO

Samples Logged by: JH Date: 1/30/09 Time: 1150

***** Notify Project Manager of discrepancies or concerns *****

Explain discrepancies or negative responses:

By: Date:

Case Narrative

prepared
for

Science Applications, Intl.

Project: 2009 Irondale Sediment Quality Investigation

ARI JOB NO: OK55

prepared
by

Analytical Resources, Inc.

Case Narrative

Client: GeoEngineers
Project: Irondale Sediment Quality Investigation
Matrix: Sediment
ARI Job No.: OK55

Sample receipt

Three sediment samples were received on January 30, 2009, under ARI Job OK55. The cooler temperature measured by IR thermometer following ARI SOP was 5.2° C. The samples were received in good condition with no discrepancies in paperwork. For further details regarding sample receipt, please refer to the Cooler Receipt Form.

PSDDA Semivolatiles

The sample was extracted and analyzed within required holding times.

Initial and continuing calibrations were within limits. Internal standard areas were within control limits.

The surrogate percent recoveries were within the control limits.

The method blank was clean at the reporting limits. The LCS percent recoveries were within control limits.

The matrix spike percent recovery of 2,4-Dimethylphenol fell outside the advisory control limits for sample **ID-000-MIX**. No corrective action is required for matrix QC.

SIM Semivolatiles

The sample was extracted and analyzed within required holding times.

Initial and continuing calibrations were within limits. Internal standard areas were within control limits.

The surrogate percent recoveries were within the control limits.

The method blank was clean at the reporting limits.

There was no LCS percent recovery for Benzyl Alcohol for **LCS-020509**. The associated sample was undetected for this compound. No further corrective action was required as the compound is a known poor performer.

The matrix spike percent recovery of Pentachlorophenol fell outside the advisory control limits and there were no matrix spike/matrix spike duplicate percent recoveries of Benzyl Alcohol for sample **ID-000-MIX**. No further corrective action is required for matrix QC.

PSDDA Pesticides by SW8081

The sample was extracted and analyzed within required holding times.

Initial and continuing calibrations were within limits. Internal standard areas were within control limits.

The surrogate percent recoveries were within the control limits.

The method blank was clean at the reporting limits. The LCS percent recoveries were within control limits.

Several matrix spike/matrix spike duplicate percent recoveries were outside the advisory control limits for sample **ID-000-MIX**. No further corrective action is required for matrix QC.

NWTPH-Dx Acid/Silica Cleaned

The samples were extracted and analyzed within required holding times.

Initial and continuing calibrations were within limits.

The surrogate percent recoveries were within the control limits.

The method blank was clean at the reporting limits. The LCS percent recovery was within control limits.

The matrix spike/matrix spike duplicate percent recoveries were within advisory control limits.

Total Mercury

The sample was digested and analyzed within required holding times. .

The method blank was clean at the detection limit. The LCS percent recovery was within the control limits.

The matrix spike percent recovery and duplicate RPD were within control limits.

General Chemistry Analyses

The samples was prepared and analyzed within required holding times.

The method blanks were clean at the detection limits and the LCS percent recoveries were within the control limits.

The SRM percent recoveries were within control limits.

The matrix spike percent recoveries were within control limits.

The replicate RPD of Sulfide was outside the control limit for sample **SB-REF-ID-01**. All other quality control parameters were met for sulfide. No further corrective action was required.

Geotechnical Parameters

A laboratory specific narrative follows.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Client: Science Applications, Intl.	**ARI Project No.:** OK55
Client Project: 2009 Irondale Sediment Quality Invs.	

Case Narrative

1. Three samples were submitted for grain size analysis according to Puget Sound Estuary Protocol (PSEP) methodology on January 30, 2008.
2. The samples were run in a single batch and one sample from this job was chosen for triplicate analysis. The triplicate data is reported on the QA summary.
3. The samples did not contain the required 5 grams of fines for the pipette portion of the analysis. The analytical balance has a capacity of about 200 grams (by 0.0001 grams) and a sample that would yield 5 grams of fines could not be split and stay within the capacity of the balance.
4. The data is provided in summary tables and plots.
5. There were no other noted anomalies in this project.

Approved by: ______________ Date: 2/25/09
Title: Geotechnical Division Manager

LCS SOLUTIONS

02/07/09

LABE	SOLN I	TEST	CONC. UG/ML	SOLVENT	EXP.
1	1549-3	PCB	20	ACETONE	10/10/09
2	1472-3	BCOC PEST	10	ACETONE	07/20/08
3	1579-3	PEST	02/04/20	ACETONE	09/23/09
4	1576-3	LOW PEST	0.2/0.4/2	ACETONE	07/31/09
5	1580-2	EPH	1500	MECL2	01/29/10
6	1559-2	PCP	12.5/125	ACETONE	11/05/09
7	1581-4	ABN	100	ACETONE	08/01/09
8	1566-1	TBT	2.5	MECL2	12/04/09
9	1567-3	PORE TBT	.125/.25	MECL2	12/04/09
10	1578-3	ABN ACID	100/200	MEOH	10/21/09
11	1563-3	TPHD	15000	ACETONE	11/20/09
12	1563-1	ABN BASE	200	ACETONE	06/30/09
13	1573-2	LOW PCB	2	ACETONE	10/10/09
14	1547-1	LOW ABN ACID	10/20	MEOH	04/10/09
15*	1452-1	SIM PNA	15/75	MEOH	04/09/09
16	1502-2	DIOXANE	100	MEOH	02/20/09
17	1516-2	1248 PCB	20	ACETONE	05/07/09
18	1514-4	LOW SIM PNA	1.5/7.5	ACETONE	04/24/09
19	1574-4	AK103	7500	MECL2	12/02/09
20	1572-2	PNA	100	ACETONE	12/26/09
21*	1414-4	SKY/BHT	100	MEOH	04/08/09
22	1570-1	HERB	12.5/12500	MEOH	02/19/09
23	1505-1	LOW ABN BASE	20	MEOH	03/20/09
24	1573-4	LOW ABN	10	ACETONE	08/01/09
25	1481-1	DIPHENYL	100	MEOH	07/20/08
26	1545-2	OP-PEST	25	MEOH	02/14/09
27	1495-1	STEROLS	200	MEOH	12/29/08
28	1494-1	ADD. PEST	4	ACETONE	01/23/09
29	1496-3	DECANES	100	MEOH	02/12/09
30	1497-2	EDB/DBCP	2	ACETONE	02/12/09
31	1510-3	TERPINEOL	100	MEOH	03/21/09

LCS SOLUTIONS

02/07/09

32	1576-2	GUAIACOL	50-200	ACETONE	06/05/09
33	1522-1	RESIN ACID	250	ACETONE	06/11/09
34	1530-2	CONGENERS	1	ACETONE	07/23/09
50	1571-1	FULL RESIN	250	ACETONE	06/10/09
*=REVERIFIED SOLUTION					

SURR SOLUTIONS

02/07/09

LABEL	SOLN ID	TEST	CONC. UG/ML	SOLVENT	EXP.
A	1559-5	ABN	100/150	MEOH	03/13/09
B	1572-1	SIM PNA	15/75	MEOH	08/28/09
C	1559-1	SIM ABN	25/37.5	MEOH	03/13/09
D	1573-3	LOW PCB	0.2	ACETONE	07/31/09
E*	1478-1	HERB	62.5	MEOH	09/21/09
F	1574-3	PCP	12.5	ACETONE	01/06/10
G	1534-1	1,4DIOXANE	100	MEOH	02/20/09
H	1545-1	OP-PEST	25	MEOH	02/14/09
I	1559-4	LOW S. PNA	1.5	MEOH	08/28/09
J	1566-5	TBT-PORE	0.125	MECL2	12/04/09
K	1538-1	MED PCB	20	ACETONE	07/31/09
L	1566-4	TBT	2.5	MECL2	12/04/09
M	1578-1	EPH	1500	MECL2	12/09/09
N	1538-2	PCB	2	ACETONE	07/31/09
O	1567-4	TPH	450	MECL2	09/24/09
P	1560-3	HCID	2250	MECL2	09/24/09
Q	1497-3	EDB	2	ACETONE	02/12/09
R	1521-4	RESIN ACID	250	ACETONE	06/11/09
S	1568-5	PBDE	.25	MEOH	12/11/09
T	*reverified solution				
U					
V					
W					
X					
Y					
Z					

Data Reporting Qualifiers

Effective 12/28/04

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
NR	Spiked compound recovery is not reported due to chromatographic interference
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
S	Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte
IA	The flagged analyte was not analyzed for
IS	The flagged analyte was not spiked into the sample

M	Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses
M2	The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
Y	The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
C	The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
P	The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

Data Summary Package

prepared
for

Science Applications, Intl.

Project: 2009 Irondale Sediment Quality Investigation

ARI JOB NO: OK55

prepared
by

Analytical Resources, Inc.

SEMIVOLATILE

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: ID-000-MIX
SAMPLE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/13/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/12/09 19:46
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.8 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 19.4%

CAS Number	Analyte	RL	Result
108-95-2	Phenol	19	< 19 U
541-73-1	1,3-Dichlorobenzene	19	< 19 U
106-46-7	1,4-Dichlorobenzene	19	< 19 U
100-51-6	Benzyl Alcohol	19	< 19 U
95-50-1	1,2-Dichlorobenzene	19	< 19 U
95-48-7	2-Methylphenol	19	< 19 U
106-44-5	4-Methylphenol	19	< 19 U
67-72-1	Hexachloroethane	19	< 19 U
105-67-9	2,4-Dimethylphenol	19	< 19 U
65-85-0	Benzoic Acid	190	< 190 U
120-82-1	1,2,4-Trichlorobenzene	19	< 19 U
91-20-3	Naphthalene	19	< 19 U
87-68-3	Hexachlorobutadiene	19	< 19 U
91-57-6	2-Methylnaphthalene	19	< 19 U
131-11-3	Dimethylphthalate	19	< 19 U
208-96-8	Acenaphthylene	19	< 19 U
83-32-9	Acenaphthene	19	< 19 U
132-64-9	Dibenzofuran	19	< 19 U
84-66-2	Diethylphthalate	19	< 19 U
86-73-7	Fluorene	19	< 19 U
86-30-6	N-Nitrosodiphenylamine	19	< 19 U
118-74-1	Hexachlorobenzene	19	< 19 U
87-86-5	Pentachlorophenol	97	< 97 U
85-01-8	**Phenanthrene**	**19**	**10 J**
120-12-7	Anthracene	19	< 19 U
84-74-2	Di-n-Butylphthalate	19	< 19 U
206-44-0	**Fluoranthene**	**19**	**21**
129-00-0	**Pyrene**	**19**	**38**
85-68-7	Butylbenzylphthalate	19	< 19 U
56-55-3	**Benzo(a)anthracene**	**19**	**15 J**
117-81-7	bis(2-Ethylhexyl)phthalate	19	< 19 U
218-01-9	**Chrysene**	**19**	**37**
117-84-0	Di-n-Octyl phthalate	19	< 19 U
205-99-2	**Benzo(b)fluoranthene**	**19**	**13 J**
207-08-9	Benzo(k)fluoranthene	19	< 19 U
50-32-8	Benzo(a)pyrene	19	< 19 U
193-39-5	Indeno(1,2,3-cd)pyrene	19	< 19 U
53-70-3	Dibenz(a,h)anthracene	19	< 19 U
191-24-2	Benzo(g,h,i)perylene	19	< 19 U

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: ID-000-MIX
SAMPLE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Date Analyzed: 02/12/09 19:46

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
NA

CAS Number	**Analyte**	**RL**	**Result**
90-12-0	1-Methylnaphthalene	19	< 19 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	61.2%	2-Fluorobiphenyl	63.2%
d14-p-Terphenyl	77.2%	d4-1,2-Dichlorobenzene	59.6%
d5-Phenol	63.7%	2-Fluorophenol	58.7%
2,4,6-Tribromophenol	81.1%	d4-2-Chlorophenol	62.7%

FORM I

SW8270 SEMIVOLATILES SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Client ID	NBZ	FBP	TPH	DCB	PHL	2FP	TBP	2CP	TOT OUT
MB-020509	56.4%	55.2%	80.8%	58.8%	56.5%	54.1%	60.5%	58.1%	0
LCS-020509	52.8%	50.8%	75.2%	53.2%	52.3%	51.5%	64.8%	52.8%	0
ID-000-MIX	61.2%	63.2%	77.2%	59.6%	63.7%	58.7%	81.1%	62.7%	0
ID-000-MIX MS	56.0%	58.4%	68.8%	55.2%	60.0%	54.7%	74.1%	57.1%	0
ID-000-MIX MSD	54.8%	58.8%	70.0%	56.4%	57.6%	54.9%	74.9%	57.6%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(37-85)	(29-87)
(FBP) = 2-Fluorobiphenyl	(39-82)	(32-88)
(TPH) = d14-p-Terphenyl	(38-105)	(21-97)
(DCB) = d4-1,2-Dichlorobenzene	(33-79)	(25-82)
(PHL) = d5-Phenol	(40-85)	(29-85)
(2FP) = 2-Fluorophenol	(20-93)	(10-114)
(TBP) = 2,4,6-Tribromophenol	(40-96)	(25-103)
(2CP) = d4-2-Chlorophenol	(41-81)	(30-84)

Prep Method: SW3550B
Log Number Range: 09-3059 to 09-3059

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ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: ID-000-MIX
MS/MSD

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/13/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted MS/MSD: 02/05/09

Date Analyzed MS: 02/12/09 20:19
MSD: 02/12/09 20:52
Instrument/Analyst MS: NT6/LJR
MSD: NT6/LJR
GPC Cleanup: YES

Sample Amount MS: 25.8 g-dry-wt
MSD: 25.9 g-dry-wt
Final Extract Volume MS: 0.5 mL
MSD: 0.5 mL
Dilution Factor MS: 1.00
MSD: 1.00
Percent Moisture: 19.4 %

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Phenol	< 19.4	261	484	53.9%	268	483	55.5%	2.6%
1,3-Dichlorobenzene	< 19.4	255	484	52.7%	268	483	55.5%	5.0%
1,4-Dichlorobenzene	< 19.4	255	484	52.7%	271	483	56.1%	6.1%
Benzyl Alcohol	< 19.4	457	967	47.3%	496	967	51.3%	8.2%
1,2-Dichlorobenzene	< 19.4	253	484	52.3%	268	483	55.5%	5.8%
2-Methylphenol	< 19.4	240	484	49.6%	261	483	54.0%	8.4%
4-Methylphenol	< 19.4	536	967	55.4%	565	967	58.4%	5.3%
Hexachloroethane	< 19.4	254	484	52.5%	265	483	54.9%	4.2%
2,4-Dimethylphenol	< 19.4	78.2	484	16.2%	119	483	24.6%	41.4%
Benzoic Acid	< 194	935	1450	64.5%	1030	1450	71.0%	9.7%
1,2,4-Trichlorobenzene	< 19.4	271	484	56.0%	275	483	56.9%	1.5%
Naphthalene	< 19.4	282	484	58.3%	288	483	59.6%	2.1%
Hexachlorobutadiene	< 19.4	289	484	59.7%	294	483	60.9%	1.7%
2-Methylnaphthalene	< 19.4	271	484	56.0%	285	483	59.0%	5.0%
Dimethylphthalate	< 19.4	287	484	59.3%	293	483	60.7%	2.1%
Acenaphthylene	< 19.4	271	484	56.0%	279	483	57.8%	2.9%
Acenaphthene	< 19.4	288	484	59.5%	296	483	61.3%	2.7%
Dibenzofuran	< 19.4	304	484	62.8%	313	483	64.8%	2.9%
Diethylphthalate	< 19.4	306	484	63.2%	318	483	65.8%	3.8%
Fluorene	< 19.4	330	484	68.2%	342	483	70.8%	3.6%
N-Nitrosodiphenylamine	< 19.4	286	484	59.1%	303	483	62.7%	5.8%
Hexachlorobenzene	< 19.4	307	484	63.4%	324	483	67.1%	5.4%
Pentachlorophenol	< 96.9	372	484	76.9%	391	483	81.0%	5.0%
Phenanthrene	10.1	355	484	71.3%	340	483	68.3%	4.3%
Anthracene	< 19.4	291	484	60.1%	310	483	64.2%	6.3%
Di-n-Butylphthalate	< 19.4	340	484	70.2%	353	483	73.1%	3.8%
Fluoranthene	20.6	422	484	82.9%	410	483	80.6%	2.9%
Pyrene	38.4	359	484	66.2%	353	483	65.1%	1.7%
Butylbenzylphthalate	< 19.4	306	484	63.2%	318	483	65.8%	3.8%
Benzo(a)anthracene	14.9	316	484	62.2%	324	483	64.0%	2.5%
bis(2-Ethylhexyl)phthalate	< 19.4	384	484	79.3%	400	483	82.8%	4.1%
Chrysene	37.2	321	484	58.6%	324	483	59.4%	0.9%
Di-n-Octyl phthalate	< 19.4	322	484	66.5%	333	483	68.9%	3.4%
Benzo(b)fluoranthene	13.4	368	484	73.3%	419	483	84.0%	13.0%
Benzo(k)fluoranthene	< 19.4	439	484	90.7%	430	483	89.0%	2.1%
Benzo(a)pyrene	< 19.4	302	484	62.4%	320	483	66.3%	5.8%
Indeno(1,2,3-cd)pyrene	< 19.4	324	484	66.9%	308	483	63.8%	5.1%
Dibenz(a,h)anthracene	< 19.4	321	484	66.3%	309	483	64.0%	3.8%
Benzo(g,h,i)perylene	< 19.4	287	484	59.3%	263	483	54.5%	8.7%
1-Methylnaphthalene	< 19.4	300	484	62.0%	308	483	63.8%	2.6%

Results reported in µg/kg
RPD calculated using sample concentrations per SW846.

FORM III

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: ID-000-MIX
MATRIX SPIKE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/13/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/12/09 20:19
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.8 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 19.4%

CAS Number	Analyte	RL	Result
108-95-2	Phenol	19	---
541-73-1	1,3-Dichlorobenzene	19	---
106-46-7	1,4-Dichlorobenzene	19	---
100-51-6	Benzyl Alcohol	19	---
95-50-1	1,2-Dichlorobenzene	19	---
95-48-7	2-Methylphenol	19	---
106-44-5	4-Methylphenol	19	---
67-72-1	Hexachloroethane	19	---
105-67-9	2,4-Dimethylphenol	19	---
65-85-0	Benzoic Acid	190	---
120-82-1	1,2,4-Trichlorobenzene	19	---
91-20-3	Naphthalene	19	---
87-68-3	Hexachlorobutadiene	19	---
91-57-6	2-Methylnaphthalene	19	---
131-11-3	Dimethylphthalate	19	---
208-96-8	Acenaphthylene	19	---
83-32-9	Acenaphthene	19	---
132-64-9	Dibenzofuran	19	---
84-66-2	Diethylphthalate	19	---
86-73-7	Fluorene	19	---
86-30-6	N-Nitrosodiphenylamine	19	---
118-74-1	Hexachlorobenzene	19	---
87-86-5	Pentachlorophenol	97	---
85-01-8	Phenanthrene	19	---
120-12-7	Anthracene	19	---
84-74-2	Di-n-Butylphthalate	19	---
206-44-0	Fluoranthene	19	---
129-00-0	Pyrene	19	---
85-68-7	Butylbenzylphthalate	19	---
56-55-3	Benzo(a)anthracene	19	---
117-81-7	bis(2-Ethylhexyl)phthalate	19	---
218-01-9	Chrysene	19	---
117-84-0	Di-n-Octyl phthalate	19	---
205-99-2	Benzo(b)fluoranthene	19	---
207-08-9	Benzo(k)fluoranthene	19	---
50-32-8	Benzo(a)pyrene	19	---
193-39-5	Indeno(1,2,3-cd)pyrene	19	---
53-70-3	Dibenz(a,h)anthracene	19	---
191-24-2	Benzo(g,h,i)perylene	19	---

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: ID-000-MIX
MATRIX SPIKE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Date Analyzed: 02/12/09 20:19

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
NA

CAS Number	Analyte	RL	Result
90-12-0	1-Methylnaphthalene	19	---

Reported in $\mu g/kg$ (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	56.0%	2-Fluorobiphenyl	58.4%
d14-p-Terphenyl	68.8%	d4-1,2-Dichlorobenzene	55.2%
d5-Phenol	60.0%	2-Fluorophenol	54.7%
2,4,6-Tribromophenol	74.1%	d4-2-Chlorophenol	57.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: ID-000-MIX
MATRIX SPIKE DUPLICATE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/13/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/12/09 20:52
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.9 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 19.4%

CAS Number	Analyte	RL	Result
108-95-2	Phenol	19	---
541-73-1	1,3-Dichlorobenzene	19	---
106-46-7	1,4-Dichlorobenzene	19	---
100-51-6	Benzyl Alcohol	19	---
95-50-1	1,2-Dichlorobenzene	19	---
95-48-7	2-Methylphenol	19	---
106-44-5	4-Methylphenol	19	---
67-72-1	Hexachloroethane	19	---
105-67-9	2,4-Dimethylphenol	19	---
65-85-0	Benzoic Acid	190	---
120-82-1	1,2,4-Trichlorobenzene	19	---
91-20-3	Naphthalene	19	---
87-68-3	Hexachlorobutadiene	19	---
91-57-6	2-Methylnaphthalene	19	---
131-11-3	Dimethylphthalate	19	---
208-96-8	Acenaphthylene	19	---
83-32-9	Acenaphthene	19	---
132-64-9	Dibenzofuran	19	---
84-66-2	Diethylphthalate	19	---
86-73-7	Fluorene	19	---
86-30-6	N-Nitrosodiphenylamine	19	---
118-74-1	Hexachlorobenzene	19	---
87-86-5	Pentachlorophenol	97	---
85-01-8	Phenanthrene	19	---
120-12-7	Anthracene	19	---
84-74-2	Di-n-Butylphthalate	19	---
206-44-0	Fluoranthene	19	---
129-00-0	Pyrene	19	---
85-68-7	Butylbenzylphthalate	19	---
56-55-3	Benzo(a)anthracene	19	---
117-81-7	bis(2-Ethylhexyl)phthalate	19	---
218-01-9	Chrysene	19	---
117-84-0	Di-n-Octyl phthalate	19	---
205-99-2	Benzo(b)fluoranthene	19	---
207-08-9	Benzo(k)fluoranthene	19	---
50-32-8	Benzo(a)pyrene	19	---
193-39-5	Indeno(1,2,3-cd)pyrene	19	---
53-70-3	Dibenz(a,h)anthracene	19	---
191-24-2	Benzo(g,h,i)perylene	19	---

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: ID-000-MIX
MATRIX SPIKE DUPLICATE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Date Analyzed: 02/12/09 20:52

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
NA

CAS Number	Analyte	RL	Result
90-12-0	1-Methylnaphthalene	19	---

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	54.8%	2-Fluorobiphenyl	58.8%
d14-p-Terphenyl	70.0%	d4-1,2-Dichlorobenzene	56.4%
d5-Phenol	57.6%	2-Fluorophenol	54.9%
2,4,6-Tribromophenol	74.9%	d4-2-Chlorophenol	57.6%

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: LCS-020509
LAB CONTROL

Lab Sample ID: LCS-020509
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/13/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/11/09 18:20
Instrument/Analyst: NT6/LJR
GPC Cleanup: YES

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Phenol	283	500	56.6%
1,3-Dichlorobenzene	272	500	54.4%
1,4-Dichlorobenzene	269	500	53.8%
Benzyl Alcohol	392	1000	39.2%
1,2-Dichlorobenzene	272	500	54.4%
2-Methylphenol	271	500	54.2%
4-Methylphenol	584	1000	58.4%
Hexachloroethane	271	500	54.2%
2,4-Dimethylphenol	215	500	43.0%
Benzoic Acid	1020	1500	68.0%
1,2,4-Trichlorobenzene	264	500	52.8%
Naphthalene	280	500	56.0%
Hexachlorobutadiene	288	500	57.6%
2-Methylnaphthalene	279	500	55.8%
Dimethylphthalate	300	500	60.0%
Acenaphthylene	268	500	53.6%
Acenaphthene	270	500	54.0%
Dibenzofuran	291	500	58.2%
Diethylphthalate	333	500	66.6%
Fluorene	324	500	64.8%
N-Nitrosodiphenylamine	313	500	62.6%
Hexachlorobenzene	307	500	61.4%
Pentachlorophenol	310	500	62.0%
Phenanthrene	321	500	64.2%
Anthracene	308	500	61.6%
Di-n-Butylphthalate	378	500	75.6%
Fluoranthene	382	500	76.4%
Pyrene	379	500	75.8%
Butylbenzylphthalate	390	500	78.0%
Benzo(a)anthracene	334	500	66.8%
bis(2-Ethylhexyl)phthalate	421	500	84.2%
Chrysene	302	500	60.4%
Di-n-Octyl phthalate	342	500	68.4%
Benzo(b)fluoranthene	412	500	82.4%
Benzo(k)fluoranthene	405	500	81.0%
Benzo(a)pyrene	315	500	63.0%
Indeno(1,2,3-cd)pyrene	405	500	81.0%

FORM III

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: LCS-020509
LAB CONTROL

Lab Sample ID: LCS-020509
LIMS ID: 09-3059
Matrix: Sediment
Date Analyzed: 02/11/09 18:20

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Dibenz(a,h)anthracene	387	500	77.4%
Benzo(g,h,i)perylene	386	500	77.2%
1-Methylnaphthalene	300	500	60.0%

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	52.8%
2-Fluorobiphenyl	50.8%
d14-p-Terphenyl	75.2%
d4-1,2-Dichlorobenzene	53.2%
d5-Phenol	52.3%
2-Fluorophenol	51.5%
2,4,6-Tribromophenol	64.8%
d4-2-Chlorophenol	52.8%

Results reported in µg/kg

FORM III

4B
SEMIVOLATILE METHOD BLANK SUMMARY

BLANK NO.

OK55MBS1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SAIC

ARI Job No: OK55

Project: 2009 IRONDALE SEDIME

Lab File ID: OK55MB

Date Extracted: 02/05/09

Instrument ID: NT6

Date Analyzed: 02/11/09

Matrix: SOLID

Time Analyzed: 1746

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	OK55LCSS1	OK55LCSS1	OK55SB	02/11/09
02	ID-000-MIX	OK55A	OK55A	02/12/09
03	ID-000-MIX MS	OK55AMS	OK55AMS	02/12/09
04	ID-000-MIX MSD	OK55AMSD	OK55AMD	02/12/09
05				
06				
07				
08				
09				
10				
11				
12				
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30				

COMMENTS:

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FORM IV SV

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: MB-020509
METHOD BLANK

Lab Sample ID: MB-020509
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/13/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
NA
Date Sampled: NA
Date Received: NA

Date Extracted: 02/05/09
Date Analyzed: 02/11/09 17:46
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	**Analyte**	**RL**	**Result**
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
67-72-1	Hexachloroethane	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	Naphthalene	20	< 20 U
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	2-Methylnaphthalene	20	< 20 U
131-11-3	Dimethylphthalate	20	< 20 U
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	Acenaphthene	20	< 20 U
132-64-9	Dibenzofuran	20	< 20 U
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	Fluorene	20	< 20 U
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	100	< 100 U
85-01-8	Phenanthrene	20	< 20 U
120-12-7	Anthracene	20	< 20 U
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	Fluoranthene	20	< 20 U
129-00-0	Pyrene	20	< 20 U
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	Benzo(a)anthracene	20	< 20 U
117-81-7	bis(2-Ethylhexyl)phthalate	20	< 20 U
218-01-9	Chrysene	20	< 20 U
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	Benzo(b)fluoranthene	20	< 20 U
207-08-9	Benzo(k)fluoranthene	20	< 20 U
50-32-8	Benzo(a)pyrene	20	< 20 U
193-39-5	Indeno(1,2,3-cd)pyrene	20	< 20 U
53-70-3	Dibenz(a,h)anthracene	20	< 20 U
191-24-2	Benzo(g,h,i)perylene	20	< 20 U

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: MB-020509
METHOD BLANK

Lab Sample ID: MB-020509
LIMS ID: 09-3059
Matrix: Sediment
Date Analyzed: 02/11/09 17:46

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
NA

CAS Number	**Analyte**	**RL**	**Result**
90-12-0	1-Methylnaphthalene	20	< 20 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	56.4%	2-Fluorobiphenyl	55.2%
d14-p-Terphenyl	80.8%	d4-1,2-Dichlorobenzene	58.8%
d5-Phenol	56.5%	2-Fluorophenol	54.1%
2,4,6-Tribromophenol	60.5%	d4-2-Chlorophenol	58.1%

FORM I

SIM SVOA

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: ID-000-MIX
SAMPLE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/10/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/09/09 18:11
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.2 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 19.4%

CAS Number	Analyte	RL	Result
53-70-3	Dibenz(a,h)anthracene	6.2	< 6.2 U
106-46-7	1,4-Dichlorobenzene	6.2	< 6.2 U
120-82-1	1,2,4-Trichlorobenzene	6.2	< 6.2 U
118-74-1	Hexachlorobenzene	6.2	< 6.2 U
87-68-3	Hexachlorobutadiene	6.2	< 6.2 U
85-68-7	Butylbenzylphthalate	15	< 15 U
95-48-7	2-Methylphenol	6.2	< 6.2 U
105-67-9	2,4-Dimethylphenol	6.2	< 6.2 U
86-30-6	N-Nitrosodiphenylamine	6.2	< 6.2 U
100-51-6	Benzyl Alcohol	31	< 31 U
87-86-5	Pentachlorophenol	31	< 31 U
95-50-1	1,2-Dichlorobenzene	6.2	< 6.2 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	86.8%	d5-Phenol	72.0%
2-Fluorophenol	73.1%	d4-2-Chlorophenol	72.3%
d4-1,2-Dichlorobenzene	66.4%	d5-Nitrobenzene	70.4%
2,4,6-Tribromophenol	84.8%	d14-p-Terphenyl	82.4%

SIM SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Client ID	FBP	PHL	FPH	CPL	DCB	NBZ	TBP	TER	TOT OUT
MB-020509	63.6%	65.3%	62.9%	59.7%	71.6%	74.8%	68.5%	90.0%	0
LCS-020509	64.8%	61.6%	65.9%	64.3%	60.4%	62.4%	74.7%	78.0%	0
ID-000-MIX	86.8%	72.0%	73.1%	72.3%	66.4%	70.4%	84.8%	82.4%	0
ID-000-MIX MS	77.2%	80.5%	65.9%	66.4%	60.8%	62.8%	88.0%	78.8%	0
ID-000-MIX MSD	73.6%	76.3%	64.0%	63.7%	58.0%	64.4%	81.1%	74.4%	0

	LCS/MB LIMITS	QC LIMITS
(FBP) = 2-Fluorobiphenyl	(30-160)	(30-160)
(PHL) = d5-Phenol	(30-160)	(30-160)
(FPH) = 2-Fluorophenol	(30-160)	(30-160)
(CPL) = d4-2-Chlorophenol	(30-160)	(30-160)
(DCB) = d4-1,2-Dichlorobenzene	(30-160)	(30-160)
(NBZ) = d5-Nitrobenzene	(30-160)	(30-160)
(TBP) = 2,4,6-Tribromophenol	(30-160)	(30-160)
(TER) = d14-p-Terphenyl	(30-160)	(30-160)

Prep Method: SW3550B
Log Number Range: 09-3059 to 09-3059

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: ID-000-MIX
MATRIX SPIKE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/10/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted MS/MSD: 02/05/09

Date Analyzed MS: 02/09/09 18:43
MSD: 02/09/09 19:15
Instrument/Analyst MS: NT2/PK
MSD: NT2/PK

Sample Amount MS: 16.2 g-dry-wt
MSD: 16.1 g-dry-wt
Final Extract Volume MS: 1.0 mL
MSD: 1.0 mL
Dilution Factor MS: 1.00
MSD: 1.00

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Dibenz(a,h)anthracene	< 6.2 U	71.6	154	46.5%	70.8	155	45.7%	1.1%
1,4-Dichlorobenzene	< 6.2 U	103	154	66.9%	100	155	64.5%	3.0%
1,2,4-Trichlorobenzene	< 6.2 U	115	154	74.7%	112	155	72.3%	2.6%
Hexachlorobenzene	< 6.2 U	134	154	87.0%	123	155	79.4%	8.6%
Hexachlorobutadiene	< 6.2 U	114	154	74.0%	111	155	71.6%	2.7%
Butylbenzylphthalate	< 15.4 U	141	154	91.6%	134	155	86.5%	5.1%
2-Methylphenol	< 6.2 U	135	154	87.7%	136	155	87.7%	0.7%
2,4-Dimethylphenol	< 6.2 U	70.4	154	45.7%	87.0	155	56.1%	21.1%
N-Nitrosodiphenylamine	< 6.2 U	140	154	90.9%	145	155	93.5%	3.5%
Benzyl Alcohol	< 30.9 U	< 30.9 U	309	NA	< 31.1 U	311	NA	NA
Pentachlorophenol	< 30.9 U	202	154	131%	193	155	125%	4.6%
1,2-Dichlorobenzene	< 6.2 U	102	154	66.2%	98.8	155	63.7%	3.2%

Reported in µg/kg (ppb)

NA-No recovery due to high concentration of analyte in original sample, calculated negative recovery, or undetected spike.
RPD calculated using sample concentrations per SW846.

FORM III

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: ID-000-MIX
MATRIX SPIKE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/10/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/09/09 18:43
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.2 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 19.4%

CAS Number	Analyte	RL	Result
53-70-3	Dibenz(a,h)anthracene	6.2	---
106-46-7	1,4-Dichlorobenzene	6.2	---
120-82-1	1,2,4-Trichlorobenzene	6.2	---
118-74-1	Hexachlorobenzene	6.2	---
87-68-3	Hexachlorobutadiene	6.2	---
85-68-7	Butylbenzylphthalate	15	---
95-48-7	2-Methylphenol	6.2	---
105-67-9	2,4-Dimethylphenol	6.2	---
86-30-6	N-Nitrosodiphenylamine	6.2	---
100-51-6	Benzyl Alcohol	31	---
87-86-5	Pentachlorophenol	31	---
95-50-1	1,2-Dichlorobenzene	6.2	---

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	77.2%	d5-Phenol	80.5%
2-Fluorophenol	65.9%	d4-2-Chlorophenol	66.4%
d4-1,2-Dichlorobenzene	60.8%	d5-Nitrobenzene	62.8%
2,4,6-Tribromophenol	88.0%	d14-p-Terphenyl	78.8%

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: ID-000-MIX
MATRIX SPIKE DUPLICATE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/10/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/09/09 19:15
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.1 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 19.4%

CAS Number	Analyte	RL	Result
53-70-3	Dibenz(a,h)anthracene	6.2	---
106-46-7	1,4-Dichlorobenzene	6.2	---
120-82-1	1,2,4-Trichlorobenzene	6.2	---
118-74-1	Hexachlorobenzene	6.2	---
87-68-3	Hexachlorobutadiene	6.2	---
85-68-7	Butylbenzylphthalate	16	---
95-48-7	2-Methylphenol	6.2	---
105-67-9	2,4-Dimethylphenol	6.2	---
86-30-6	N-Nitrosodiphenylamine	6.2	---
100-51-6	Benzyl Alcohol	31	---
87-86-5	Pentachlorophenol	31	---
95-50-1	1,2-Dichlorobenzene	6.2	---

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	73.6%	d5-Phenol	76.3%
2-Fluorophenol	64.0%	d4-2-Chlorophenol	63.7%
d4-1,2-Dichlorobenzene	58.0%	d5-Nitrobenzene	64.4%
2,4,6-Tribromophenol	81.1%	d14-p-Terphenyl	74.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
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Sample ID: LCS-020509
LAB CONTROL SAMPLE

Lab Sample ID: LCS-020509
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/10/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
Event: NA
Date Sampled: NA
Date Received: NA

Date Extracted: 02/05/09
Date Analyzed LCS: 02/09/09 17:39
Instrument/Analyst LCS: NT2/PK

Sample Amount LCS: 16.0 g-dry-wt
Final Extract Volume LCS: 1.0 mL
Dilution Factor LCS: 1.00

Analyte	**LCS**	**Spike Added**	**Recovery**
Dibenz(a,h)anthracene	85.6	156	54.9%
1,4-Dichlorobenzene	110	156	70.5%
1,2,4-Trichlorobenzene	112	156	71.8%
Hexachlorobenzene	125	156	80.1%
Hexachlorobutadiene	114	156	73.1%
Butylbenzylphthalate	144	156	92.3%
2-Methylphenol	108	156	69.2%
2,4-Dimethylphenol	51.9	156	33.3%
N-Nitrosodiphenylamine	125	156	80.1%
Benzyl Alcohol	< 31.2 U	312	NA
Pentachlorophenol	166	156	106%
1,2-Dichlorobenzene	125	156	80.1%

Reported in µg/kg (ppb)

NA-No recovery due to high concentration of analyte in original sample, calculated negative recovery, or undetected spike.

SIM Semivolatile Surrogate Recovery	
2-Fluorobiphenyl	64.8%
d5-Phenol	61.6%
2-Fluorophenol	65.9%
d4-2-Chlorophenol	64.3%
d4-1,2-Dichlorobenzene	60.4%
d5-Nitrobenzene	62.4%
2,4,6-Tribromophenol	74.7%
d14-p-Terphenyl	78.0%

FORM III

4B
SEMIVOLATILE METHOD BLANK SUMMARY

BLANK NO.

OK55MBS1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SAIC

ARI Job No: OK55

Project: 2009 IRONDALE SEDIME

Lab File ID: 020908

Date Extracted: 02/05/09

Instrument ID: NT2

Date Analyzed: 02/09/09

Matrix: SOLID

Time Analyzed: 1706

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	OK55LCSS1	OK55LCSS1	020909	02/09/09
02	ID-000-MIX	OK55A	020910	02/09/09
03	ID-000-MIX MS	OK55AMS	020911	02/09/09
04	ID-000-MIX MSD	OK55AMSD	020912	02/09/09
05				
06				
07				
08				
09				
10				
11				
12				
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COMMENTS:

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FORM IV SV

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS **Sample ID: MB-020509**
Page 1 of 1 **METHOD BLANK**

Lab Sample ID: MB-020509
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/10/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
Event: NA
Date Sampled: NA
Date Received: NA

Date Extracted: 02/05/09
Date Analyzed: 02/09/09 17:06
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.0 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	Analyte	RL	Result
53-70-3	Dibenz(a,h)anthracene	6.2	< 6.2 U
106-46-7	1,4-Dichlorobenzene	6.2	< 6.2 U
120-82-1	1,2,4-Trichlorobenzene	6.2	< 6.2 U
118-74-1	Hexachlorobenzene	6.2	< 6.2 U
87-68-3	Hexachlorobutadiene	6.2	< 6.2 U
85-68-7	Butylbenzylphthalate	16	< 16 U
95-48-7	2-Methylphenol	6.2	< 6.2 U
105-67-9	2,4-Dimethylphenol	6.2	< 6.2 U
86-30-6	N-Nitrosodiphenylamine	6.2	< 6.2 U
100-51-6	Benzyl Alcohol	31	< 31 U
87-86-5	Pentachlorophenol	31	< 31 U
95-50-1	1,2-Dichlorobenzene	6.2	< 6.2 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	63.6%	d5-Phenol	65.3%
2-Fluorophenol	62.9%	d4-2-Chlorophenol	59.7%
d4-1,2-Dichlorobenzene	71.6%	d5-Nitrobenzene	74.8%
2,4,6-Tribromophenol	68.5%	d14-p-Terphenyl	90.0%

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ORGANICS ANALYSIS DATA SHEET
PSDDA Pesticides/PCB by GC/ECD
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Sample ID: ID-000-MIX
SAMPLE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/14/09 00:20
Instrument/Analyst: ECD4/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes
Florisil Cleanup: No
Acid Cleanup: No

Sample Amount: 25.8 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 1.00
Silica Gel: Yes

Percent Moisture: 19.4%

CAS Number	**Analyte**	**RL**	**Result**
58-89-9	gamma-BHC (Lindane)	0.97	< 0.97 U
76-44-8	Heptachlor	0.97	< 0.97 U
309-00-2	Aldrin	0.97	< 0.97 U
60-57-1	Dieldrin	1.9	< 1.9 U
72-55-9	4,4'-DDE	1.9	< 1.9 U
72-54-8	4,4'-DDD	1.9	< 1.9 U
50-29-3	4,4'-DDT	1.9	< 1.9 U
5103-74-2	gamma Chlordane	0.97	< 0.97 U
5103-71-9	alpha Chlordane	0.97	< 0.97 U
789-02-6	2,4'-DDT	1.9	< 1.9 U
3424-82-6	2,4'-DDE	1.9	< 1.9 U
53-19-0	2,4'-DDD	1.9	< 1.9 U
27304-13-8	oxy Chlordane	1.9	< 1.9 U
5103-73-1	cis-Nonachlor	1.9	< 1.9 U
39765-80-5	trans-Nonachlor	1.9	< 1.9 U

Reported in µg/kg (ppb)

Pest/PCB Surrogate Recovery

Decachlorobiphenyl	75.0%
Tetrachlorometaxylene	64.2%

FORM I

ORGANICS ANALYSIS DATA SHEET
PSDDA Pesticides/PCB by GC/ECD
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Sample ID: ID-000-MIX
DILUTION

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/11/09 01:45
Instrument/Analyst: ECD4/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes
Florisil Cleanup: No
Acid Cleanup: No

Sample Amount: 25.8 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 5.00
Silica Gel: Yes

Percent Moisture: 19.4%

CAS Number	Analyte	RL	Result
58-89-9	gamma-BHC (Lindane)	4.8	< 4.8 U
76-44-8	Heptachlor	4.8	< 4.8 U
309-00-2	Aldrin	4.8	< 4.8 U
60-57-1	Dieldrin	9.7	< 9.7 U
72-55-9	4,4'-DDE	9.7	< 9.7 U
72-54-8	4,4'-DDD	9.7	< 9.7 U
50-29-3	4,4'-DDT	9.7	< 9.7 U
5103-74-2	gamma Chlordane	4.8	< 4.8 U
5103-71-9	alpha Chlordane	4.8	< 4.8 U
789-02-6	2,4'-DDT	9.7	< 9.7 U
3424-82-6	2,4'-DDE	9.7	< 9.7 U
53-19-0	2,4'-DDD	9.7	< 9.7 U
27304-13-8	oxy Chlordane	9.7	< 9.7 U
5103-73-1	cis-Nonachlor	9.7	< 9.7 U
39765-80-5	trans-Nonachlor	9.7	< 9.7 U

Reported in µg/kg (ppb)

Pest/PCB Surrogate Recovery

Decachlorobiphenyl	109%
Tetrachlorometaxylene	83.9%

FORM I

SW8081 PESTICIDE SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Client ID	DCBP	TCMX	TOT OUT
MB-020509	94.2%	79.8%	0
LCS-020509	82.0%	86.0%	0
ID-000-MIX	75.0%	64.2%	0
ID-000-MIX DL	109%	83.9%	0
ID-000-MIX MS	92.5%	53.5%	0
ID-000-MIX MSD	110%	56.8%	0

	LCS/MB LIMITS	QC LIMITS
(DCBP) = Decachlorobiphenyl	(65-125)	(52-143)
(TCMX) = Tetrachlorometaxylene	(53-112)	(43-128)

Prep Method: SW3550B
Log Number Range: 09-3059 to 09-3059

ORGANICS ANALYSIS DATA SHEET
PSDDA Pesticides/PCB by GC/ECD
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Sample ID: ID-000-MIX
MS/MSD

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted MS/MSD: 02/05/09

Sample Amount MS: 25.9 g-dry-wt
MSD: 25.9 g-dry-wt

Date Analyzed MS: 02/14/09 00:40
MSD: 02/14/09 01:00
Instrument/Analyst MS: ECD4/AAR
MSD: ECD4/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes
Florisil Cleanup: No

Final Extract Volume MS: 5.0 mL
MSD: 5.0 mL
Dilution Factor MS: 1.00
MSD: 1.00
Silica Gel: Yes

Percent Moisture: 19.4%

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
gamma-BHC (Lindane)	< 0.968	3.38	3.87	87.3%	2.69	3.87	69.5%	22.7%
Heptachlor	< 0.968	3.36	3.87	86.8%	3.60	3.87	93.0%	6.9%
Aldrin	< 0.968	3.09	3.87	79.8%	2.67	3.87	69.0%	14.6%
Dieldrin	< 1.94	4.35	7.73	56.3%	4.43	7.73	57.3%	1.8%
4,4'-DDE	< 1.94	6.48	7.73	83.8%	6.52	7.73	84.3%	0.6%
4,4'-DDD	< 1.94	4.10	7.73	53.0%	4.49	7.73	58.1%	9.1%
4,4'-DDT	< 1.94	4.20	7.73	54.3%	4.56	7.73	59.0%	8.2%
gamma Chlordane	< 0.968	3.25	3.87	84.0%	2.82	3.87	72.9%	14.2%
alpha Chlordane	< 0.968	2.75	3.87	71.1%	2.61	3.87	67.4%	5.2%

Reported in µg/kg (ppb)
RPD calculated using sample concentrations per SW846.

ORGANICS ANALYSIS DATA SHEET
PSDDA Pesticides/PCB by GC/ECD
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Sample ID: ID-000-MIX
MATRIX SPIKE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/14/09 00:40
Instrument/Analyst: ECD4/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes
Florisil Cleanup: No
Acid Cleanup: No

Sample Amount: 25.9 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 1.00
Silica Gel: Yes

Percent Moisture: 19.4%

CAS Number	Analyte	RL	Result
58-89-9	gamma-BHC (Lindane)	0.97	---
76-44-8	Heptachlor	0.97	---
309-00-2	Aldrin	0.97	---
60-57-1	Dieldrin	1.9	---
72-55-9	4,4'-DDE	1.9	---
72-54-8	4,4'-DDD	1.9	---
50-29-3	4,4'-DDT	1.9	---
5103-74-2	gamma Chlordane	0.97	---
5103-71-9	alpha Chlordane	0.97	---
789-02-6	2,4'-DDT	1.9	< 1.9 U
3424-82-6	2,4'-DDE	1.9	< 1.9 U
53-19-0	2,4'-DDD	1.9	< 1.9 U
27304-13-8	oxy Chlordane	1.9	< 1.9 U
5103-73-1	cis-Nonachlor	1.9	< 1.9 U
39765-80-5	trans-Nonachlor	1.9	< 1.9 U

Reported in µg/kg (ppb)

Pest/PCB Surrogate Recovery

Decachlorobiphenyl	92.5%
Tetrachlorometaxylene	53.5%

FORM I

ORGANICS ANALYSIS DATA SHEET
PSDDA Pesticides/PCB by GC/ECD
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Sample ID: ID-000-MIX
MATRIX SPIKE DUP

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/14/09 01:00
Instrument/Analyst: ECD4/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes
Florisil Cleanup: No
Acid Cleanup: No

Sample Amount: 25.9 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 1.00
Silica Gel: Yes

Percent Moisture: 19.4%

CAS Number	Analyte	RL	Result
58-89-9	gamma-BHC (Lindane)	0.97	---
76-44-8	Heptachlor	0.97	---
309-00-2	Aldrin	0.97	---
60-57-1	Dieldrin	1.9	---
72-55-9	4,4'-DDE	1.9	---
72-54-8	4,4'-DDD	1.9	---
50-29-3	4,4'-DDT	1.9	---
5103-74-2	gamma Chlordane	0.97	---
5103-71-9	alpha Chlordane	0.97	---
789-02-6	2,4'-DDT	1.9	< 1.9 U
3424-82-6	2,4'-DDE	1.9	< 1.9 U
53-19-0	2,4'-DDD	1.9	< 1.9 U
27304-13-8	oxy Chlordane	1.9	< 1.9 U
5103-73-1	cis-Nonachlor	1.9	< 1.9 U
39765-80-5	trans-Nonachlor	1.9	< 1.9 U

Reported in µg/kg (ppb)

Pest/PCB Surrogate Recovery

Decachlorobiphenyl	110%
Tetrachlorometaxylene	56.8%

FORM I

ORGANICS ANALYSIS DATA SHEET
PSDDA Pesticides/PCB by GC/ECD
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Sample ID: LCS-020509
LAB CONTROL

Lab Sample ID: LCS-020509
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/11/09 01:25
Instrument/Analyst: ECD4/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes
Florisil Cleanup: No

Sample Amount: 25.0 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 1.00
Silica Gel: Yes

Percent Moisture: NA

Analyte	**Lab Control**	**Spike Added**	**Recovery**
gamma-BHC (Lindane)	4.46	4.00	112%
Heptachlor	4.32	4.00	108%
Aldrin	4.40	4.00	110%
Dieldrin	7.62	8.00	95.2%
4,4'-DDE	9.04	8.00	113%
4,4'-DDD	9.18	8.00	115%
4,4'-DDT	9.50	8.00	119%
gamma Chlordane	3.88	4.00	97.0%
alpha Chlordane	3.76	4.00	94.0%

Pest/PCB Surrogate Recovery

Decachlorobiphenyl	82.0%
Tetrachlorometaxylene	86.0%

Reported in µg/kg (ppb)

FORM 4
PESTICIDE METHOD BLANK SUMMARY

SAMPLE NO.

OK55MBS1

Lab Name: ANALYTICAL RESOURCES, INC
Client: SCIENCE APPLICATIONS, INTL.
ARI Job No.: OK55
Project: 2009 IRONDALE SEDIMENT
Lab Sample ID: OK55MBS1
Lab File ID: 0210A036
Matrix (soil/water) SOLID
Extraction:(SepF/Cont/Sonc) SW3550B
Sulfur Cleanup (Y/N) Y
Date Extracted: 02/05/09
Date Analyzed (1): 02/11/09
Date Analyzed (2): 02/11/09
Time Analyzed (1): 0104
Time Analyzed (2): 0104
Instrument ID (1): ECD4
Instrument ID (2): ECD4
GC Column (1): STX-CLP1 ID: 0.53(mm)
GC Column (2): STX-CLP2 ID: 0.53(mm)

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED 1	DATE ANALYZED 2
01	OK55LCSS1	OK55LCSS1	02/11/09	02/11/09
02	ID-000-MIX	OK55A	02/11/09	02/11/09
03	ID-000-MIX	OK55A	02/14/09	02/14/09
04	ID-000-MIX M	OK55AMS	02/14/09	02/14/09
05	ID-000-MIX M	OK55AMSD	02/14/09	02/14/09

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PSDDA Pesticides/PCB by GC/ECD
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Sample ID: MB-020509
METHOD BLANK

Lab Sample ID: MB-020509
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: NA
Date Received: NA

Date Extracted: 02/05/09
Date Analyzed: 02/11/09 01:04
Instrument/Analyst: ECD4/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes
Florisil Cleanup: No
Acid Cleanup: No

Sample Amount: 25.0 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 1.00
Silica Gel: Yes

Percent Moisture: NA

CAS Number	Analyte	RL	Result
58-89-9	gamma-BHC (Lindane)	1.0	< 1.0 U
76-44-8	Heptachlor	1.0	< 1.0 U
309-00-2	Aldrin	1.0	< 1.0 U
60-57-1	Dieldrin	2.0	< 2.0 U
72-55-9	4,4'-DDE	2.0	< 2.0 U
72-54-8	4,4'-DDD	2.0	< 2.0 U
50-29-3	4,4'-DDT	2.0	< 2.0 U
5103-74-2	gamma Chlordane	1.0	< 1.0 U
5103-71-9	alpha Chlordane	1.0	< 1.0 U
789-02-6	2,4'-DDT	2.0	< 2.0 U
3424-82-6	2,4'-DDE	2.0	< 2.0 U
53-19-0	2,4'-DDD	2.0	< 2.0 U
27304-13-8	oxy Chlordane	2.0	< 2.0 U
5103-73-1	cis-Nonachlor	2.0	< 2.0 U
39765-80-5	trans-Nonachlor	2.0	< 2.0 U

Reported in μg/kg (ppb)

Pest/PCB Surrogate Recovery

Decachlorobiphenyl	94.2%
Tetrachlorometaxylene	79.8%

FORM I

NWTPHDx

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1
Matrix: Sediment

QC Report No: OK55-Science Applications, Intl
Project: 2009 IRONDALE SEDIMENT QUALITY

Data Release Authorized:
Reported: 02/06/09

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range	RL	Result
OK55A	ID-000-MIX	02/04/09	02/05/09	1.00	**Diesel**	**31**	**360**
09-3059	HC ID: **DRO/MOTOR OIL**		FID3A	5.0	**Motor Oil**	**61**	**330**
					o-Terphenyl		81.3%
MB-020409	Method Blank	02/04/09	02/05/09	1.00	Diesel	5.0	< 5.0 U
09-3060	HC ID: ---		FID3A	1.0	Motor Oil	10	< 10 U
					o-Terphenyl		86.4%
OK55B	SB-REF-ID-01	02/04/09	02/05/09	1.00	Diesel	6.6	< 6.6 U
09-3060	HC ID: ---		FID3A	1.0	Motor Oil	13	< 13 U
					o-Terphenyl		82.9%
OK55C	SB-REF-ID-02	02/04/09	02/05/09	1.00	Diesel	6.2	< 6.2 U
09-3061	HC ID: ---		FID3A	1.0	Motor Oil	12	< 12 U
					o-Terphenyl		84.0%

Reported in mg/kg (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel quantitation on total peaks in the range from C12 to C24.
Motor Oil quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Client ID	OTER	TOT OUT
ID-000-MIX	81.3%	0
MB-020409	86.4%	0
LCS-020409	90.9%	0
SB-REF-ID-01	82.9%	0
SB-REF-ID-01 MS	86.0%	0
SB-REF-ID-01 MSD	88.7%	0
SB-REF-ID-02	84.0%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(62-118)	(49-125)

Prep Method: SW3546
Log Number Range: 09-3059 to 09-3061

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1

Sample ID: SB-REF-ID-01
MS/MSD

Lab Sample ID: OK55B
LIMS ID: 09-3060
Matrix: Sediment
Data Release Authorized:
Reported: 02/06/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted MS/MSD: 02/04/09

Sample Amount MS: 7.63 g-dry-wt
MSD: 7.84 g-dry-wt
Final Extract Volume MS: 1.0 mL
MSD: 1.0 mL

Date Analyzed MS: 02/05/09 17:09
MSD: 02/05/09 17:28
Instrument/Analyst MS: FID/MS
MSD: FID/MS

Dilution Factor MS: 1.0
MSD: 1.0
Percent Moisture: 24.8%

Range	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Diesel	< 6.6	134	197	68.0%	136	191	71.2%	1.5%

TPHD Surrogate Recovery

	MS	**MSD**
o-Terphenyl	86.0%	88.7%

Results reported in mg/kg
RPD calculated using sample concentrations per SW846.

FORM III

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1

Sample ID: LCS-020409
LAB CONTROL

Lab Sample ID: LCS-020409
LIMS ID: 09-3060
Matrix: Sediment
Data Release Authorized:
Reported: 02/06/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/04/09
Date Analyzed: 02/05/09 16:32
Instrument/Analyst: FID/MS

Sample Amount: 10.0 g
Final Extract Volume: 1.0 mL
Dilution Factor: 1.0

Range	**Lab Control**	**Spike Added**	**Recovery**
Diesel	112	150	74.7%

TPHD Surrogate Recovery	
o-Terphenyl	90.9%

Results reported in mg/kg

FORM III

4

TPH METHOD BLANK SUMMARY

BLANK NO.

OK55MBS1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SCIENCE APPLICATIONS,INTL.

SDG No.: OK55

Project No.: IRONDALE

Date Extracted: 02/04/09

Matrix: SOLID

Date Analyzed : 02/05/09

Instrument ID : FID3A

Time Analyzed : 1651

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS, and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED
01	OK55LCSS1	OK55LCSS1	02/05/09
02	ID-000-MIX	OK55A	02/05/09
03	SB-REF-ID-01	OK55B	02/05/09
04	SB-REF-ID-01	OK55BMS	02/05/09
05	SB-REF-ID-01	OK55BMSD	02/05/09
06	SB-REF-ID-02	OK55C	02/05/09

page 1 of 1

FORM IV TPH

METALS

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: ID-000-MIX
SAMPLE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Percent Total Solids: 76.7%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	02/09/09	7471A	02/20/09	7439-97-6	Mercury	0.04	0.04	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: ID-000-MIX
DUPLICATE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Mercury	7471A	0.04 U	0.07	54.5%	+/- 0.04	L

Reported in mg/kg-dry

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: ID-000-MIX
MATRIX SPIKE

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized
Reported: 02/23/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Mercury	7471A	0.04 U	0.51	0.445	115%	

Reported in mg/kg-dry

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: OK55MB
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: NA
Date Received: NA

Percent Total Solids: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	02/09/09	7471A	02/20/09	7439-97-6	Mercury	0.05	0.05	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: OK55LCS
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Mercury	7471A	1.08	1.00	108%	

Reported in mg/kg-dry

N-Control limit not met
NA-Not Applicable, Analyte Not Spiked
Control Limits: 80-120%

GENERAL CHEMISTRY

SAMPLE RESULTS-CONVENTIONALS
OK55-Science Applications, Intl.

ANALYTICAL
RESOURCES
INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 02/09/09

Project: 2009 IRONDALE SEDIMENT QUALI
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Client ID: ID-000-MIX
ARI ID: 09-3059 OK55A

Analyte	**Date**	**Method**	**Units**	**RL**	**Sample**
Total Solids	02/02/09 020209#1	EPA 160.3	Percent	0.01	74.60
Total Volatile Solids	02/02/09 020209#1	EPA 160.4	Percent	0.01	1.95
N-Ammonia	02/02/09 020209#1	EPA 350.1M	mg-N/kg	0.13	0.32
Total Organic Carbon	02/05/09 020509#1	Plumb,1981	Percent	0.202	4.26

RL Analytical reporting limit
U Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OK55-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 02/09/09

Project: 2009 IRONDALE SEDIMENT QUALI
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Client ID: SB-REF-ID-01
ARI ID: 09-3060 OK55B

Analyte	Date	Method	Units	RL	Sample
Total Solids	02/02/09 020209#1	EPA 160.3	Percent	0.01	76.60
Preserved Total Solids	02/02/09 020209#1	EPA 160.3	Percent	0.01	76.70
Total Volatile Solids	02/02/09 020209#1	EPA 160.4	Percent	0.01	0.74
N-Ammonia	02/02/09 020209#1	EPA 350.1M	mg-N/kg	0.13	4.68
Sulfide	02/02/09 020209#1	EPA 376.2	mg/kg	1.27	1.50
Total Organic Carbon	02/05/09 020509#1	Plumb,1981	Percent	0.020	0.232

RL Analytical reporting limit
U Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

SAMPLE RESULTS-CONVENTIONALS
OK55-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 02/09/09

Project: 2009 IRONDALE SEDIMENT QUALI
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Client ID: SB-REF-ID-02
ARI ID: 09-3061 OK55C

Analyte	Date	Method	Units	RL	Sample
Total Solids	02/02/09 020209#1	EPA 160.3	Percent	0.01	73.30
Preserved Total Solids	02/02/09 020209#1	EPA 160.3	Percent	0.01	74.50
Total Volatile Solids	02/02/09 020209#1	EPA 160.4	Percent	0.01	0.79
N-Ammonia	02/02/09 020209#1	EPA 350.1M	mg-N/kg	0.14	2.57
Sulfide	02/02/09 020209#1	EPA 376.2	mg/kg	1.33	< 1.33 U
Total Organic Carbon	02/05/09 020509#1	Plumb,1981	Percent	0.020	0.354

RL Analytical reporting limit
U Undetected at reported detection limit

Ammonia determined on 2N KCl extracts.

METHOD BLANK RESULTS-CONVENTIONALS
OK55-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 02/09/09

Project: 2009 IRONDALE SEDIMENT QUALI
Event: NA
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	02/02/09	Percent	< 0.01 U
Preserved Total Solids	02/02/09	Percent	< 0.01 U
Total Volatile Solids	02/02/09	Percent	< 0.01 U
N-Ammonia	02/02/09	mg-N/kg	< 0.10 U
Sulfide	02/02/09	mg/kg	< 1.00 U
Total Organic Carbon	02/05/09	Percent	< 0.020 U

LAB CONTROL RESULTS-CONVENTIONALS
OK55-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 02/09/09

Project: 2009 IRONDALE SEDIMENT QUALI
Event: NA
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	LCS	Spike Added	Recovery
Sulfide	02/02/09	mg/kg	6.30	6.54	96.3%
Total Organic Carbon	02/05/09	Percent	0.544	0.500	108.8%

STANDARD REFERENCE RESULTS-CONVENTIONALS
OK55-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized:
Reported: 02/09/09

Project: 2009 IRONDALE SEDIMENT QUALI
Event: NA
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Date	Units	SRM	True Value	Recovery
N-Ammonia SPEX 28-24AS	02/02/09	mg-N/kg	102	100	102.0%
Total Organic Carbon NIST #8704	02/05/09	Percent	2.96	3.35	88.4%

REPLICATE RESULTS-CONVENTIONALS
OK55-Science Applications, Intl.

ANALYTICAL RESOURCES INCORPORATED

Matrix: Sediment
Data Release Authorized
Reported: 02/09/09

Project: 2009 IRONDALE SEDIMENT QUALI
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: OK55B Client ID: SB-REF-ID-01					
Total Solids	02/02/09	Percent	76.60	76.20 77.10	0.6%
Preserved Total Solids	02/02/09	Percent	76.70	75.10 75.70	1.1%
Total Volatile Solids	02/02/09	Percent	0.74	0.80 0.72	5.5%
N-Ammonia	02/02/09	mg-N/kg	4.68	4.94 5.92	12.6%
Sulfide	02/02/09	mg/kg	1.50	2.44	47.7%
Total Organic Carbon	02/05/09	Percent	0.232	0.234 0.230	0.9%

Matrix: Sediment
Data Release Authorized:
Reported: 02/09/09

Project: 2009 IRONDALE SEDIMENT QUALI
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

ARI ID: OK55B Client ID: SB-REF-ID-01

Analyte	**Date**	**Units**	**Sample**	**Spike**	**Spike Added**	**Recovery**
N-Ammonia	02/02/09	mg-N/kg	4.68	132	128	99.7%
Sulfide	02/02/09	mg/kg	1.50	182	168	107.4%
Total Organic Carbon	02/05/09	Percent	0.232	0.724	0.477	103.1%

GEOTECH

Science Applications, Intl.
2009 Irondale Sediment Quality Invs.

Apparent Grain Size Distribution Summary
Percent Finer Than Indicated Size

Sample No.	Gravel			Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt				Clay	
Phi Size	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Sieve Size (microns)	3/8"	#4 (4750)	#10 (2000)	#18 (1000)	#35 (500)	#60 (250)	#120 (125)	#230 (63)	31.00	15.60	7.80	3.90	2.00	1.00
SB-REF-ID-02	100.0	100.0	99.5	98.7	94.9	39.5	1.9	0.9	NA	NA	NA	NA	NA	NA
	100.0	98.7	98.2	97.5	93.5	39.2	1.8	0.9	NA	NA	NA	NA	NA	NA
	100.0	99.2	98.3	97.5	93.7	39.7	2.2	1.4	NA	NA	NA	NA	NA	NA
ID-000-MIX	100.0	91.0	85.9	81.1	64.1	22.7	4.0	2.0	NA	NA	NA	NA	NA	NA
SB-REF-ID-01	100.0	99.7	99.3	98.5	90.9	36.4	4.4	0.9	NA	NA	NA	NA	NA	NA

Notes to the Testing:

1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

Science Applications, Intl.
2009 Irondale Sediment Quality Invs.

Apparent Grain Size Distribution Summary
Percent Retained in Each Size Fraction

Sample No.	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Medium Silt	Fine Silt	Very Fine Silt	Clay			Total Fines
Phi Size	> -1	-1 to 0	0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	< 10	<4
Sieve Size (microns)	> #10 (2000)	10 to 18 (2000-1000)	18-35 (1000-500)	35-60 (500-250)	60-120 (250-125)	120-230 (125-62)	62.5-31.0	31.0-15.6	15.6-7.8	7.8-3.9	3.9-2.0	2.0-1.0	<1.0	<230 (<62)
SB-REF-ID-02	0.5	0.8	3.7	55.5	37.6	0.9	NA	NA	NA	NA	NA	NA	NA	0.9
	1.8	0.7	3.9	54.4	37.3	0.9	NA	NA	NA	NA	NA	NA	NA	0.9
	1.7	0.8	3.8	54.0	37.5	0.9	NA	NA	NA	NA	NA	NA	NA	1.4
ID-000-MIX	14.1	4.7	17.0	41.4	18.7	2.0	NA	NA	NA	NA	NA	NA	NA	2.0
SB-REF-ID-01	0.7	0.7	7.7	54.4	32.0	3.5	NA	NA	NA	NA	NA	NA	NA	0.9

Notes to the Testing:
1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

QA SUMMARY

Client:	Science Applications, Intl.	Project No.:	2009 Irondale Sediment Quality Invs.
ARI Trip. Sample ID:	OK55C	Batch No.:	OK55-1
Client Trip. Sample ID:	SB-REF-ID-02	Page:	1 of 1

Relative Standard Deviation, By Phi Size

Sample ID	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
SB-REF-ID-02	100.0	100.0	99.5	98.7	94.9	39.5	1.9	0.9	NA	NA	NA	NA	NA	NA
	100.0	98.7	98.2	97.5	93.5	39.2	1.8	0.9	NA	NA	NA	NA	NA	NA
	100.0	99.2	98.3	97.5	93.7	39.7	2.2	1.4	NA	NA	NA	NA	NA	NA
AVE	NA	99.28	98.65	97.88	94.07	39.46	1.97	1.07	NA	NA	NA	NA	NA	NA
STDEV	NA	0.64	0.73	0.69	0.76	0.28	0.21	0.25	NA	NA	NA	NA	NA	NA
%RSD	NA	0.64	0.74	0.71	0.80	0.72	10.85	23.15	NA	NA	NA	NA	NA	NA

The Triplicate Applies To The Following Samples

Client ID	Date Sampled	Date Extracted	Date Complete	QA Ratio (95-105)	Data Qualifiers	Pipette Portion (5.0-25.0g)
SB-REF-ID-02	1/29/2009	2/19/2009	2/24/2009	99.4	SS	1.0
	1/29/2009	2/19/2009	2/24/2009	99.4	SS	1.0
	1/29/2009	2/19/2009	2/24/2009	99.9	SS	1.5
ID-000-MIX	1/29/2009	2/19/2009	2/24/2009	100.2	SS	2.4
SB-REF-ID-01	1/29/2009	2/19/2009	2/24/2009	99.3	SS	1.1

* ARI Internal QA limits = 95-105%

Notes to the Testing:

1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

TOTAL SOLIDS

Extractions Total Solids-extts
Data By: Woo suk Chang
Created: 2/ 2/09

Worklist: 7847
Analyst: RVR
Comments:

	ARI ID CLIENT ID	Tare Wt (g)	Wet Wt (g)	Dry Wt (g)	% Solids	pH
1.	OK55A 09-3059 ID-000-MIX	1.16	13.50	11.11	80.6	NR
2.	OK55B 09-3060 SB-REF-ID-01	1.16	13.80	10.66	75.2	NR
3.	OK55C 09-3061 SB-REF-ID-02	1.16	13.58	10.31	73.7	NR

```
Solids Data Entry Report      Checked by: MH   Date: 02/10/09
Date: 02/10/09                Data Analyst: KM

Solids Determination performed on 02/09/09 by MH

JOB     SAMPLE  CLIENTID                TAREWEIGHT   SAMPDISH  DRYWEIGHT    SOLIDS
----------------------------------------------------------------------------------
OK55    A       ID-000-MIX                   0.954     10.218      8.061     76.72
```

Laboratory Data Package

prepared
for

Science Applications, Intl.

Project: 2009 Irondale Sediment Quality Investigation

ARI JOB NO: OK55

prepared
by

Analytical Resources, Inc.

Semivolatile Analysis
QC Summary Data

prepared
for

Science Applications, Intl.

Project: 2009 Irondale Sediment Quality Investigation

ARI JOB NO: OK55

prepared
by

Analytical Resources, Inc.

SW8270 SEMIVOLATILES SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Client ID	NBZ	FBP	TPH	DCB	PHL	2FP	TBP	2CP	TOT OUT
MB-020509	56.4%	55.2%	80.8%	58.8%	56.5%	54.1%	60.5%	58.1%	0
LCS-020509	52.8%	50.8%	75.2%	53.2%	52.3%	51.5%	64.8%	52.8%	0
ID-000-MIX	61.2%	63.2%	77.2%	59.6%	63.7%	58.7%	81.1%	62.7%	0
ID-000-MIX MS	56.0%	58.4%	68.8%	55.2%	60.0%	54.7%	74.1%	57.1%	0
ID-000-MIX MSD	54.8%	58.8%	70.0%	56.4%	57.6%	54.9%	74.9%	57.6%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(37-85)	(29-87)
(FBP) = 2-Fluorobiphenyl	(39-82)	(32-88)
(TPH) = d14-p-Terphenyl	(38-105)	(21-97)
(DCB) = d4-1,2-Dichlorobenzene	(33-79)	(25-82)
(PHL) = d5-Phenol	(40-85)	(29-85)
(2FP) = 2-Fluorophenol	(20-93)	(10-114)
(TBP) = 2,4,6-Tribromophenol	(40-96)	(25-103)
(2CP) = d4-2-Chlorophenol	(41-81)	(30-84)

Prep Method: SW3550B
Log Number Range: 09-3059 to 09-3059

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 1 of 1

Sample ID: ID-000-MIX
MS/MSD

Lab Sample ID: OK55A
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/13/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted MS/MSD: 02/05/09

Date Analyzed MS: 02/12/09 20:19
MSD: 02/12/09 20:52
Instrument/Analyst MS: NT6/LJR
MSD: NT6/LJR
GPC Cleanup: YES

Sample Amount MS: 25.8 g-dry-wt
MSD: 25.9 g-dry-wt
Final Extract Volume MS: 0.5 mL
MSD: 0.5 mL
Dilution Factor MS: 1.00
MSD: 1.00
Percent Moisture: 19.4 %

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Phenol	< 19.4	261	484	53.9%	268	483	55.5%	2.6%
1,3-Dichlorobenzene	< 19.4	255	484	52.7%	268	483	55.5%	5.0%
1,4-Dichlorobenzene	< 19.4	255	484	52.7%	271	483	56.1%	6.1%
Benzyl Alcohol	< 19.4	457	967	47.3%	496	967	51.3%	8.2%
1,2-Dichlorobenzene	< 19.4	253	484	52.3%	268	483	55.5%	5.8%
2-Methylphenol	< 19.4	240	484	49.6%	261	483	54.0%	8.4%
4-Methylphenol	< 19.4	536	967	55.4%	565	967	58.4%	5.3%
Hexachloroethane	< 19.4	254	484	52.5%	265	483	54.9%	4.2%
2,4-Dimethylphenol	< 19.4	78.2	484	16.2%	119	483	24.6%	41.4%
Benzoic Acid	< 194	935	1450	64.5%	1030	1450	71.0%	9.7%
1,2,4-Trichlorobenzene	< 19.4	271	484	56.0%	275	483	56.9%	1.5%
Naphthalene	< 19.4	282	484	58.3%	288	483	59.6%	2.1%
Hexachlorobutadiene	< 19.4	289	484	59.7%	294	483	60.9%	1.7%
2-Methylnaphthalene	< 19.4	271	484	56.0%	285	483	59.0%	5.0%
Dimethylphthalate	< 19.4	287	484	59.3%	293	483	60.7%	2.1%
Acenaphthylene	< 19.4	271	484	56.0%	279	483	57.8%	2.9%
Acenaphthene	< 19.4	288	484	59.5%	296	483	61.3%	2.7%
Dibenzofuran	< 19.4	304	484	62.8%	313	483	64.8%	2.9%
Diethylphthalate	< 19.4	306	484	63.2%	318	483	65.8%	3.8%
Fluorene	< 19.4	330	484	68.2%	342	483	70.8%	3.6%
N-Nitrosodiphenylamine	< 19.4	286	484	59.1%	303	483	62.7%	5.8%
Hexachlorobenzene	< 19.4	307	484	63.4%	324	483	67.1%	5.4%
Pentachlorophenol	< 96.9	372	484	76.9%	391	483	81.0%	5.0%
Phenanthrene	10.1	355	484	71.3%	340	483	68.3%	4.3%
Anthracene	< 19.4	291	484	60.1%	310	483	64.2%	6.3%
Di-n-Butylphthalate	< 19.4	340	484	70.2%	353	483	73.1%	3.8%
Fluoranthene	20.6	422	484	82.9%	410	483	80.6%	2.9%
Pyrene	38.4	359	484	66.2%	353	483	65.1%	1.7%
Butylbenzylphthalate	< 19.4	306	484	63.2%	318	483	65.8%	3.8%
Benzo(a)anthracene	14.9	316	484	62.2%	324	483	64.0%	2.5%
bis(2-Ethylhexyl)phthalate	< 19.4	384	484	79.3%	400	483	82.8%	4.1%
Chrysene	37.2	321	484	58.6%	324	483	59.4%	0.9%
Di-n-Octyl phthalate	< 19.4	322	484	66.5%	333	483	68.9%	3.4%
Benzo(b)fluoranthene	13.4	368	484	73.3%	419	483	84.0%	13.0%
Benzo(k)fluoranthene	< 19.4	439	484	90.7%	430	483	89.0%	2.1%
Benzo(a)pyrene	< 19.4	302	484	62.4%	320	483	66.3%	5.8%
Indeno(1,2,3-cd)pyrene	< 19.4	324	484	66.9%	308	483	63.8%	5.1%
Dibenz(a,h)anthracene	< 19.4	321	484	66.3%	309	483	64.0%	3.8%
Benzo(g,h,i)perylene	< 19.4	287	484	59.3%	263	483	54.5%	8.7%
1-Methylnaphthalene	< 19.4	300	484	62.0%	308	483	63.8%	2.6%

Results reported in µg/kg
RPD calculated using sample concentrations per SW846.

FORM III

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: LCS-020509
LAB CONTROL

Lab Sample ID: LCS-020509
LIMS ID: 09-3059
Matrix: Sediment
Data Release Authorized:
Reported: 02/13/09

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/05/09
Date Analyzed: 02/11/09 18:20
Instrument/Analyst: NT6/LJR
GPC Cleanup: YES

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Phenol	283	500	56.6%
1,3-Dichlorobenzene	272	500	54.4%
1,4-Dichlorobenzene	269	500	53.8%
Benzyl Alcohol	392	1000	39.2%
1,2-Dichlorobenzene	272	500	54.4%
2-Methylphenol	271	500	54.2%
4-Methylphenol	584	1000	58.4%
Hexachloroethane	271	500	54.2%
2,4-Dimethylphenol	215	500	43.0%
Benzoic Acid	1020	1500	68.0%
1,2,4-Trichlorobenzene	264	500	52.8%
Naphthalene	280	500	56.0%
Hexachlorobutadiene	288	500	57.6%
2-Methylnaphthalene	279	500	55.8%
Dimethylphthalate	300	500	60.0%
Acenaphthylene	268	500	53.6%
Acenaphthene	270	500	54.0%
Dibenzofuran	291	500	58.2%
Diethylphthalate	333	500	66.6%
Fluorene	324	500	64.8%
N-Nitrosodiphenylamine	313	500	62.6%
Hexachlorobenzene	307	500	61.4%
Pentachlorophenol	310	500	62.0%
Phenanthrene	321	500	64.2%
Anthracene	308	500	61.6%
Di-n-Butylphthalate	378	500	75.6%
Fluoranthene	382	500	76.4%
Pyrene	379	500	75.8%
Butylbenzylphthalate	390	500	78.0%
Benzo(a)anthracene	334	500	66.8%
bis(2-Ethylhexyl)phthalate	421	500	84.2%
Chrysene	302	500	60.4%
Di-n-Octyl phthalate	342	500	68.4%
Benzo(b)fluoranthene	412	500	82.4%
Benzo(k)fluoranthene	405	500	81.0%
Benzo(a)pyrene	315	500	63.0%
Indeno(1,2,3-cd)pyrene	405	500	81.0%

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270D GC/MS
Page 2 of 2

Sample ID: LCS-020509
LAB CONTROL

Lab Sample ID: LCS-020509
LIMS ID: 09-3059
Matrix: Sediment
Date Analyzed: 02/11/09 18:20

QC Report No: OK55-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Dibenz(a,h)anthracene	387	500	77.4%
Benzo(g,h,i)perylene	386	500	77.2%
1-Methylnaphthalene	300	500	60.0%

Semivolatile Surrogate Recovery

d5-Nitrobenzene	52.8%
2-Fluorobiphenyl	50.8%
d14-p-Terphenyl	75.2%
d4-1,2-Dichlorobenzene	53.2%
d5-Phenol	52.3%
2-Fluorophenol	51.5%
2,4,6-Tribromophenol	64.8%
d4-2-Chlorophenol	52.8%

Results reported in µg/kg

FORM III

4B
SEMIVOLATILE METHOD BLANK SUMMARY

BLANK NO.

OK55MBS1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SAIC

ARI Job No: OK55

Project: 2009 IRONDALE SEDIME

Lab File ID: OK55MB

Date Extracted: 02/05/09

Instrument ID: NT6

Date Analyzed: 02/11/09

Matrix: SOLID

Time Analyzed: 1746

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	OK55LCSS1	OK55LCSS1	OK55SB	02/11/09
02	ID-000-MIX	OK55A	OK55A	02/12/09
03	ID-000-MIX MS	OK55AMS	OK55AMS	02/12/09
04	ID-000-MIX MSD	OK55AMSD	OK55AMD	02/12/09
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COMMENTS:

FORM IV SV

5B

SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: ANALYTICAL RESOURCES, INC Client: SAIC

Instrument ID: NT6 Project: 2009 IRONDALE SEDIME

DFTPP Injection Date: 01/29/09 DFTPP Injection Time: 1017

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	30.0 - 80.0% of mass 198	56.2
68	Less than 2.0% of mass 69	0.6 (1.1)1
69	Mass 69 relative abundance	54.8
70	Less than 2.0% of mass 69	0.0 (0.0)1
127	25.0 - 75.0% of mass 198	54.7
197	Less than 1.0% of mass 198	0.0
198	Base Peak, 100% relative abundance	100.0
199	5.0 to 9.0% of mass 198	6.4
275	10.0 - 30.0% of mass 198	22.3
365	Greater than 0.75% of mass 198	2.71
441	Present, but less than mass 443	11.1
442	40.0 - 110.0% of mass 198	75.5
443	15.0 - 24.0% of mass 442	14.8 (19.6)2

1-Value is % mass 69 2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	ABN 25	ABN 25	0250129	01/29/09	1017
02	ABN 80	ABN 80	0800129	01/29/09	1051
03	ABN 1	ABN 1	0010129	01/29/09	1126
04	ABN 40	ABN 40	0400129	01/29/09	1201
05	ABN 5	ABN 5	0050129	01/29/09	1235
06	ABN 10	ABN 10	0100129	01/29/09	1310
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5B
SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: ANALYTICAL RESOURCES, INC Client: SAIC

Instrument ID: NT6 Project: 2009 IRONDALE SEDIME

DFTPP Injection Date: 02/11/09 DFTPP Injection Time: 1318

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	30.0 - 80.0% of mass 198	62.1
68	Less than 2.0% of mass 69	0.7 (1.2)1
69	Mass 69 relative abundance	57.1
70	Less than 2.0% of mass 69	0.2 (0.4)1
127	25.0 - 75.0% of mass 198	56.3
197	Less than 1.0% of mass 198	0.0
198	Base Peak, 100% relative abundance	100.0
199	5.0 to 9.0% of mass 198	6.8
275	10.0 - 30.0% of mass 198	22.1
365	Greater than 0.75% of mass 198	2.52
441	Present, but less than mass 443	10.9
442	40.0 - 110.0% of mass 198	75.7
443	15.0 - 24.0% of mass 442	14.6 (19.3)2

1-Value is % mass 69 2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	ABN CCAL	ABN 25	CC0211	02/11/09	1318
02	OK55MBS1	OK55MBS1	OK55MB	02/11/09	1746
03	OK55LCSS1	OK55LCSS1	OK55SB	02/11/09	1820
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5B
SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: ANALYTICAL RESOURCES, INC   Client: SAIC

Instrument ID: NT6   Project: 2009 IRONDALE SEDIME

DFTPP Injection Date: 02/12/09   DFTPP Injection Time: 1413

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	30.0 - 80.0% of mass 198	61.5	
68	Less than 2.0% of mass 69	0.8	(1.3)1
69	Mass 69 relative abundance	56.5	
70	Less than 2.0% of mass 69	0.0	(0.0)1
127	25.0 - 75.0% of mass 198	57.8	
197	Less than 1.0% of mass 198	0.2	
198	Base Peak, 100% relative abundance	100.0	
199	5.0 to 9.0% of mass 198	6.4	
275	10.0 - 30.0% of mass 198	22.3	
365	Greater than 0.75% of mass 198	2.80	
441	Present, but less than mass 443	10.7	
442	40.0 - 110.0% of mass 198	75.0	
443	15.0 - 24.0% of mass 442	15.2	(20.3)2

1-Value is % mass 69   2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	ABN CCAL	ABN 25	CC0212	02/12/09	1413
02	ID-000-MIX	OK55A	OK55A	02/12/09	1946
03	ID-000-MIX MS	OK55AMS	OK55AMS	02/12/09	2019
04	ID-000-MIX MSD	OK55AMSD	OK55AMD	02/12/09	2052
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page 1 of 1

FORM V SV

8B

SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC
Client: SAIC
ARI Job No: OK55
Project: 2009 IRONDALE SEDIME
Cont. Calib. ID: CC0211
Date Analyzed: 02/11/09
Instrument ID: NT6
Time Analyzed: 1318

		IS1 (DCB) AREA #	RT #	IS2 (NPT) AREA #	RT #	IS3 (ANT) AREA #	RT #
	12 HOUR STD	116604	7.00	421305	9.07	222668	11.90
	UPPER LIMIT	233208	7.50	842610	9.57	445336	12.40
	LOWER LIMIT	58302	6.50	210652	8.57	111334	11.40
	CLIENT SAMP. NO.						
01	OK55MBS1	144919	7.00	527879	9.06	283746	11.90
02	OK55LCSS1	145001	7.00	521210	9.07	283271	11.90
03							
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IS1 (DCB) = 1,4-Dichlorobenzene-d4
IS2 (NPT) = Naphthalene-d8
IS3 (ANT) = Acenaphthene-d10

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

8C

SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC
Client: SAIC

ARI Job No: OK55
Project: 2009 IRONDALE SEDIME

Cont. Calib. ID: CC0211
Date Analyzed: 02/11/09

Instrument ID: NT6
Time Analyzed: 1318

		IS4 (PHN) AREA #	RT #	IS5 (CRY) AREA #	RT #	IS6 (PRY) AREA #	RT #
	12 HOUR STD	346584	14.24	260769	18.51	250599	20.64
	UPPER LIMIT	693168	14.74	521538	19.01	501198	21.14
	LOWER LIMIT	173292	13.74	130384	18.01	125300	20.14
	CLIENT SAMP. NO.						
01	OK55MBS1	443520	14.24	352347	18.50	325812	20.63
02	OK55LCSS1	460009	14.24	361780	18.50	350049	20.63
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IS4 (PHN) = Phenanthrene-d10
IS5 (CRY) = Chrysene-d12
IS6 (PRY) = Perylene-d12

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

8C
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC	Client: SAIC
ARI Job No: OK55	Project: 2009 IRONDALE SEDIME
Cont. Calib. ID: CC0211	Date Analyzed: 02/11/09
Instrument ID: NT6	Time Analyzed: 1318

		IS7 AREA #	RT #	AREA #	RT #	AREA #	RT #
	12 HOUR STD	422967	19.76				
	UPPER LIMIT	845934	20.26				
	LOWER LIMIT	211484	19.26				
	CLIENT SAMP. NO.						
01	OK55MBS1	572383	19.76				
02	OK55LCSS1	590836	19.75				
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IS7 = Di-n-octylphthalate-d4

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

FORM VIII SV-3

8B
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC
Client: SAIC
ARI Job No: OK55
Project: 2009 IRONDALE SEDIME
Cont. Calib. ID: CC0212
Date Analyzed: 02/12/09
Instrument ID: NT6
Time Analyzed: 1413

		IS1(DCB) AREA #	RT #	IS2(NPT) AREA #	RT #	IS3(ANT) AREA #	RT #
	12 HOUR STD	121921	6.91	430869	8.98	226717	11.81
	UPPER LIMIT	243842	7.41	861738	9.48	453434	12.31
	LOWER LIMIT	60960	6.41	215434	8.48	113358	11.31
	CLIENT SAMP. NO.						
01	ID-000-MIX	135665	6.91	465331	8.97	242195	11.81
02	ID-000-MIX M	143034	6.91	487633	8.97	254412	11.82
03	ID-000-MIX M	144085	6.92	492762	8.98	255292	11.82
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IS1 (DCB) = 1,4-Dichlorobenzene-d4
IS2 (NPT) = Naphthalene-d8
IS3 (ANT) = Acenaphthene-d10

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

8C

SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC Client: SAIC

ARI Job No: OK55 Project: 2009 IRONDALE SEDIME

Cont. Calib. ID: CC0212 Date Analyzed: 02/12/09

Instrument ID: NT6 Time Analyzed: 1413

		IS4 (PHN) AREA #	RT #	IS5 (CRY) AREA #	RT #	IS6 (PRY) AREA #	RT #
	12 HOUR STD	336757	14.14	258028	18.40	296570	20.51
	UPPER LIMIT	673514	14.64	516056	18.90	593140	21.01
	LOWER LIMIT	168378	13.64	129014	17.90	148285	20.01
	CLIENT SAMP. NO.						
01	ID-000-MIX	392897	14.16	398390	18.42	391469	20.56
02	ID-000-MIX M	413775	14.16	406758	18.43	397902	20.57
03	ID-000-MIX M	418177	14.16	406006	18.43	385199	20.57
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IS4 (PHN) = Phenanthrene-d10
IS5 (CRY) = Chrysene-d12
IS6 (PRY) = Perylene-d12

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

8C

SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC

Client: SAIC

ARI Job No: OK55

Project: 2009 IRONDALE SEDIME

Cont. Calib. ID: CC0212

Date Analyzed: 02/12/09

Instrument ID: NT6

Time Analyzed: 1413

		IS7 AREA #	RT #	AREA #	RT #	AREA #	RT #
	12 HOUR STD	430749	19.65				
	UPPER LIMIT	861498	20.15				
	LOWER LIMIT	215374	19.15				
	CLIENT SAMP. NO.						
01	ID-000-MIX	610685	19.68				
02	ID-000-MIX M	606203	19.69				
03	ID-000-MIX M	613020	19.69				
04							
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

IS7 = Di-n-octylphthalate-d4

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

February 26, 2009

Neil Morton
GeoEngineers, Inc.
Plaza 600 Building
600 Stewart, Suite 1700
Seattle, WA 98101

RE: Project: Irondale Sediment Quality Investigation
ARI Job No.: OL50

Dear Mr. Morton:

Please find enclosed original Chain-of-Custody (COC) record, sample receipt documentation, and the data package for samples from the project referenced above.

Sample receipt and details of these analyses are discussed in the Case Narrative.

Please note that current ARI control limits are available at www.arilabs.com.

An electronic copy of this package will remain on file with ARI. Should you have any questions or problems, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Susan D. Dunnihoo
Director, Client Services
206-695-6207
sue@arilabs.com

Enclosures

cc: eFile OL50

SD/co

Chain of Custody
Documentation

prepared
for

SCIENCE APPLICATIONS, INTL.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OL50

prepared
by

Analytical Resources, Inc.

OH26

SAIC®
From Science to Solutions

18912 North Creek Parkway, Suite 101
Bothell, Washington 98011
TEL: 425.485.5800 • FAX: 425.485.5566

CHAIN OF CUSTODY RECORD

Project No.:
Project Mgr: Tim Hammermeister
Project Name: Irondale Sediment Quality Investigation
Project Location: Irondale, WA
Sample Collectors: JB, TH, RB
Client Name: Washington State DOE

Shipping Information

Number of Shipping Containers:
Date Shipped:
Carrier:
Waybill No.:

Sample ID	Depth	Matrix	Date	Time	# of Containers	TPH-Dx extended	T. Sulfides	Sediment Conventionals	SVOCs ARCHIVE	Metals ARCHIVE	Sediment ARCHIVE	SVOCs/TPH/Metal Rinseates				Comments
ID-108-12-18-SD	Inter-tidal	Sediment	1-8-09	20:50	6	☒	☒	☒	☒	☒	☒					11476, 11477, 11478, 11479 11480, 11481
ID-101-8-14-SD				17:05	6	☒	☒	☒	☒	☒	☒					11420, 11421, 11422, 11423 11424, 11425
ID-102-9-15-SD				17:35	6	☒	☒	☒	☒	☒	☒					11427, 11428, 11429, 11430 11431, 11432
ID-103-11-17-SD				18:05	6	☒	☒	☒	☒	☒	☒					11434, 11435, 11436, 11437 11438, 11439
ID-103-11-17-D				18:05	4	☒		☒	☒	☒						11441, 11442, 11443, 11444
ID-103-11-17-T				18:05	1			☒								11445
ID-104-13-19-SD		↓		18:45	6	☒	☒	☒	☒	☒	☒					11446, 11447, 11448, 11449 11450, 11451
ID-104-R		WATER		18:45	2							☒				
ID-100-15-21-SD				19:40	6	☒	☒	☒	☒	☒	☒					11455, 11456, 11457, 11458 11459, 11460
ID-106-13-19-SD				20:00	6	☒	☒	☒	☒	☒	☒					11462, 11463, 11464, 11465 11466, 11467
ID107-8-~~14~~-SD				20:20	6	☒	☒	☒	☒	☒	☒					11469, 11470, 11471, 11472 11473, 11474
	↓	↓	↓													

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature:	Signature:	Signature:	Signature:
Date/Time: 12:50 1/9/09	Date/Time: 1/9/09 1250	Date/Time:	Date/Time:
Affiliation: SAIC	Affiliation: ARI	Affiliation:	Affiliation:

• White: Lab Returns to Originator Upon Receipt of Samples • Canary: Lab Retains • Pink: Lab Returns to Project Manager with Final Report • Goldenrod: Retained by Sampler

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: SAIC
COC No:
Assigned ARI Job No: OH26
Project Name:
Delivered by: Hand
Tracking No:

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? .... [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO
Record cooler temperature (recommended 2.0-6.0 °C for chemistry .... 5.2, 1.2, 0.6 °C

Cooler Accepted by: JH Date: 1/9/09 Time: 1250

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... [✓ YES] NO
What kind of packing material was used? .... Ice
Was sufficient ice used (if appropriate)? .... [✓ YES] NO
Were all bottles sealed in individual plastic bags? .... [✓ YES] NO
Did all bottle arrive in good condition (unbroken)? .... [✓ YES] NO
Were all bottle labels complete and legible? .... [✓ YES] NO
Did all bottle labels and tags agree with custody papers? .... [✓ YES] NO
Were all bottles used correct for the requested analyses? .... [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation checklist) .... YES [✓ NO]
Were all VOC vials free of air bubbles? .... [✓ NA] YES NO
Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO

Samples Logged by: JH Date: 1/10/09 Time: 8:20

***** Notify Project Manager of discrepancies or concerns *****

Explain discrepancies or negative responses:

By: Date:

0K55

SAIC®

18706 North Creek Parkway, Suite 110
Bothell, Washington 98011
TEL: 425.485.5800 • FAX: 425.485.5566

CHAIN OF CUSTODY RECORD

Project No.: ______ Project Mgr: Tim Hammermeister
Project Name: 2009 Irondale Sediment Quality Investigation
Project Location: Irondale, WA
Sample Collectors: TH, JB
Client Name: [redacted] Washington State DOE

						Analyses / Tests										
Sample ID	Depth	Matrix	Date	Time	# of Containers	Sediment Conventionals	Total Sulfides	TPHs	Metals: Mercury	SVOCs	Pesticides					Comments
ID-000-MIX	X	Sediment	1/29/09	13:30	3	X		X	X	X	X					11486, 11487, 11488
SB-REF-ID-01	X	↓	↓	10:30	2	X	X	X								11489, 11490
SB-REF-ID-02	X	↓	↓	11:00	2	X	X	X								11491, 11492

Shipping Information

Number of Shipping Containers:
Date Shipped:
Carrier:
Waybill No.:

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
Signature:		Signature:		Signature:		Signature:	
Date/Time:	1/30/09 10:25	Date/Time:	1/30/09 1025	Date/Time:		Date/Time:	
Affiliation:	SAIC	Affiliation:	ARI	Affiliation:		Affiliation:	

• White: Lab Returns to Originator Upon Receipt of Samples; • Canary: Lab Retains; • Pink: Lab Returns to Project Manager with Final Report; • Goldenrod: Retained by Sampler

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: SAIC
COC No:
Assigned ARI Job No: 0K55
Project Name:
Delivered by: Hand
Tracking No:

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? .... [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO
Record cooler temperature (recommended 2.0-6.0 °C for chemistry .... 5.2 °C

Cooler Accepted by: JW Date: 1/30/09 Time: 1025

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... YES [✓ NO]
What kind of packing material was used? .... Ice
Was sufficient ice used (if appropriate)? .... [✓ YES] NO
Were all bottles sealed in individual plastic bags? .... YES [✓ NO]
Did all bottle arrive in good condition (unbroken)? .... [✓ YES] NO
Were all bottle labels complete and legible? .... [✓ YES] NO
Did all bottle labels and tags agree with custody papers? .... [✓ YES] NO
Were all bottles used correct for the requested analyses? .... [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation checklist) .... YES [✓ NO]
Were all VOC vials free of air bubbles? .... [✓ NA] YES NO
Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO

Samples Logged by: JH Date: 1/30/09 Time: 1150

***** Notify Project Manager of discrepancies or concerns *****

Explain discrepancies or negative responses:

By: Date:

Case Narrative

prepared
for

SCIENCE APPLICATIONS, INTL.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OL50

prepared
by

Analytical Resources, Inc.

ANALYTICAL
RESOURCES
INCORPORATED

Case Narrative

Client: GeoEngineers
Project: Irondale Sediment Quality Investigation
Matrix: Sediment
ARI Job No.: OL50

Sample receipt

On February 6, 2009, SAIC requested that five sediment samples be removed from archive. The samples were logged under ARI job number OL50 and analyzed for PSDDA SVOCs, SIM SVOCs, and Total Metals, as requested. All samples were previously frozen to protect holding times.

PSDDA Semivolatiles

The samples were extracted and analyzed within required holding times for frozen samples.

Initial and continuing calibrations were within limits. Internal standard areas were within control limits.

The surrogate percent recoveries were within the control limits.

The method blank was clean at the reporting limits. The LCS percent recoveries were within control limits.

The matrix spike/matrix spike duplicate percent recoveries of Benzyl Alcohol fell outside the advisory control limits for samples **ID-100-15-21-SD**. No corrective action is required for matrix QC.

SIM Semivolatiles

The samples were extracted and analyzed within required holding times for frozen samples.

Initial and continuing calibrations were within limits. Internal standard areas were within control limits.

The surrogate percent recoveries were within the control limits.

Dibenz(a,h)anthracene and 1,2-Dichlorobenzene were present in **MB-021009** at levels that were greater than the reporting limits. All associated samples were undetected for these compounds. No further corrective action was required.

The matrix spike/matrix spike duplicate percent recoveries were within advisory control limits.

Total Mercury

All samples for Total Metals were prepared and analyzed within the method recommended holding times for frozen samples. All samples for Total Mercury were prepared and analyzed outside the method recommended holding times, as requested.

The method blank was clean at the detection limit. The LCS percent recovery was within the control limits.

The matrix spike percent recoveries and duplicate RPDs were within control limits.

Data Reporting Qualifiers

Effective 12/28/04

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
NR	Spiked compound recovery is not reported due to chromatographic interference
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
S	Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte
JA	The flagged analyte was not analyzed for
IS	The flagged analyte was not spiked into the sample

M	Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses
M2	The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
Y	The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
C	The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
P	The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

LCS SOLUTIONS

02/07/09

LABE	SOLN ID	TEST	CONC. UG/ML	SOLVENT	EXP.
1	1549-3	PCB	20	ACETONE	10/10/09
2	1472-3	BCOC PEST	10	ACETONE	07/20/08
3	1579-3	PEST	02/04/20	ACETONE	09/23/09
4	1576-3	LOW PEST	0.2/0.4/2	ACETONE	07/31/09
5	1580-2	EPH	1500	MECL2	01/29/10
6	1559-2	PCP	12.5/125	ACETONE	11/05/09
7	1581-4	ABN	100	ACETONE	08/01/09
8	1566-1	TBT	2.5	MECL2	12/04/09
9	1567-3	PORE TBT	.125/.25	MECL2	12/04/09
10	1578-3	ABN ACID	100/200	MEOH	10/21/09
11	1563-3	TPHD	15000	ACETONE	11/20/09
12	1563-1	ABN BASE	200	ACETONE	06/30/09
13	1573-2	LOW PCB	2	ACETONE	10/10/09
14	1547-1	LOW ABN ACID	10/20	MEOH	04/10/09
15*	1452-1	SIM PNA	15/75	MEOH	04/09/09
16	1502-2	DIOXANE	100	MEOH	02/20/09
17	1516-2	1248 PCB	20	ACETONE	05/07/09
18	1514-4	LOW SIM PNA	1.5/7.5	ACETONE	04/24/09
19	1574-4	AK103	7500	MECL2	12/02/09
20	1572-2	PNA	100	ACETONE	12/26/09
21*	1414-4	SKY/BHT	100	MEOH	04/08/09
22	1570-1	HERB	12.5/12500	MEOH	02/19/09
23	1505-1	LOW ABN BASE	20	MEOH	03/20/09
24	1573-4	LOW ABN	10	ACETONE	08/01/09
25	1481-1	DIPHENYL	100	MEOH	07/20/08
26	1545-2	OP-PEST	25	MEOH	02/14/09
27	1495-1	STEROLS	200	MEOH	12/29/08
28	1494-1	ADD. PEST	4	ACETONE	01/23/09
29	1496-3	DECANES	100	MEOH	02/12/09
30	1497-2	EDB/DBCP	2	ACETONE	02/12/09
31	1510-3	TERPINEOL	100	MEOH	03/21/09

LCS SOLUTIONS

02/07/09

32	1576-2	GUAIACOL	50-200	ACETONE	06/05/09
33	1522-1	RESIN ACID	250	ACETONE	06/11/09
34	1530-2	CONGENERS	1	ACETONE	07/23/09
50	1571-1	FULL RESIN	250	ACETONE	06/10/09
*=REVERIFIED SOLUTION					

SURR SOLUTIONS

02/07/09

LABEL	SOLN ID	TEST	CONC. UG/ML	SOLVENT	EXP.
A	1559-5	ABN	100/150	MEOH	03/13/09
B	1572-1	SIM PNA	15/75	MEOH	08/28/09
C	1559-1	SIM ABN	25/37.5	MEOH	03/13/09
D	1573-3	LOW PCB	0.2	ACETONE	07/31/09
E*	1478-1	HERB	62.5	MEOH	09/21/09
F	1574-3	PCP	12.5	ACETONE	01/06/10
G	1534-1	1,4DIOXANE	100	MEOH	02/20/09
H	1545-1	OP-PEST	25	MEOH	02/14/09
I	1559-4	LOW S. PNA	1.5	MEOH	08/28/09
J	1566-5	TBT-PORE	0.125	MECL2	12/04/09
K	1538-1	MED PCB	20	ACETONE	07/31/09
L	1566-4	TBT	2.5	MECL2	12/04/09
M	1578-1	EPH	1500	MECL2	12/09/09
N	1538-2	PCB	2	ACETONE	07/31/09
O	1567-4	TPH	450	MECL2	09/24/09
P	1560-3	HCID	2250	MECL2	09/24/09
Q	1497-3	EDB	2	ACETONE	02/12/09
R	1521-4	RESIN ACID	250	ACETONE	06/11/09
S	1568-5	PBDE	.25	MEOH	12/11/09
T	*reverified	solution			
U					
V					
W					
X					
Y					
Z					

Data Summary Package

prepared
for

SCIENCE APPLICATIONS, INTL.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OL50

prepared
by

Analytical Resources, Inc.

SEMIVOLATILE ORGANICS

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270 GC/MS
Page 1 of 2

Sample ID: ID-108-12-18-SD
SAMPLE

Lab Sample ID: OL50A
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 18:40
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.5 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 15.6%

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	Naphthalene	20	< 20 U
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	2-Methylnaphthalene	20	< 20 U
131-11-3	Dimethylphthalate	20	< 20 U
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	Acenaphthene	20	< 20 U
132-64-9	Dibenzofuran	20	< 20 U
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	Fluorene	20	< 20 U
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	98	< 98 U
85-01-8	**Phenanthrene**	**20**	**12 J**
120-12-7	Anthracene	20	< 20 U
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**11 J**
129-00-0	**Pyrene**	**20**	**10 J**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	Benzo(a)anthracene	20	< 20 U
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20**	**13 J**
218-01-9	Chrysene	20	< 20 U
117-84-0	Di-n-Octyl phthalate	20	< 20 U

FORM I

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270 GC/MS
Page 2 of 2

Sample ID: ID-108-12-18-SD
SAMPLE

Lab Sample ID: OL50A
LIMS ID: 09-3731
Matrix: Sediment
Date Analyzed: 02/16/09 18:40

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA

CAS Number	Analyte	RL	Result
205-99-2	Benzo(b)fluoranthene	20	< 20 U
207-08-9	Benzo(k)fluoranthene	20	< 20 U
50-32-8	Benzo(a)pyrene	20	< 20 U
193-39-5	Indeno(1,2,3-cd)pyrene	20	< 20 U
53-70-3	Dibenz(a,h)anthracene	20	< 20 U
191-24-2	Benzo(g,h,i)perylene	20	< 20 U
90-12-0	1-Methylnaphthalene	20	< 20 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	58.4%	2-Fluorobiphenyl	61.6%
d14-p-Terphenyl	75.6%	d4-1,2-Dichlorobenzene	58.0%
d5-Phenol	56.0%	2-Fluorophenol	58.9%
2,4,6-Tribromophenol	82.1%	d4-2-Chlorophenol	62.1%

FORM I

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270 GC/MS
Page 1 of 2

Sample ID: ID-101-8-14-SD
SAMPLE

Lab Sample ID: OL50B
LIMS ID: 09-3732
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 19:13
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.2 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 23.8%

CAS Number	**Analyte**	**RL**	**Result**
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	Naphthalene	20	< 20 U
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	2-Methylnaphthalene	20	< 20 U
131-11-3	Dimethylphthalate	20	< 20 U
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	Acenaphthene	20	< 20 U
132-64-9	Dibenzofuran	20	< 20 U
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	Fluorene	20	< 20 U
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	99	< 99 U
85-01-8	**Phenanthrene**	**20**	**10 J**
120-12-7	Anthracene	20	< 20 U
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**24**
129-00-0	**Pyrene**	**20**	**32**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	**Benzo(a)anthracene**	**20**	**14 J**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20**	**13 J**
218-01-9	**Chrysene**	**20**	**20**
117-84-0	Di-n-Octyl phthalate	20	< 20 U

FORM I

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270 GC/MS
Page 2 of 2

Sample ID: ID-101-8-14-SD
SAMPLE

Lab Sample ID: OL50B
LIMS ID: 09-3732
Matrix: Sediment
Date Analyzed: 02/16/09 19:13

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA

CAS Number	**Analyte**	**RL**	**Result**
205-99-2	**Benzo(b)fluoranthene**	**20**	**14 J**
207-08-9	**Benzo(k)fluoranthene**	**20**	**12 J**
50-32-8	**Benzo(a)pyrene**	**20**	**12 J**
193-39-5	Indeno(1,2,3-cd)pyrene	20	< 20 U
53-70-3	Dibenz(a,h)anthracene	20	< 20 U
191-24-2	Benzo(g,h,i)perylene	20	< 20 U
90-12-0	1-Methylnaphthalene	20	< 20 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	52.4%	2-Fluorobiphenyl	54.0%
d14-p-Terphenyl	67.6%	d4-1,2-Dichlorobenzene	52.8%
d5-Phenol	49.1%	2-Fluorophenol	52.8%
2,4,6-Tribromophenol	74.4%	d4-2-Chlorophenol	54.7%

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Sample ID: ID-102-9-15-SD
SAMPLE

Lab Sample ID: OL50C
LIMS ID: 09-3733
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 19:47
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.4 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 23.3%

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	Naphthalene	20	< 20 U
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	2-Methylnaphthalene	20	< 20 U
131-11-3	Dimethylphthalate	20	< 20 U
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	Acenaphthene	20	< 20 U
132-64-9	Dibenzofuran	20	< 20 U
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	Fluorene	20	< 20 U
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	98	< 98 U
85-01-8	**Phenanthrene**	**20**	**22**
120-12-7	Anthracene	20	< 20 U
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**36**
129-00-0	**Pyrene**	**20**	**49**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	**Benzo(a)anthracene**	**20**	**23**
117-81-7	bis(2-Ethylhexyl)phthalate	20	< 20 U
218-01-9	**Chrysene**	**20**	**47**
117-84-0	Di-n-Octyl phthalate	20	< 20 U

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Sample ID: ID-102-9-15-SD
SAMPLE

Lab Sample ID: OL50C
LIMS ID: 09-3733
Matrix: Sediment
Date Analyzed: 02/16/09 19:47

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA

CAS Number	Analyte	RL	Result
205-99-2	**Benzo(b)fluoranthene**	**20**	**17 J**
207-08-9	**Benzo(k)fluoranthene**	**20**	**21**
50-32-8	**Benzo(a)pyrene**	**20**	**13 J**
193-39-5	Indeno(1,2,3-cd)pyrene	20	< 20 U
53-70-3	Dibenz(a,h)anthracene	20	< 20 U
191-24-2	Benzo(g,h,i)perylene	20	< 20 U
90-12-0	1-Methylnaphthalene	20	< 20 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	56.8%	2-Fluorobiphenyl	63.2%
d14-p-Terphenyl	70.8%	d4-1,2-Dichlorobenzene	59.2%
d5-Phenol	54.7%	2-Fluorophenol	55.5%
2,4,6-Tribromophenol	69.6%	d4-2-Chlorophenol	59.7%

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Sample ID: ID-100-15-21-SD
SAMPLE

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 20:20
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.6 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 18.5%

CAS Number	**Analyte**	**RL**	**Result**
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	Naphthalene	20	< 20 U
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	2-Methylnaphthalene	20	< 20 U
131-11-3	Dimethylphthalate	20	< 20 U
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	Acenaphthene	20	< 20 U
132-64-9	Dibenzofuran	20	< 20 U
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	Fluorene	20	< 20 U
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	98	< 98 U
85-01-8	Phenanthrene	20	< 20 U
120-12-7	Anthracene	20	< 20 U
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**19 J**
129-00-0	**Pyrene**	**20**	**19 J**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	Benzo(a)anthracene	20	< 20 U
117-81-7	bis(2-Ethylhexyl)phthalate	20	< 20 U
218-01-9	**Chrysene**	**20**	**11 J**
117-84-0	Di-n-Octyl phthalate	20	< 20 U

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Sample ID: ID-100-15-21-SD
SAMPLE

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Date Analyzed: 02/16/09 20:20

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA

CAS Number	Analyte	RL	Result
205-99-2	Benzo(b)fluoranthene	20	< 20 U
207-08-9	Benzo(k)fluoranthene	20	< 20 U
50-32-8	Benzo(a)pyrene	20	< 20 U
193-39-5	Indeno(1,2,3-cd)pyrene	20	< 20 U
53-70-3	Dibenz(a,h)anthracene	20	< 20 U
191-24-2	Benzo(g,h,i)perylene	20	< 20 U
90-12-0	1-Methylnaphthalene	20	< 20 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	53.2%	2-Fluorobiphenyl	55.6%
d14-p-Terphenyl	71.6%	d4-1,2-Dichlorobenzene	52.8%
d5-Phenol	48.8%	2-Fluorophenol	53.1%
2,4,6-Tribromophenol	79.7%	d4-2-Chlorophenol	56.0%

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Sample ID: ID-000-MIX
SAMPLE

Lab Sample ID: OL50E
LIMS ID: 09-3735
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 21:59
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.6 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 25.4%

CAS Number	**Analyte**	**RL**	**Result**
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	Naphthalene	20	< 20 U
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	2-Methylnaphthalene	20	< 20 U
131-11-3	Dimethylphthalate	20	< 20 U
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	Acenaphthene	20	< 20 U
132-64-9	Dibenzofuran	20	< 20 U
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	Fluorene	20	< 20 U
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	98	< 98 U
85-01-8	Phenanthrene	20	< 20 U
120-12-7	Anthracene	20	< 20 U
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	Fluoranthene	20	< 20 U
129-00-0	**Pyrene**	**20**	**29**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	Benzo(a)anthracene	20	< 20 U
117-81-7	bis(2-Ethylhexyl)phthalate	20	< 20 U
218-01-9	**Chrysene**	**20**	**21**
117-84-0	Di-n-Octyl phthalate	20	< 20 U

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Sample ID: ID-000-MIX
SAMPLE

Lab Sample ID: OL50E
LIMS ID: 09-3735
Matrix: Sediment
Date Analyzed: 02/16/09 21:59

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA

CAS Number	Analyte	RL	Result
205-99-2	Benzo(b)fluoranthene	20	< 20 U
207-08-9	Benzo(k)fluoranthene	20	< 20 U
50-32-8	Benzo(a)pyrene	20	< 20 U
193-39-5	Indeno(1,2,3-cd)pyrene	20	< 20 U
53-70-3	Dibenz(a,h)anthracene	20	< 20 U
191-24-2	Benzo(g,h,i)perylene	20	< 20 U
90-12-0	1-Methylnaphthalene	20	< 20 U

Reported in μg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	52.4%	2-Fluorobiphenyl	58.0%
d14-p-Terphenyl	67.6%	d4-1,2-Dichlorobenzene	54.0%
d5-Phenol	48.8%	2-Fluorophenol	51.5%
2,4,6-Tribromophenol	71.7%	d4-2-Chlorophenol	54.7%

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SW8270 SEMIVOLATILES SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Client ID	NBZ	FBP	TPH	DCB	PHL	2FP	TBP	2CP	TOT OUT
ID-108-12-18-SD	58.4%	61.6%	75.6%	58.0%	56.0%	58.9%	82.1%	62.1%	0
ID-101-8-14-SD	52.4%	54.0%	67.6%	52.8%	49.1%	52.8%	74.4%	54.7%	0
ID-102-9-15-SD	56.8%	63.2%	70.8%	59.2%	54.7%	55.5%	69.6%	59.7%	0
MB-021009	63.2%	62.8%	82.4%	66.8%	62.7%	60.8%	72.0%	65.9%	0
LCS-021009	64.0%	65.6%	80.4%	67.2%	64.3%	63.5%	87.2%	65.1%	0
ID-100-15-21-SD	53.2%	55.6%	71.6%	52.8%	48.8%	53.1%	79.7%	56.0%	0
ID-100-15-21-SD MS	50.4%	52.0%	69.6%	52.8%	55.2%	52.8%	74.7%	55.7%	0
ID-100-15-21-SD MSD	54.8%	58.0%	77.6%	56.8%	60.3%	58.4%	87.2%	60.5%	0
ID-000-MIX	52.4%	58.0%	67.6%	54.0%	48.8%	51.5%	71.7%	54.7%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(37-85)	(29-87)
(FBP) = 2-Fluorobiphenyl	(39-82)	(32-88)
(TPH) = d14-p-Terphenyl	(38-105)	(21-97)
(DCB) = d4-1,2-Dichlorobenzene	(33-79)	(25-82)
(PHL) = d5-Phenol	(40-85)	(29-85)
(2FP) = 2-Fluorophenol	(20-93)	(10-114)
(TBP) = 2,4,6-Tribromophenol	(40-96)	(25-103)
(2CP) = d4-2-Chlorophenol	(41-81)	(30-84)

Prep Method: SW3550B
Log Number Range: 09-3731 to 09-3735

FORM-II SW8270

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Sample ID: ID-100-15-21-SD
MS/MSD

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized: VTD
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted MS/MSD: 02/10/09

Date Analyzed MS: 02/16/09 20:53
MSD: 02/16/09 21:26
Instrument/Analyst MS: NT6/LJR
MSD: NT6/LJR
GPC Cleanup: YES

Sample Amount MS: 25.4 g-dry-wt
MSD: 25.4 g-dry-wt
Final Extract Volume MS: 0.5 mL
MSD: 0.5 mL
Dilution Factor MS: 1.00
MSD: 1.00
Percent Moisture: 18.5 %

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Phenol	< 19.6	263	492	53.5%	286	493	58.0%	8.4%
1,3-Dichlorobenzene	< 19.6	250	492	50.8%	273	493	55.4%	8.8%
1,4-Dichlorobenzene	< 19.6	253	492	51.4%	273	493	55.4%	7.6%
Benzyl Alcohol	< 19.6	66.3	984	6.7%	44.0	986	4.5%	40.4%
1,2-Dichlorobenzene	< 19.6	251	492	51.0%	272	493	55.2%	8.0%
2-Methylphenol	< 19.6	253	492	51.4%	261	493	52.9%	3.1%
4-Methylphenol	< 19.6	515	984	52.3%	560	986	56.8%	8.4%
2,4-Dimethylphenol	< 19.6	174	492	35.4%	197	493	40.0%	12.4%
Benzoic Acid	< 196	1090	1480	73.6%	1190	1480	80.4%	8.8%
1,2,4-Trichlorobenzene	< 19.6	272	492	55.3%	302	493	61.3%	10.5%
Naphthalene	< 19.6	272	492	55.3%	303	493	61.5%	10.8%
Hexachlorobutadiene	< 19.6	284	492	57.7%	326	493	66.1%	13.8%
2-Methylnaphthalene	< 19.6	303	492	61.6%	340	493	69.0%	11.5%
Dimethylphthalate	< 19.6	280	492	56.9%	315	493	63.9%	11.8%
Acenaphthylene	< 19.6	265	492	53.9%	295	493	59.8%	10.7%
Acenaphthene	< 19.6	271	492	55.1%	304	493	61.7%	11.5%
Dibenzofuran	< 19.6	293	492	59.6%	331	493	67.1%	12.2%
Diethylphthalate	< 19.6	313	492	63.6%	359	493	72.8%	13.7%
Fluorene	< 19.6	320	492	65.0%	363	493	73.6%	12.6%
N-Nitrosodiphenylamine	< 19.6	289	492	58.7%	321	493	65.1%	10.5%
Hexachlorobenzene	< 19.6	308	492	62.6%	350	493	71.0%	12.8%
Pentachlorophenol	< 97.8	359	492	73.0%	426	493	86.4%	17.1%
Phenanthrene	< 19.6	319	492	64.8%	361	493	73.2%	12.4%
Anthracene	< 19.6	286	492	58.1%	326	493	66.1%	13.1%
Di-n-Butylphthalate	< 19.6	329	492	66.9%	376	493	76.3%	13.3%
Fluoranthene	18.6	353	492	68.0%	397	493	76.8%	11.7%
Pyrene	18.6	350	492	67.4%	390	493	75.3%	10.8%
Butylbenzylphthalate	< 19.6	347	492	70.5%	391	493	79.3%	11.9%
Benzo(a)anthracene	< 19.6	316	492	64.2%	363	493	73.6%	13.8%
bis(2-Ethylhexyl)phthalate	< 19.6	383	492	77.8%	428	493	86.8%	11.1%
Chrysene	11.1	310	492	60.8%	347	493	68.1%	11.3%
Di-n-Octyl phthalate	< 19.6	318	492	64.6%	357	493	72.4%	11.6%
Benzo(b)fluoranthene	< 19.6	379	492	77.0%	412	493	83.6%	8.3%
Benzo(k)fluoranthene	< 19.6	411	492	83.5%	502	493	102%	19.9%
Benzo(a)pyrene	< 19.6	272	492	55.3%	306	493	62.1%	11.8%
Indeno(1,2,3-cd)pyrene	< 19.6	257	492	52.2%	287	493	58.2%	11.0%
Dibenz(a,h)anthracene	< 19.6	241	492	49.0%	273	493	55.4%	12.5%
Benzo(g,h,i)perylene	< 19.6	210	492	42.7%	240	493	48.7%	13.3%

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Sample ID: ID-100-15-21-SD
MS/MSD

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Date Analyzed MS: 02/16/09 20:53
MSD: 02/16/09 21:26

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
1-Methylnaphthalene	< 19.6	310	492	63.0%	353	493	71.6%	13.0%

Results reported in µg/kg
RPD calculated using sample concentrations per SW846.

FORM III

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Sample ID: ID-100-15-21-SD
MATRIX SPIKE

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 20:53
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.4 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 18.5%

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	---
541-73-1	1,3-Dichlorobenzene	20	---
106-46-7	1,4-Dichlorobenzene	20	---
100-51-6	Benzyl Alcohol	20	---
95-50-1	1,2-Dichlorobenzene	20	---
95-48-7	2-Methylphenol	20	---
106-44-5	4-Methylphenol	20	---
105-67-9	2,4-Dimethylphenol	20	---
65-85-0	Benzoic Acid	200	---
120-82-1	1,2,4-Trichlorobenzene	20	---
91-20-3	Naphthalene	20	---
87-68-3	Hexachlorobutadiene	20	---
91-57-6	2-Methylnaphthalene	20	---
131-11-3	Dimethylphthalate	20	---
208-96-8	Acenaphthylene	20	---
83-32-9	Acenaphthene	20	---
132-64-9	Dibenzofuran	20	---
84-66-2	Diethylphthalate	20	---
86-73-7	Fluorene	20	---
86-30-6	N-Nitrosodiphenylamine	20	---
118-74-1	Hexachlorobenzene	20	---
87-86-5	Pentachlorophenol	98	---
85-01-8	Phenanthrene	20	---
120-12-7	Anthracene	20	---
84-74-2	Di-n-Butylphthalate	20	---
206-44-0	Fluoranthene	20	---
129-00-0	Pyrene	20	---
85-68-7	Butylbenzylphthalate	20	---
56-55-3	Benzo(a)anthracene	20	---
117-81-7	bis(2-Ethylhexyl)phthalate	20	---
218-01-9	Chrysene	20	---
117-84-0	Di-n-Octyl phthalate	20	---

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PSDDA Semivolatiles by SW8270 GC/MS
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Sample ID: ID-100-15-21-SD
MATRIX SPIKE

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Date Analyzed: 02/16/09 20:53

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA

CAS Number	Analyte	RL	Result
205-99-2	Benzo(b)fluoranthene	20	---
207-08-9	Benzo(k)fluoranthene	20	---
50-32-8	Benzo(a)pyrene	20	---
193-39-5	Indeno(1,2,3-cd)pyrene	20	---
53-70-3	Dibenz(a,h)anthracene	20	---
191-24-2	Benzo(g,h,i)perylene	20	---
90-12-0	1-Methylnaphthalene	20	---

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	50.4%	2-Fluorobiphenyl	52.0%
d14-p-Terphenyl	69.6%	d4-1,2-Dichlorobenzene	52.8%
d5-Phenol	55.2%	2-Fluorophenol	52.8%
2,4,6-Tribromophenol	74.7%	d4-2-Chlorophenol	55.7%

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Sample ID: ID-100-15-21-SD
MATRIX SPIKE DUPLICATE

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 21:26
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.4 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 18.5%

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	---
541-73-1	1,3-Dichlorobenzene	20	---
106-46-7	1,4-Dichlorobenzene	20	---
100-51-6	Benzyl Alcohol	20	---
95-50-1	1,2-Dichlorobenzene	20	---
95-48-7	2-Methylphenol	20	---
106-44-5	4-Methylphenol	20	---
105-67-9	2,4-Dimethylphenol	20	---
65-85-0	Benzoic Acid	200	---
120-82-1	1,2,4-Trichlorobenzene	20	---
91-20-3	Naphthalene	20	---
87-68-3	Hexachlorobutadiene	20	---
91-57-6	2-Methylnaphthalene	20	---
131-11-3	Dimethylphthalate	20	---
208-96-8	Acenaphthylene	20	---
83-32-9	Acenaphthene	20	---
132-64-9	Dibenzofuran	20	---
84-66-2	Diethylphthalate	20	---
86-73-7	Fluorene	20	---
86-30-6	N-Nitrosodiphenylamine	20	---
118-74-1	Hexachlorobenzene	20	---
87-86-5	Pentachlorophenol	99	---
85-01-8	Phenanthrene	20	---
120-12-7	Anthracene	20	---
84-74-2	Di-n-Butylphthalate	20	---
206-44-0	Fluoranthene	20	---
129-00-0	Pyrene	20	---
85-68-7	Butylbenzylphthalate	20	---
56-55-3	Benzo(a)anthracene	20	---
117-81-7	bis(2-Ethylhexyl)phthalate	20	---
218-01-9	Chrysene	20	---
117-84-0	Di-n-Octyl phthalate	20	---

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Sample ID: ID-100-15-21-SD
MATRIX SPIKE DUPLICATE

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Date Analyzed: 02/16/09 21:26

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA

CAS Number	Analyte	RL	Result
205-99-2	Benzo(b)fluoranthene	20	---
207-08-9	Benzo(k)fluoranthene	20	---
50-32-8	Benzo(a)pyrene	20	---
193-39-5	Indeno(1,2,3-cd)pyrene	20	---
53-70-3	Dibenz(a,h)anthracene	20	---
191-24-2	Benzo(g,h,i)perylene	20	---
90-12-0	1-Methylnaphthalene	20	---

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	54.8%	2-Fluorobiphenyl	58.0%
d14-p-Terphenyl	77.6%	d4-1,2-Dichlorobenzene	56.8%
d5-Phenol	60.3%	2-Fluorophenol	58.4%
2,4,6-Tribromophenol	87.2%	d4-2-Chlorophenol	60.5%

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Sample ID: LCS-021009
LAB CONTROL

Lab Sample ID: LCS-021009
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 13:42
Instrument/Analyst: NT6/LJR
GPC Cleanup: YES

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

Analyte	Lab Control	Spike Added	Recovery
Phenol	323	500	64.6%
1,3-Dichlorobenzene	314	500	62.8%
1,4-Dichlorobenzene	313	500	62.6%
Benzyl Alcohol	515	1000	51.5%
1,2-Dichlorobenzene	314	500	62.8%
2-Methylphenol	305	500	61.0%
4-Methylphenol	651	1000	65.1%
2,4-Dimethylphenol	244	500	48.8%
Benzoic Acid	1270	1500	84.7%
1,2,4-Trichlorobenzene	333	500	66.6%
Naphthalene	338	500	67.6%
Hexachlorobutadiene	353	500	70.6%
2-Methylnaphthalene	337	500	67.4%
Dimethylphthalate	346	500	69.2%
Acenaphthylene	326	500	65.2%
Acenaphthene	322	500	64.4%
Dibenzofuran	346	500	69.2%
Diethylphthalate	383	500	76.6%
Fluorene	379	500	75.8%
N-Nitrosodiphenylamine	356	500	71.2%
Hexachlorobenzene	382	500	76.4%
Pentachlorophenol	463	500	92.6%
Phenanthrene	387	500	77.4%
Anthracene	368	500	73.6%
Di-n-Butylphthalate	433	500	86.6%
Fluoranthene	447	500	89.4%
Pyrene	393	500	78.6%
Butylbenzylphthalate	413	500	82.6%
Benzo(a)anthracene	394	500	78.8%
bis(2-Ethylhexyl)phthalate	450	500	90.0%

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Sample ID: LCS-021009
LAB CONTROL

Lab Sample ID: LCS-021009
LIMS ID: 09-3734
Matrix: Sediment
Date Analyzed: 02/16/09 13:42

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Chrysene	357	500	71.4%
Di-n-Octyl phthalate	391	500	78.2%
Benzo(b)fluoranthene	455	500	91.0%
Benzo(k)fluoranthene	450	500	90.0%
Benzo(a)pyrene	346	500	69.2%
Indeno(1,2,3-cd)pyrene	473	500	94.6%
Dibenz(a,h)anthracene	439	500	87.8%
Benzo(g,h,i)perylene	451	500	90.2%
1-Methylnaphthalene	363	500	72.6%

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	64.0%
2-Fluorobiphenyl	65.6%
d14-p-Terphenyl	80.4%
d4-1,2-Dichlorobenzene	67.2%
d5-Phenol	64.3%
2-Fluorophenol	63.5%
2,4,6-Tribromophenol	87.2%
d4-2-Chlorophenol	65.1%

Results reported in µg/kg

4B
SEMIVOLATILE METHOD BLANK SUMMARY

BLANK NO.

OL50MBS1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SAIC

ARI Job No: OL50

Project: IRONDALE SEDIMENT QU

Lab File ID: OL50MB

Date Extracted: 02/10/09

Instrument ID: NT6

Date Analyzed: 02/16/09

Matrix: SOLID

Time Analyzed: 1309

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	OL50LCSS1	OL50LCSS1	OL50SB	02/16/09
02	ID-108-12-18-SD	OL50A	OL50A	02/16/09
03	ID-101-8-14-SD	OL50B	OL50B	02/16/09
04	ID-102-9-15-SD	OL50C	OL50C	02/16/09
05	ID-100-15-21-SD	OL50D	OL50D	02/16/09
06	ID-100-15-21-SD	OL50DMS	OL50DMS	02/16/09
07	ID-100-15-21-SD	OLD50DMSD	OL50DMSD	02/16/09
08	ID-000-MIX	OL50E	OL50E	02/16/09
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COMMENTS:

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Sample ID: MB-021009
METHOD BLANK

Lab Sample ID: MB-021009
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA
Date Sampled: NA
Date Received: NA

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 13:09
Instrument/Analyst: NT6/LJR
GPC Cleanup: Yes

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	Naphthalene	20	< 20 U
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	2-Methylnaphthalene	20	< 20 U
131-11-3	Dimethylphthalate	20	< 20 U
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	Acenaphthene	20	< 20 U
132-64-9	Dibenzofuran	20	< 20 U
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	Fluorene	20	< 20 U
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	100	< 100 U
85-01-8	Phenanthrene	20	< 20 U
120-12-7	Anthracene	20	< 20 U
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	Fluoranthene	20	< 20 U
129-00-0	Pyrene	20	< 20 U
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	Benzo(a)anthracene	20	< 20 U
117-81-7	bis(2-Ethylhexyl)phthalate	20	< 20 U
218-01-9	Chrysene	20	< 20 U
117-84-0	Di-n-Octyl phthalate	20	< 20 U

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PSDDA Semivolatiles by SW8270 GC/MS
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Sample ID: MB-021009
METHOD BLANK

Lab Sample ID: MB-021009
LIMS ID: 09-3734
Matrix: Sediment
Date Analyzed: 02/16/09 13:09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
NA

CAS Number	**Analyte**	**RL**	**Result**
205-99-2	Benzo(b)fluoranthene	20	< 20 U
207-08-9	Benzo(k)fluoranthene	20	< 20 U
50-32-8	Benzo(a)pyrene	20	< 20 U
193-39-5	Indeno(1,2,3-cd)pyrene	20	< 20 U
53-70-3	Dibenz(a,h)anthracene	20	< 20 U
191-24-2	Benzo(g,h,i)perylene	20	< 20 U
90-12-0	1-Methylnaphthalene	20	< 20 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	63.2%	2-Fluorobiphenyl	62.8%
d14-p-Terphenyl	82.4%	d4-1,2-Dichlorobenzene	66.8%
d5-Phenol	62.7%	2-Fluorophenol	60.8%
2,4,6-Tribromophenol	72.0%	d4-2-Chlorophenol	65.9%

SIM SEMIVOLATILES

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Sample ID: ID-108-12-18-SD
SAMPLE

Lab Sample ID: OL50A
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 14:06
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.1 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 15.6%

CAS Number	Analyte	RL	Result
53-70-3	Dibenz(a,h)anthracene	6.2	< 6.2 U
106-46-7	1,4-Dichlorobenzene	6.2	< 6.2 U
120-82-1	1,2,4-Trichlorobenzene	6.2	< 6.2 U
118-74-1	Hexachlorobenzene	6.2	< 6.2 U
87-68-3	Hexachlorobutadiene	6.2	< 6.2 U
85-68-7	Butylbenzylphthalate	16	< 16 U
95-48-7	2-Methylphenol	6.2	< 6.2 U
105-67-9	2,4-Dimethylphenol	6.2	< 6.2 U
86-30-6	N-Nitrosodiphenylamine	6.2	< 6.2 U
100-51-6	Benzyl Alcohol	31	< 31 U
87-86-5	Pentachlorophenol	31	< 31 U
95-50-1	1,2-Dichlorobenzene	6.2	< 6.2 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	82.4%	d5-Phenol	77.6%
2-Fluorophenol	78.9%	d4-2-Chlorophenol	76.5%
d4-1,2-Dichlorobenzene	74.0%	d5-Nitrobenzene	97.2%
2,4,6-Tribromophenol	100%	d14-p-Terphenyl	90.8%

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Sample ID: ID-101-8-14-SD
SAMPLE

Lab Sample ID: OL50B
LIMS ID: 09-3732
Matrix: Sediment
Data Release Authorized
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 15:37
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.2 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 23.8%

CAS Number	Analyte	RL	Result
53-70-3	Dibenz(a,h)anthracene	6.2	< 6.2 U
106-46-7	1,4-Dichlorobenzene	6.2	< 6.2 U
120-82-1	1,2,4-Trichlorobenzene	6.2	< 6.2 U
118-74-1	Hexachlorobenzene	6.2	< 6.2 U
87-68-3	Hexachlorobutadiene	6.2	< 6.2 U
85-68-7	Butylbenzylphthalate	15	< 15 U
95-48-7	2-Methylphenol	6.2	< 6.2 U
105-67-9	2,4-Dimethylphenol	6.2	< 6.2 U
86-30-6	N-Nitrosodiphenylamine	6.2	< 6.2 U
100-51-6	Benzyl Alcohol	31	< 31 U
87-86-5	Pentachlorophenol	31	< 31 U
95-50-1	1,2-Dichlorobenzene	6.2	< 6.2 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	81.6%	d5-Phenol	70.9%
2-Fluorophenol	72.0%	d4-2-Chlorophenol	66.7%
d4-1,2-Dichlorobenzene	64.8%	d5-Nitrobenzene	69.6%
2,4,6-Tribromophenol	108%	d14-p-Terphenyl	78.8%

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Sample ID: ID-102-9-15-SD
SAMPLE

Lab Sample ID: OL50C
LIMS ID: 09-3733
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 16:08
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.1 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 23.3%

CAS Number	Analyte	RL	Result
53-70-3	Dibenz(a,h)anthracene	6.2	< 6.2 U
106-46-7	1,4-Dichlorobenzene	6.2	< 6.2 U
120-82-1	1,2,4-Trichlorobenzene	6.2	< 6.2 U
118-74-1	Hexachlorobenzene	6.2	< 6.2 U
87-68-3	Hexachlorobutadiene	6.2	< 6.2 U
85-68-7	Butylbenzylphthalate	16	< 16 U
95-48-7	2-Methylphenol	6.2	< 6.2 U
105-67-9	**2,4-Dimethylphenol**	**6.2**	**6.8**
86-30-6	N-Nitrosodiphenylamine	6.2	< 6.2 U
100-51-6	Benzyl Alcohol	31	< 31 U
87-86-5	Pentachlorophenol	31	< 31 U
95-50-1	1,2-Dichlorobenzene	6.2	< 6.2 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	83.6%	d5-Phenol	75.5%
2-Fluorophenol	77.1%	d4-2-Chlorophenol	76.3%
d4-1,2-Dichlorobenzene	68.8%	d5-Nitrobenzene	72.4%
2,4,6-Tribromophenol	110%	d14-p-Terphenyl	81.2%

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Semivolatiles by Selected Ion Monitoring GC/MS
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Sample ID: ID-100-15-21-SD
SAMPLE

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 16:39
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.5 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 18.5%

CAS Number	Analyte	RL	Result
53-70-3	Dibenz(a,h)anthracene	6.1	< 6.1 U
106-46-7	1,4-Dichlorobenzene	6.1	< 6.1 U
120-82-1	1,2,4-Trichlorobenzene	6.1	< 6.1 U
118-74-1	Hexachlorobenzene	6.1	< 6.1 U
87-68-3	Hexachlorobutadiene	6.1	< 6.1 U
85-68-7	Butylbenzylphthalate	15	< 15 U
95-48-7	2-Methylphenol	6.1	< 6.1 U
105-67-9	2,4-Dimethylphenol	6.1	< 6.1 U
86-30-6	N-Nitrosodiphenylamine	6.1	< 6.1 U
100-51-6	Benzyl Alcohol	30	< 30 U
87-86-5	Pentachlorophenol	30	< 30 U
95-50-1	1,2-Dichlorobenzene	6.1	< 6.1 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	76.4%	d5-Phenol	67.5%
2-Fluorophenol	72.5%	d4-2-Chlorophenol	66.1%
d4-1,2-Dichlorobenzene	64.0%	d5-Nitrobenzene	83.6%
2,4,6-Tribromophenol	92.3%	d14-p-Terphenyl	97.6%

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Sample ID: ID-000-MIX
SAMPLE

Lab Sample ID: OL50E
LIMS ID: 09-3735
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: 01/29/09
Date Received: 01/30/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 17:10
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.5 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 25.4%

CAS Number	**Analyte**	**RL**	**Result**
53-70-3	Dibenz(a,h)anthracene	6.1	< 6.1 U
106-46-7	1,4-Dichlorobenzene	6.1	< 6.1 U
120-82-1	1,2,4-Trichlorobenzene	6.1	< 6.1 U
118-74-1	Hexachlorobenzene	6.1	< 6.1 U
87-68-3	Hexachlorobutadiene	6.1	< 6.1 U
85-68-7	Butylbenzylphthalate	15	< 15 U
95-48-7	2-Methylphenol	6.1	< 6.1 U
105-67-9	2,4-Dimethylphenol	6.1	< 6.1 U
86-30-6	N-Nitrosodiphenylamine	6.1	< 6.1 U
100-51-6	Benzyl Alcohol	30	< 30 U
87-86-5	Pentachlorophenol	30	< 30 U
95-50-1	1,2-Dichlorobenzene	6.1	< 6.1 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	83.2%	d5-Phenol	70.4%
2-Fluorophenol	75.2%	d4-2-Chlorophenol	68.3%
d4-1,2-Dichlorobenzene	67.2%	d5-Nitrobenzene	75.6%
2,4,6-Tribromophenol	103%	d14-p-Terphenyl	84.4%

SIM SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Client ID	FBP	PHL	FPH	CPL	DCB	NBZ	TBP	TER	TOT OU
MB-021009	81.2%	85.6%	81.9%	72.8%	89.2%	80.0%	91.5%	92.4%	0
LCS-021009	73.2%	74.7%	79.5%	70.9%	84.0%	73.2%	99.7%	86.0%	0
ID-108-12-18-SD	82.4%	77.6%	78.9%	76.5%	74.0%	97.2%	100%	90.8%	0
ID-108-12-18-SD MS	72.8%	75.5%	70.9%	66.4%	62.0%	64.8%	102%	81.2%	0
ID-108-12-18-SD MSD	77.2%	76.3%	72.0%	67.5%	63.6%	69.2%	92.3%	82.4%	0
ID-101-8-14-SD	81.6%	70.9%	72.0%	66.7%	64.8%	69.6%	108%	78.8%	0
ID-102-9-15-SD	83.6%	75.5%	77.1%	76.3%	68.8%	72.4%	110%	81.2%	0
ID-100-15-21-SD	76.4%	67.5%	72.5%	66.1%	64.0%	83.6%	92.3%	97.6%	0
ID-000-MIX	83.2%	70.4%	75.2%	68.3%	67.2%	75.6%	103%	84.4%	0

	LCS/MB LIMITS	QC LIMITS
(FBP) = 2-Fluorobiphenyl	(30-160)	(30-160)
(PHL) = d5-Phenol	(30-160)	(30-160)
(FPH) = 2-Fluorophenol	(30-160)	(30-160)
(CPL) = d4-2-Chlorophenol	(30-160)	(30-160)
(DCB) = d4-1,2-Dichlorobenzene	(30-160)	(30-160)
(NBZ) = d5-Nitrobenzene	(30-160)	(30-160)
(TBP) = 2,4,6-Tribromophenol	(30-160)	(30-160)
(TER) = d14-p-Terphenyl	(30-160)	(30-160)

Prep Method: SW3550B
Log Number Range: 09-3731 to 09-3735

FORM-II SIM SW8270

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: ID-108-12-18-SD
MATRIX SPIKE

Lab Sample ID: OL50A
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted MS/MSD: 02/10/09

Date Analyzed MS: 02/16/09 14:36
MSD: 02/16/09 15:07
Instrument/Analyst MS: NT2/PK
MSD: NT2/PK

Sample Amount MS: 16.1 g-dry-wt
MSD: 16.1 g-dry-wt
Final Extract Volume MS: 1.0 mL
MSD: 1.0 mL
Dilution Factor MS: 1.00
MSD: 1.00

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Dibenz(a,h)anthracene	< 6.2 U	80.1	155	51.7%	77.6	155	50.1%	3.2%
1,4-Dichlorobenzene	< 6.2 U	102	155	65.8%	109	155	70.3%	6.6%
1,2,4-Trichlorobenzene	< 6.2 U	117	155	75.5%	121	155	78.1%	3.4%
Hexachlorobenzene	< 6.2 U	136	155	87.7%	142	155	91.6%	4.3%
Hexachlorobutadiene	< 6.2 U	121	155	78.1%	125	155	80.6%	3.3%
Butylbenzylphthalate	< 15.5 U	140	155	90.3%	142	155	91.6%	1.4%
2-Methylphenol	< 6.2 U	123	155	79.4%	127	155	81.9%	3.2%
2,4-Dimethylphenol	< 6.2 U	91.3	155	58.9%	91.9	155	59.3%	0.7%
N-Nitrosodiphenylamine	< 6.2 U	125	155	80.6%	137	155	88.4%	9.2%
Benzyl Alcohol	< 31.1 U	278	311	89.4%	282	311	90.7%	1.4%
Pentachlorophenol	< 31.1 U	222	155	143%	231	155	149%	4.0%
1,2-Dichlorobenzene	< 6.2 U	103	155	66.5%	107	155	69.0%	3.8%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: ID-108-12-18-SD
MATRIX SPIKE

Lab Sample ID: OL50A
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 14:36
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.1 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 15.6%

CAS Number	**Analyte**	**RL**	**Result**
53-70-3	Dibenz(a,h)anthracene	6.2	---
106-46-7	1,4-Dichlorobenzene	6.2	---
120-82-1	1,2,4-Trichlorobenzene	6.2	---
118-74-1	Hexachlorobenzene	6.2	---
87-68-3	Hexachlorobutadiene	6.2	---
85-68-7	Butylbenzylphthalate	16	---
95-48-7	2-Methylphenol	6.2	---
105-67-9	2,4-Dimethylphenol	6.2	---
86-30-6	N-Nitrosodiphenylamine	6.2	---
100-51-6	Benzyl Alcohol	31	---
87-86-5	Pentachlorophenol	31	---
95-50-1	1,2-Dichlorobenzene	6.2	---

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	72.8%	d5-Phenol	75.5%
2-Fluorophenol	70.9%	d4-2-Chlorophenol	66.4%
d4-1,2-Dichlorobenzene	62.0%	d5-Nitrobenzene	64.8%
2,4,6-Tribromophenol	102%	d14-p-Terphenyl	81.2%

FORM I

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: ID-108-12-18-SD
MATRIX SPIKE DUPLICATE

Lab Sample ID: OL50A
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 15:07
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.1 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: 15.6%

CAS Number	Analyte	RL	Result
53-70-3	Dibenz(a,h)anthracene	6.2	---
106-46-7	1,4-Dichlorobenzene	6.2	---
120-82-1	1,2,4-Trichlorobenzene	6.2	---
118-74-1	Hexachlorobenzene	6.2	---
87-68-3	Hexachlorobutadiene	6.2	---
85-68-7	Butylbenzylphthalate	16	---
95-48-7	2-Methylphenol	6.2	---
105-67-9	2,4-Dimethylphenol	6.2	---
86-30-6	N-Nitrosodiphenylamine	6.2	---
100-51-6	Benzyl Alcohol	31	---
87-86-5	Pentachlorophenol	31	---
95-50-1	1,2-Dichlorobenzene	6.2	---

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	77.2%	d5-Phenol	76.3%
2-Fluorophenol	72.0%	d4-2-Chlorophenol	67.5%
d4-1,2-Dichlorobenzene	63.6%	d5-Nitrobenzene	69.2%
2,4,6-Tribromophenol	92.3%	d14-p-Terphenyl	82.4%

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: LCS-021009
LAB CONTROL SAMPLE

Lab Sample ID: LCS-021009
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: NA
Date Received: NA

Date Extracted: 02/10/09
Date Analyzed LCS: 02/16/09 12:44
Instrument/Analyst LCS: NT2/PK

Sample Amount LCS: 16.0 g-dry-wt
Final Extract Volume LCS: 1.0 mL
Dilution Factor LCS: 1.00

Analyte	**LCS**	**Spike Added**	**Recovery**
Dibenz(a,h)anthracene	165	156	106%
1,4-Dichlorobenzene	125	156	80.1%
1,2,4-Trichlorobenzene	129	156	82.7%
Hexachlorobenzene	141	156	90.4%
Hexachlorobutadiene	131	156	84.0%
Butylbenzylphthalate	157	156	101%
2-Methylphenol	138	156	88.5%
2,4-Dimethylphenol	91.2	156	58.5%
N-Nitrosodiphenylamine	131	156	84.0%
Benzyl Alcohol	176	312	56.4%
Pentachlorophenol	221	156	142%
1,2-Dichlorobenzene	144	156	92.3%

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery	
2-Fluorobiphenyl	73.2%
d5-Phenol	74.7%
2-Fluorophenol	79.5%
d4-2-Chlorophenol	70.9%
d4-1,2-Dichlorobenzene	84.0%
d5-Nitrobenzene	73.2%
2,4,6-Tribromophenol	99.7%
d14-p-Terphenyl	86.0%

4B
SEMIVOLATILE METHOD BLANK SUMMARY

BLANK NO.

OL50MBS1

Lab Name: ANALYTICAL RESOURCES, INC

Client: SAIC

ARI Job No: OL50

Project: IRONDALE SEDIMENT QU

Lab File ID: 021601

Date Extracted: 02/10/09

Instrument ID: NT2

Date Analyzed: 02/16/09

Matrix: SOLID

Time Analyzed: 1213

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	OL50LCSS1	OL50LCSS1	021602	02/16/09
02	ID-108-12-18-SD	OL50A	021603	02/16/09
03	ID-108-12-18-SD	OL50AMS	021604	02/16/09
04	ID-108-12-18-SD	OL50AMSD	021605	02/16/09
05	ID-101-8-14-SD	OL50B	021606	02/16/09
06	ID-102-9-15-SD	OL50C	021607	02/16/09
07	ID-100-15-21-SD	OL50D	021608	02/16/09
08	ID-000-MIX	OL50E	021609	02/16/09
09				
10				
11				
12				
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COMMENTS:

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FORM IV SV

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by Selected Ion Monitoring GC/MS
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Sample ID: MB-021009
METHOD BLANK

Lab Sample ID: MB-021009
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized:
Reported: 02/18/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST
Event: NA
Date Sampled: NA
Date Received: NA

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 12:13
Instrument/Analyst: NT2/PK
GPC Cleanup: Yes
Silica Gel Cleanup: No
Alumina Cleanup: No

Sample Amount: 16.0 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	Analyte	RL	Result
53-70-3	**Dibenz(a,h)anthracene**	**6.2**	**8.1**
106-46-7	1,4-Dichlorobenzene	6.2	< 6.2 U
120-82-1	1,2,4-Trichlorobenzene	6.2	< 6.2 U
118-74-1	Hexachlorobenzene	6.2	< 6.2 U
87-68-3	Hexachlorobutadiene	6.2	< 6.2 U
85-68-7	Butylbenzylphthalate	16	< 16 U
95-48-7	2-Methylphenol	6.2	< 6.2 U
105-67-9	2,4-Dimethylphenol	6.2	< 6.2 U
86-30-6	N-Nitrosodiphenylamine	6.2	< 6.2 U
100-51-6	Benzyl Alcohol	31	< 31 U
87-86-5	Pentachlorophenol	31	< 31 U
95-50-1	**1,2-Dichlorobenzene**	**6.2**	**6.2**

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

2-Fluorobiphenyl	81.2%	d5-Phenol	85.6%
2-Fluorophenol	81.9%	d4-2-Chlorophenol	72.8%
d4-1,2-Dichlorobenzene	89.2%	d5-Nitrobenzene	80.0%
2,4,6-Tribromophenol	91.5%	d14-p-Terphenyl	92.4%

METALS

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: ID-108-12-18-SD
SAMPLE

Lab Sample ID: OL50A
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

Percent Total Solids: 81.7%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/17/09	6010B	02/20/09	7440-38-2	Arsenic	6	6	U
3050B	02/17/09	6010B	02/20/09	7440-43-9	Cadmium	0.2	0.2	U
3050B	02/17/09	6010B	02/20/09	**7440-47-3**	**Chromium**	0.6	**20.1**	
3050B	02/17/09	6010B	02/20/09	**7440-50-8**	**Copper**	0.2	**19.7**	
3050B	02/17/09	6010B	02/20/09	**7439-92-1**	**Lead**	2	**4**	
CLP	02/17/09	7471A	02/20/09	7439-97-6	Mercury	0.05	0.05	U
3050B	02/17/09	6010B	02/20/09	7440-22-4	Silver	0.3	0.3	U
3050B	02/17/09	6010B	02/20/09	**7440-66-6**	**Zinc**	1	**29**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: ID-108-12-18-SD
DUPLICATE

Lab Sample ID: OL50A
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Arsenic	6010B	6 U	6 U	0.0%	+/- 6	L
Cadmium	6010B	0.2 U	0.2 U	0.0%	+/- 0.2	L
Chromium	6010B	20.1	19.2	4.6%	+/- 20%	
Copper	6010B	19.7	17.8	10.1%	+/- 20%	
Lead	6010B	4	5	22.2%	+/- 2	L
Mercury	7471A	0.05 U	0.05 U	0.0%	+/- 0.05	L
Silver	6010B	0.3 U	0.3 U	0.0%	+/- 0.3	L
Zinc	6010B	29	26	10.9%	+/- 20%	

Reported in mg/kg-dry

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: ID-108-12-18-SD
MATRIX SPIKE

Lab Sample ID: OL50A
LIMS ID: 09-3731
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	**Analysis Method**	**Sample**	**Spike**	**Spike Added**	**% Recovery**	**Q**
Arsenic	6010B	6 U	211	225	93.8%	
Cadmium	6010B	0.2 U	54.2	56.3	96.3%	
Chromium	6010B	20.1	83.3	56.3	112%	
Copper	6010B	19.7	71.9	56.3	92.7%	
Lead	6010B	4	203	225	88.4%	
Mercury	7471A	0.05 U	0.57	0.492	116%	
Silver	6010B	0.3 U	56.4	56.3	100%	
Zinc	6010B	29	83	56.3	95.9%	

Reported in mg/kg-dry

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

FORM-V

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: ID-101-8-14-SD
SAMPLE

Lab Sample ID: OL50B
LIMS ID: 09-3732
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

Percent Total Solids: 77.1%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/17/09	6010B	02/20/09	7440-38-2	Arsenic	20	20	U
3050B	02/17/09	6010B	02/20/09	7440-43-9	Cadmium	0.6	0.6	U
3050B	02/17/09	6010B	02/20/09	**7440-47-3**	**Chromium**	2	**16**	
3050B	02/17/09	6010B	02/20/09	**7440-50-8**	**Copper**	0.6	**112**	
3050B	02/17/09	6010B	02/20/09	**7439-92-1**	**Lead**	6	**17**	
CLP	02/17/09	7471A	02/20/09	**7439-97-6**	**Mercury**	0.06	**0.07**	
3050B	02/17/09	6010B	02/20/09	7440-22-4	Silver	0.9	0.9	U
3050B	02/17/09	6010B	02/20/09	**7440-66-6**	**Zinc**	3	**99**	

U-Analyte undetected at given RL
RL-Reporting Limit

FORM-I

ANALYTICAL
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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: ID-102-9-15-SD
SAMPLE

Lab Sample ID: OL50C
LIMS ID: 09-3733
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

Percent Total Solids: 79.1%

Prep Meth	**Prep Date**	**Analysis Method**	**Analysis Date**	**CAS Number**	**Analyte**	**RL**	**mg/kg-dry**	**Q**
3050B	02/17/09	6010B	02/20/09	7440-38-2	Arsenic	20	20	U
3050B	02/17/09	6010B	02/20/09	7440-43-9	Cadmium	0.6	0.6	U
3050B	02/17/09	6010B	02/20/09	**7440-47-3**	**Chromium**	2	**14**	
3050B	02/17/09	6010B	02/20/09	**7440-50-8**	**Copper**	0.6	**76.7**	
3050B	02/17/09	6010B	02/20/09	**7439-92-1**	**Lead**	6	**10**	
CLP	02/17/09	7471A	02/20/09	**7439-97-6**	**Mercury**	0.05	**0.05**	
3050B	02/17/09	6010B	02/20/09	7440-22-4	Silver	0.9	0.9	U
3050B	02/17/09	6010B	02/20/09	**7440-66-6**	**Zinc**	3	**57**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: ID-100-15-21-SD
SAMPLE

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

Percent Total Solids: 82.0%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/17/09	6010B	02/20/09	7440-38-2	Arsenic	10	10	U
3050B	02/17/09	6010B	02/20/09	7440-43-9	Cadmium	0.6	0.6	U
3050B	02/17/09	6010B	02/20/09	**7440-47-3**	**Chromium**	1	**17**	
3050B	02/17/09	6010B	02/20/09	**7440-50-8**	**Copper**	0.6	**113**	
3050B	02/17/09	6010B	02/20/09	**7439-92-1**	**Lead**	6	**25**	
CLP	02/17/09	7471A	02/20/09	**7439-97-6**	**Mercury**	0.05	**0.06**	
3050B	02/17/09	6010B	02/20/09	7440-22-4	Silver	0.9	0.9	U
3050B	02/17/09	6010B	02/20/09	**7440-66-6**	**Zinc**	3	**144**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: ID-000-MIX
SAMPLE

Lab Sample ID: OL50E
LIMS ID: 09-3735
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/29/09
Date Received: 01/30/09

Percent Total Solids: 77.2%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/17/09	6010B	02/20/09	7440-38-2	Arsenic	6	6	U
3050B	02/17/09	6010B	02/20/09	7440-43-9	Cadmium	0.2	0.2	U
3050B	02/17/09	6010B	02/20/09	**7440-47-3**	**Chromium**	0.6	**18.4**	
3050B	02/17/09	6010B	02/20/09	**7440-50-8**	**Copper**	0.2	**30.4**	
3050B	02/17/09	6010B	02/20/09	**7439-92-1**	**Lead**	2	**8**	
CLP	02/17/09	7471A	02/20/09	7439-97-6	Mercury	0.04	0.04	U
3050B	02/17/09	6010B	02/20/09	7440-22-4	Silver	0.4	0.4	U
3050B	02/17/09	6010B	02/20/09	**7440-66-6**	**Zinc**	1	**124**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: OL50MB
LIMS ID: 09-3732
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: NA
Date Received: NA

Percent Total Solids: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/17/09	6010B	02/20/09	7440-38-2	Arsenic	5	5	U
3050B	02/17/09	6010B	02/20/09	7440-43-9	Cadmium	0.2	0.2	U
3050B	02/17/09	6010B	02/20/09	7440-47-3	Chromium	0.5	0.5	U
3050B	02/17/09	6010B	02/20/09	7440-50-8	Copper	0.2	0.2	U
3050B	02/17/09	6010B	02/20/09	7439-92-1	Lead	2	2	U
CLP	02/17/09	7471A	02/20/09	7439-97-6	Mercury	0.05	0.05	U
3050B	02/17/09	6010B	02/20/09	7440-22-4	Silver	0.3	0.3	U
3050B	02/17/09	6010B	02/20/09	7440-66-6	Zinc	1	1	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: OL50LCS
LIMS ID: 09-3732
Matrix: Sediment
Data Release Authorized:
Reported: 02/23/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	6010B	193	200	96.5%	
Cadmium	6010B	49.5	50.0	99.0%	
Chromium	6010B	48.0	50.0	96.0%	
Copper	6010B	48.1	50.0	96.2%	
Lead	6010B	190	200	95.0%	
Mercury	7471A	1.09	1.00	109%	
Silver	6010B	51.4	50.0	103%	
Zinc	6010B	47	50	94.0%	

Reported in mg/kg-dry

N-Control limit not met
NA-Not Applicable, Analyte Not Spiked
Control Limits: 80-120%

FORM-VII

TOTAL SOLIDS

Extractions Total Solids-extts
Data By: Tae K. You
Created: 2/ 9/09

Worklist: 212
Analyst: RVR
Comments:

	ARI ID CLIENT ID	Tare Wt (g)	Wet Wt (g)	Dry Wt (g)	% Solids	pH
1.	OL50A 09-3731 ID-108-12-18-SD	1.16	12.30	10.56	84.4	NR
2.	OL50B 09-3732 ID-101-8-14-SD	1.16	12.35	9.69	76.2	NR
3.	OL50C 09-3733 ID-102-9-15-SD	1.18	11.27	8.92	76.7	NR
4.	OL50D 09-3734 ID-100-15-21-SD	1.18	11.80	9.84	81.5	NR
5.	OL50E 09-3735 ID-000-MIX	1.18	11.82	9.12	74.6	NR

Solids Data Entry Report   Checked by: KU Date: 2/19/09
Date: 02/18/09   Data Analyst: MH

Solids Determination performed on 02/17/09 by MH

JOB	SAMPLE	CLIENTID	TAREWEIGHT	SAMPDISH	DRYWEIGHT	SOLIDS
OL50	A	ID-108-12-18-SD	0.984	10.705	8.927	81.71
OL50	B	ID-101-8-14-SD	0.969	10.208	8.091	77.09
OL50	C	ID-102-9-15-SD	0.988	10.797	8.749	79.12
OL50	D	ID-100-15-21-SD	0.974	10.249	8.584	82.05
OL50	E	ID-000-MIX	0.977	10.672	8.457	77.15

Laboratory Data Package

prepared
for

SCIENCE APPLICATIONS, INTL.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OL50

prepared
by

Analytical Resources, Inc.

Semivolatile Organics
QC Summary Data

prepared
for

SCIENCE APPLICATIONS, INTL.

Project: Irondale Sediment Quality Investigation

ARI JOB NO: OL50

prepared
by

Analytical Resources, Inc.

SW8270 SEMIVOLATILES SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Client ID	NBZ	FBP	TPH	DCB	PHL	2FP	TBP	2CP	TOT OUT
ID-108-12-18-SD	58.4%	61.6%	75.6%	58.0%	56.0%	58.9%	82.1%	62.1%	0
ID-101-8-14-SD	52.4%	54.0%	67.6%	52.8%	49.1%	52.8%	74.4%	54.7%	0
ID-102-9-15-SD	56.8%	63.2%	70.8%	59.2%	54.7%	55.5%	69.6%	59.7%	0
MB-021009	63.2%	62.8%	82.4%	66.8%	62.7%	60.8%	72.0%	65.9%	0
LCS-021009	64.0%	65.6%	80.4%	67.2%	64.3%	63.5%	87.2%	65.1%	0
ID-100-15-21-SD	53.2%	55.6%	71.6%	52.8%	48.8%	53.1%	79.7%	56.0%	0
ID-100-15-21-SD MS	50.4%	52.0%	69.6%	52.8%	55.2%	52.8%	74.7%	55.7%	0
ID-100-15-21-SD MSD	54.8%	58.0%	77.6%	56.8%	60.3%	58.4%	87.2%	60.5%	0
ID-000-MIX	52.4%	58.0%	67.6%	54.0%	48.8%	51.5%	71.7%	54.7%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(37-85)	(29-87)
(FBP) = 2-Fluorobiphenyl	(39-82)	(32-88)
(TPH) = d14-p-Terphenyl	(38-105)	(21-97)
(DCB) = d4-1,2-Dichlorobenzene	(33-79)	(25-82)
(PHL) = d5-Phenol	(40-85)	(29-85)
(2FP) = 2-Fluorophenol	(20-93)	(10-114)
(TBP) = 2,4,6-Tribromophenol	(40-96)	(25-103)
(2CP) = d4-2-Chlorophenol	(41-81)	(30-84)

Prep Method: SW3550B
Log Number Range: 09-3731 to 09-3735

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270 GC/MS
Page 1 of 2

Sample ID: ID-100-15-21-SD
MS/MSD

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized: VTD
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted MS/MSD: 02/10/09

Date Analyzed MS: 02/16/09 20:53
MSD: 02/16/09 21:26
Instrument/Analyst MS: NT6/LJR
MSD: NT6/LJR
GPC Cleanup: YES

Sample Amount MS: 25.4 g-dry-wt
MSD: 25.4 g-dry-wt
Final Extract Volume MS: 0.5 mL
MSD: 0.5 mL
Dilution Factor MS: 1.00
MSD: 1.00
Percent Moisture: 18.5 %

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Phenol	< 19.6	263	492	53.5%	286	493	58.0%	8.4%
1,3-Dichlorobenzene	< 19.6	250	492	50.8%	273	493	55.4%	8.8%
1,4-Dichlorobenzene	< 19.6	253	492	51.4%	273	493	55.4%	7.6%
Benzyl Alcohol	< 19.6	66.3	984	6.7%	44.0	986	4.5%	40.4%
1,2-Dichlorobenzene	< 19.6	251	492	51.0%	272	493	55.2%	8.0%
2-Methylphenol	< 19.6	253	492	51.4%	261	493	52.9%	3.1%
4-Methylphenol	< 19.6	515	984	52.3%	560	986	56.8%	8.4%
2,4-Dimethylphenol	< 19.6	174	492	35.4%	197	493	40.0%	12.4%
Benzoic Acid	< 196	1090	1480	73.6%	1190	1480	80.4%	8.8%
1,2,4-Trichlorobenzene	< 19.6	272	492	55.3%	302	493	61.3%	10.5%
Naphthalene	< 19.6	272	492	55.3%	303	493	61.5%	10.8%
Hexachlorobutadiene	< 19.6	284	492	57.7%	326	493	66.1%	13.8%
2-Methylnaphthalene	< 19.6	303	492	61.6%	340	493	69.0%	11.5%
Dimethylphthalate	< 19.6	280	492	56.9%	315	493	63.9%	11.8%
Acenaphthylene	< 19.6	265	492	53.9%	295	493	59.8%	10.7%
Acenaphthene	< 19.6	271	492	55.1%	304	493	61.7%	11.5%
Dibenzofuran	< 19.6	293	492	59.6%	331	493	67.1%	12.2%
Diethylphthalate	< 19.6	313	492	63.6%	359	493	72.8%	13.7%
Fluorene	< 19.6	320	492	65.0%	363	493	73.6%	12.6%
N-Nitrosodiphenylamine	< 19.6	289	492	58.7%	321	493	65.1%	10.5%
Hexachlorobenzene	< 19.6	308	492	62.6%	350	493	71.0%	12.8%
Pentachlorophenol	< 97.8	359	492	73.0%	426	493	86.4%	17.1%
Phenanthrene	< 19.6	319	492	64.8%	361	493	73.2%	12.4%
Anthracene	< 19.6	286	492	58.1%	326	493	66.1%	13.1%
Di-n-Butylphthalate	< 19.6	329	492	66.9%	376	493	76.3%	13.3%
Fluoranthene	18.6	353	492	68.0%	397	493	76.8%	11.7%
Pyrene	18.6	350	492	67.4%	390	493	75.3%	10.8%
Butylbenzylphthalate	< 19.6	347	492	70.5%	391	493	79.3%	11.9%
Benzo(a)anthracene	< 19.6	316	492	64.2%	363	493	73.6%	13.8%
bis(2-Ethylhexyl)phthalate	< 19.6	383	492	77.8%	428	493	86.8%	11.1%
Chrysene	11.1	310	492	60.8%	347	493	68.1%	11.3%
Di-n-Octyl phthalate	< 19.6	318	492	64.6%	357	493	72.4%	11.6%
Benzo(b)fluoranthene	< 19.6	379	492	77.0%	412	493	83.6%	8.3%
Benzo(k)fluoranthene	< 19.6	411	492	83.5%	502	493	102%	19.9%
Benzo(a)pyrene	< 19.6	272	492	55.3%	306	493	62.1%	11.8%
Indeno(1,2,3-cd)pyrene	< 19.6	257	492	52.2%	287	493	58.2%	11.0%
Dibenz(a,h)anthracene	< 19.6	241	492	49.0%	273	493	55.4%	12.5%
Benzo(g,h,i)perylene	< 19.6	210	492	42.7%	240	493	48.7%	13.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270 GC/MS
Page 2 of 2

Sample ID: ID-100-15-21-SD
MS/MSD

Lab Sample ID: OL50D
LIMS ID: 09-3734
Matrix: Sediment
Date Analyzed MS: 02/16/09 20:53
MSD: 02/16/09 21:26

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
1-Methylnaphthalene	< 19.6	310	492	63.0%	353	493	71.6%	13.0%

Results reported in µg/kg
RPD calculated using sample concentrations per SW846.

FORM III

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270 GC/MS
Page 1 of 2

Sample ID: LCS-021009
LAB CONTROL

Lab Sample ID: LCS-021009
LIMS ID: 09-3734
Matrix: Sediment
Data Release Authorized: VTS
Reported: 02/17/09

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Date Sampled: 01/08/09
Date Received: 01/10/09

Date Extracted: 02/10/09
Date Analyzed: 02/16/09 13:42
Instrument/Analyst: NT6/LJR
GPC Cleanup: YES

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Phenol	323	500	64.6%
1,3-Dichlorobenzene	314	500	62.8%
1,4-Dichlorobenzene	313	500	62.6%
Benzyl Alcohol	515	1000	51.5%
1,2-Dichlorobenzene	314	500	62.8%
2-Methylphenol	305	500	61.0%
4-Methylphenol	651	1000	65.1%
2,4-Dimethylphenol	244	500	48.8%
Benzoic Acid	1270	1500	84.7%
1,2,4-Trichlorobenzene	333	500	66.6%
Naphthalene	338	500	67.6%
Hexachlorobutadiene	353	500	70.6%
2-Methylnaphthalene	337	500	67.4%
Dimethylphthalate	346	500	69.2%
Acenaphthylene	326	500	65.2%
Acenaphthene	322	500	64.4%
Dibenzofuran	346	500	69.2%
Diethylphthalate	383	500	76.6%
Fluorene	379	500	75.8%
N-Nitrosodiphenylamine	356	500	71.2%
Hexachlorobenzene	382	500	76.4%
Pentachlorophenol	463	500	92.6%
Phenanthrene	387	500	77.4%
Anthracene	368	500	73.6%
Di-n-Butylphthalate	433	500	86.6%
Fluoranthene	447	500	89.4%
Pyrene	393	500	78.6%
Butylbenzylphthalate	413	500	82.6%
Benzo(a)anthracene	394	500	78.8%
bis(2-Ethylhexyl)phthalate	450	500	90.0%

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by SW8270 GC/MS
Page 2 of 2

Sample ID: LCS-021009
LAB CONTROL

Lab Sample ID: LCS-021009
LIMS ID: 09-3734
Matrix: Sediment
Date Analyzed: 02/16/09 13:42

QC Report No: OL50-Science Applications, Intl.
Project: IRONDALE SEDIMENT QUALITY INVST

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Chrysene	357	500	71.4%
Di-n-Octyl phthalate	391	500	78.2%
Benzo(b)fluoranthene	455	500	91.0%
Benzo(k)fluoranthene	450	500	90.0%
Benzo(a)pyrene	346	500	69.2%
Indeno(1,2,3-cd)pyrene	473	500	94.6%
Dibenz(a,h)anthracene	439	500	87.8%
Benzo(g,h,i)perylene	451	500	90.2%
1-Methylnaphthalene	363	500	72.6%

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	64.0%
2-Fluorobiphenyl	65.6%
d14-p-Terphenyl	80.4%
d4-1,2-Dichlorobenzene	67.2%
d5-Phenol	64.3%
2-Fluorophenol	63.5%
2,4,6-Tribromophenol	87.2%
d4-2-Chlorophenol	65.1%

Results reported in µg/kg

4B
SEMIVOLATILE METHOD BLANK SUMMARY

BLANK NO.
OL50MBS1

Lab Name: ANALYTICAL RESOURCES, INC
Client: SAIC
ARI Job No: OL50
Project: IRONDALE SEDIMENT QU
Lab File ID: OL50MB
Date Extracted: 02/10/09
Instrument ID: NT6
Date Analyzed: 02/16/09
Matrix: SOLID
Time Analyzed: 1309

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	OL50LCSS1	OL50LCSS1	OL50SB	02/16/09
02	ID-108-12-18-SD	OL50A	OL50A	02/16/09
03	ID-101-8-14-SD	OL50B	OL50B	02/16/09
04	ID-102-9-15-SD	OL50C	OL50C	02/16/09
05	ID-100-15-21-SD	OL50D	OL50D	02/16/09
06	ID-100-15-21-SD	OL50DMS	OL50DMS	02/16/09
07	ID-100-15-21-SD	OLD50DMSD	OL50DMSD	02/16/09
08	ID-000-MIX	OL50E	OL50E	02/16/09
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COMMENTS:

FORM IV SV

5B

SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: ANALYTICAL RESOURCES, INC Client: SAIC

Instrument ID: NT6 Project: IRONDALE SEDIMENT QU

DFTPP Injection Date: 01/29/09 DFTPP Injection Time: 1017

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	30.0 - 80.0% of mass 198	56.2	
68	Less than 2.0% of mass 69	0.6	(1.1)1
69	Mass 69 relative abundance	54.8	
70	Less than 2.0% of mass 69	0.0	(0.0)1
127	25.0 - 75.0% of mass 198	54.7	
197	Less than 1.0% of mass 198	0.0	
198	Base Peak, 100% relative abundance	100.0	
199	5.0 to 9.0% of mass 198	6.4	
275	10.0 - 30.0% of mass 198	22.3	
365	Greater than 0.75% of mass 198	2.71	
441	Present, but less than mass 443	11.1	
442	40.0 - 110.0% of mass 198	75.5	
443	15.0 - 24.0% of mass 442	14.8	(19.6)2

1-Value is % mass 69 2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	ABN 25	ABN 25	0250129	01/29/09	1017
02	ABN 80	ABN 80	0800129	01/29/09	1051
03	ABN 1	ABN 1	0010129	01/29/09	1126
04	ABN 40	ABN 40	0400129	01/29/09	1201
05	ABN 5	ABN 5	0050129	01/29/09	1235
06	ABN 10	ABN 10	0100129	01/29/09	1310
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page 1 of 1

FORM V SV

5B

SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: ANALYTICAL RESOURCES, INC   Client: SAIC

Instrument ID: NT6   Project: IRONDALE SEDIMENT QU

DFTPP Injection Date: 02/16/09   DFTPP Injection Time: 1056

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	30.0 - 80.0% of mass 198	57.2	
68	Less than 2.0% of mass 69	0.7	(1.3)1
69	Mass 69 relative abundance	55.5	
70	Less than 2.0% of mass 69	0.0	(0.0)1
127	25.0 - 75.0% of mass 198	56.4	
197	Less than 1.0% of mass 198	0.0	
198	Base Peak, 100% relative abundance	100.0	
199	5.0 to 9.0% of mass 198	6.6	
275	10.0 - 30.0% of mass 198	21.8	
365	Greater than 0.75% of mass 198	2.33	
441	Present, but less than mass 443	10.9	
442	40.0 - 110.0% of mass 198	78.1	
443	15.0 - 24.0% of mass 442	15.3	(19.6)2

1-Value is % mass 69   2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	ABN CCAL	ABN 25	CC0216	02/16/09	1056
02	OL50MBS1	OL50MBS1	OL50MB	02/16/09	1309
03	OL50LCSS1	OL50LCSS1	OL50SB	02/16/09	1342
04	ID-108-12-18-SD	OL50A	OL50A	02/16/09	1840
05	ID-101-8-14-SD	OL50B	OL50B	02/16/09	1913
06	ID-102-9-15-SD	OL50C	OL50C	02/16/09	1947
07	ID-100-15-21-SD	OL50D	OL50D	02/16/09	2020
08	ID-100-15-21-SD	OL50DMS	OL50DMS	02/16/09	2053
09	ID-100-15-21-SD	OLD50DMSD	OL50DMSD	02/16/09	2126
10	ID-000-MIX	OL50E	OL50E	02/16/09	2159
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

page 1 of 1

FORM V SV

8B
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC
Client: SAIC
ARI Job No: OL50
Project: IRONDALE SEDIMENT QU
Cont. Calib. ID: CC0216
Date Analyzed: 02/16/09
Instrument ID: NT6
Time Analyzed: 1056

		IS1 (DCB) AREA #	RT #	IS2 (NPT) AREA #	RT #	IS3 (ANT) AREA #	RT #
	12 HOUR STD	122677	6.76	429656	8.83	231189	11.66
	UPPER LIMIT	245354	7.26	859312	9.33	462378	12.16
	LOWER LIMIT	61338	6.26	214828	8.33	115594	11.16
	CLIENT SAMP. NO.						
01	OL50MBS1	136241	6.76	474064	8.83	249318	11.66
02	OL50LCSS1	138794	6.76	471325	8.83	251380	11.66
03	ID-108-12-18	141066	6.76	477681	8.83	275373	11.66
04	ID-101-8-14-	146014	6.77	484660	8.83	280526	11.66
05	ID-102-9-15-	151805	6.76	518285	8.83	288035	11.67
06	ID-100-15-21	142916	6.77	479753	8.83	279546	11.66
07	ID-100-15-21	142459	6.77	485203	8.84	288536	11.67
08	ID-100-15-21	147550	6.77	498693	8.84	291766	11.67
09	ID-000-MIX	141434	6.77	474084	8.83	269846	11.67
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

IS1 (DCB) = 1,4-Dichlorobenzene-d4
IS2 (NPT) = Naphthalene-d8
IS3 (ANT) = Acenaphthene-d10

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

8C
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC
Client: SAIC
ARI Job No: OL50
Project: IRONDALE SEDIMENT QU
Cont. Calib. ID: CC0216
Date Analyzed: 02/16/09
Instrument ID: NT6
Time Analyzed: 1056

		IS4 (PHN) AREA #	RT #	IS5 (CRY) AREA #	RT #	IS6 (PRY) AREA #	RT #
	12 HOUR STD	371452	13.99	344512	18.24	354917	20.35
	UPPER LIMIT	742904	14.49	689024	18.74	709834	20.85
	LOWER LIMIT	185726	13.49	172256	17.74	177458	19.85
	CLIENT SAMP. NO.						
01	OL50MBS1	381844	13.99	328743	18.23	344553	20.35
02	OL50LCSS1	402457	13.99	358832	18.23	380327	20.35
03	ID-108-12-18	435015	13.99	378180	18.25	337514	20.38
04	ID-101-8-14-	444620	13.99	400338	18.26	373478	20.39
05	ID-102-9-15-	461742	14.01	419499	18.30	339607	20.45
06	ID-100-15-21	463242	13.99	382283	18.24	325361	20.37
07	ID-100-15-21	480809	14.00	380078	18.25	333154	20.37
08	ID-100-15-21	498654	13.99	399145	18.25	350898	20.37
09	ID-000-MIX	445849	14.01	400488	18.27	326712	20.40
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

IS4 (PHN) = Phenanthrene-d10
IS5 (CRY) = Chrysene-d12
IS6 (PRY) = Perylene-d12

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

8C
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES, INC
ARI Job No: OL50
Cont. Calib. ID: CC0216
Instrument ID: NT6

Client: SAIC
Project: IRONDALE SEDIMENT QU
Date Analyzed: 02/16/09
Time Analyzed: 1056

		IS7 AREA #	RT #	AREA #	RT #	AREA #	RT #
	12 HOUR STD	559795	19.51				
	UPPER LIMIT	1119590	20.01				
	LOWER LIMIT	279898	19.01				
	CLIENT SAMP. NO.						
01	OL50MBS1	544942	19.51				
02	OL50LCSS1	596291	19.51				
03	ID-108-12-18	621906	19.52				
04	ID-101-8-14-	636430	19.53				
05	ID-102-9-15-	548677	19.57				
06	ID-100-15-21	639194	19.52				
07	ID-100-15-21	634160	19.52				
08	ID-100-15-21	667895	19.52				
09	ID-000-MIX	618473	19.54				
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

IS7 = Di-n-octylphthalate-d4

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.50 minutes of internal standard RT
RT LOWER LIMIT = - 0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1
Matrix: Sediment

QC Report No: OM70-Science Applications, Int
Project: 2009 IRONDALE SEDIMENT QUALITY

Data Release Authorized: VTS
Reported: 02/27/09

ARI ID	**Sample ID**	**Extraction Date**	**Analysis Date**	**EFV DL**	**Range**	**RL**	**Result**
MB-021709	Method Blank	02/17/09	02/18/09	1.00	Diesel	5.0	< 5.0 U
09-4522	HC ID: ---		FID4B	1.0	Motor Oil	10	< 10 U
					o-Terphenyl		78.9%
OM70A	ID-000-MIX	02/17/09	02/18/09	1.00	**Diesel**	**12**	**260**
09-4522	HC ID: **DRO/MOTOR OIL**		FID4B	2.0	**Motor Oil**	**24**	**240**
					o-Terphenyl		81.3%
OM70A DP	ID-000-MIX	02/17/09	02/18/09	1.00	**Diesel**	**12**	**230**
09-4522	HC ID: **DRO/MOTOR OIL**		FID4B	2.0		RPD:	12.2%
					Motor Oil	**24**	**230**
						RPD:	4.3%
					o-Terphenyl		85.8%
OM70A TP	ID-000-MIX	02/17/09	02/18/09	1.00	**Diesel**	**12**	**210**
09-4522	HC ID: **DRO/MOTOR OIL**		FID4B	2.0		RPD:	21.3%
					Motor Oil	**24**	**210**
						RPD:	13.3%
					o-Terphenyl		82.2%

Reported in mg/kg (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel quantitation on total peaks in the range from C12 to C24.
Motor Oil quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

FORM I

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: OM70-Science Applications, Intl.
Project: 2009 IRONDALE SEDIMENT QUALITY INVS

Client ID	**OTER**	**TOT OUT**
MB-021709	78.9%	0
LCS-021709	85.6%	0
ID-000-MIX	81.3%	0
ID-000-MIX DUP	85.8%	0
ID-000-MIX TRP	82.2%	0

	LCS/MB LIMITS	**QC LIMITS**
(OTER) = o-Terphenyl	(62-118)	(49-125)

Prep Method: SW3546
Log Number Range: 09-4522 to 09-4522

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: OM70
Matrix: Sediment
Project: 2009 IRONDALE SEDIMENT QUALITY INVS
Date Received: 01/30/09

ARI ID	Client ID	Client Amt	Final Vol	Basis	Prep Date
09-4522-021709MB1	Method Blank	10.0 g	1.00 mL	-	02/17/09
09-4522-021709LCS1	Lab Control	10.0 g	1.00 mL	-	02/17/09
09-4522-OM70A	ID-000-MIX	8.23 g	1.00 mL	D	02/17/09
09-4522-OM70ADP	ID-000-MIX	8.23 g	1.00 mL	D	02/17/09
09-4522-OM70ATP	ID-000-MIX	8.21 g	1.00 mL	D	02/17/09

Basis: D=Dry Weight W=As Received

EcoChem, INC.
Environmental Data Quality

Transmittal

DATE: April 6, 2009

PROJECT NO.: 4122-7

TO: **Will Hafner**
SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011
(425) 485-5800

FROM: **Christine Ransom**
EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104
(206) 233-9332 ext. 104

VIA: **US Mail**

WE ARE SENDING THE FOLLOWING MATERIALS:

Data Validation Report for Irondale sediments

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EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

WASHINGTON DOE TOXICS CLEANUP PROGRAM
REMEDIAL INVESTIGATION FEASIBLITY STUDY
IRONDALE, WASHINGTON

Prepared for:

SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C4122-7

April 2, 2009

Approved for Release

Christine Ransom
Project Manager
EcoChem, INC.

INTRODUCTION

Basis for the Data Validation

This report summarizes the results of the summary (Level III) data validation performed on sediment and quality control (QC) sample data for the Washington Department of Ecology – Remedial Investigation Feasibility Study at Irondale, Washington. A complete list of samples is provided in the **Sample Index**. Analytical Resources, Inc., Tukwila, Washington performed all analyses. The analytical methods and EcoChem project chemists are listed below.

Analysis	Method of Analysis	Primary Review	Secondary Review
Semivolatile Organic Compounds (SVOC)	SW8270D	Jennifer Newkirk	Eric Strout
SVOC-SIM	SW8270D-SIM	Jennifer Newkirk	Eric Strout
Pesticides	SW8081A	Jennifer Newkirk	Eric Strout
Diesel and Residual Range Hydrocarbons	NWTPH-Dx	Linda Holz	Eric Strout
Metals & Mercury	SW6010B, EPA 200.8, 7471A	Linda Holz	Christine Ransom
Conventional Parameters (T. Pres Solids, Grain Size, TOC, Ammonia, Sulfide)	E160.3, E160.4, PSEP 1986, Plumb 1981, E350.1M, E376.2	Linda Holz	Christine Ransom

The data validation is based on QC criteria documented in the above listed methods, the *Quality Assurance Project Plan (QAPP) - Investigation/Feasibility Study, Irondale, Washington (2007)*; and *USEPA National Functional Guidelines for Organic* (1999) *and Inorganic (2004) Data Review*.

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

Data qualifier definitions, reason codes, and validation criteria are included as **Appendix A**. **Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem.

SAMPLE INDEX
Irondale - Sediments

SDG	Sample ID	Laboratory ID	SVOC	SVOC-SIM	TPH-Dx	Metals	Pres. Total Solids	TVS	Ammonia	Sulfide	TOC	Grain Size
OH26	ID-108-12-18-SD	09-846-OH26A			✓		✓	✓	✓	✓	✓	✓
	ID-101-8-14-SD	09-847-OH26B			✓		✓	✓	✓	✓	✓	✓
	ID-102-9-15-SD	09-848-OH26C			✓		✓	✓	✓	✓	✓	✓
	ID-103-11-17-SD	09-849-OH26D			✓		✓	✓	✓	✓	✓	✓
	ID-103-11-17-D	09-850-OH26E			✓			✓	✓	✓	✓	✓
	ID-103-11-17-T	09-851-OH26F						✓	✓	✓	✓	✓
	ID-104-13-19-SD	09-852-OH26G			✓		✓	✓	✓	✓	✓	✓
	ID-100-15-21-SD	09-853-OH26H			✓		✓	✓	✓	✓	✓	✓
	ID-106-13-19-SD	09-854-OH26I			✓		✓	✓	✓	✓	✓	✓
	ID-107-8-14-SD	09-855-OH26J			✓		✓	✓	✓	✓	✓	✓
	ID-104-R	09-856-OH26K	✓	✓	✓	✓						
OK55	ID-000-MIX	09-3059-OK55A	✓	✓	✓			✓	✓	✓	✓	✓
	SB-REF-ID-01	09-3060-OK55B			✓		✓	✓	✓	✓	✓	✓
	SB-REF-ID-02	09-3061-OK55C			✓		✓	✓	✓	✓	✓	✓
OL50	ID-108-12-18-SD	09-3731-OL50A	✓	✓		✓						
	ID-101-8-14-SD	09-3732-OL50B	✓	✓		✓						
	ID-102-9-15-SD	09-3733-OL50C	✓	✓		✓						
	ID-100-15-21-SD	09-3734-OL50D	✓	✓		✓						
	ID-000-MIX	09-3735-OL50E	✓	✓		✓						
OM70	ID-000-MIX	09-4522-OM70A			✓							

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Semivolatile Organic Compounds by EPA Method 8270D

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OK55	1 Sediment	Summary
OL50	5 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table.

1 Holding Times and Sample Preservation
GC/MS Instrument Performance Check
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Laboratory Blanks
Field Blanks
Surrogate Compounds
Laboratory Control Samples (LCS/LCSD)
2 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Internal Standards
Field Duplicates
Target Analyte List
Reporting Limits
2 Reported Results

---

[1] *Quality control results are discussed below, but no data were qualified*

[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

Matrix spike/matrix spike duplicate (MS/MSD) analyses were performed at the required frequency. All MS/MSD percent recovery (%R) values were within the specified control limits, with the exceptions noted below.

SDG OK55: The 2,4-dimethylphenol percent recovery (%R) value was less than the lower control limit in the matrix spike (MS) analysis performed using Sample ID-00-MIX. The matrix spike duplicate (MSD) recovery was in control, therefore no qualification was necessary. The relative percent difference (RPD) value between the MS/MSD was greater than the upper control limit. Since the compound was not detected, no qualification was necessary.

SDG OL50: The benzyl alcohol %R values were less than 10% in the MS/MSD analyses performed using Sample ID-100-15-21-SD. Benzyl alcohol was not detected in this sample; the reporting limit was rejected (R-8) due to the extreme low bias. The benzyl alcohol RPD value was also greater than the upper control limit. No additional action was necessary.

Reported Results

SDGs OK55 & OL50: Sample ID-000-MIX was analyzed originally in SDG OK55. The sample was reanalyzed per client request and reported in SDG OL50. The reanalysis results confirm the original results. Since two sets of similar results were reported, the results in the reanalysis (in SDG OL50) were labeled do-not-report (DNR-11), and the original data should be used. Since a usable result remains for each compound in this sample, completeness is not affected.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, MS/MSD, and laboratory control sample %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the MS/MSD RPD values, with the exceptions previously noted.

One result for benzyl alcohol was rejected based on MS/MSD %R values less than 10%. Data were labeled do-not-report (DNR) in order to report only one set of results for each sample.

Data that has been rejected or labeled DNR should not be used for any purpose. All other data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Selected Semivolatiles by EPA Method 8270D-SIM

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH26	1 Field Blank	Summary
OK55	1 Sediment	Summary
OL50	5 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

SDG OH58: There was a calibration calculation error in the data submitted by the laboratory. Results were recalculated correctly and a revised hardcopy and electronic data deliverable were submitted.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table:

1 Holding Times and Sample Preservation
GC/MS Instrument Performance Check
2 Initial Calibration (ICAL)
1 Continuing Calibration (CCAL)
2 Laboratory Blanks
1 Field Blanks
Surrogate Compounds
2 Laboratory Control Samples (LCS)
2 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Internal Standards
Field Duplicates
Target Analyte List
Reporting Limits
2 Reported Results

---

[1] *Quality control results are discussed below, but no data were qualified*
[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Initial Calibration

All relative response factor (RRF) values were greater than the 0.05 minimum control limit. The percent relative standard deviation (%RSD) values were within the ±30% control limit for all initial calibrations (ICAL), with the exception noted below.

SDG OH26: ICAL 1/13/09 Instrument NT6: benzoic acid. Benzoic acid results were estimated (UJ-5A) in all associated samples.

Continuing Calibration (CCAL)

All RRF values were greater than the 0.05 minimum control limit. The percent difference (%D) values were within the ±25% control limit, with the exceptions noted below.

SDG OH26: CCAL 1/17/08, Instrument NT6: 2,4-dinitrophenol (high bias). This compound was not detected in any sample. Reporting limits were not affected by the potential high bias and no qualification of data was necessary.

Laboratory Blanks

To assess the impact of each blank contaminant on the reported sample results, an action level is established at five times the concentration reported in the blank. If a contaminant is reported in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-7). If the result is also less than the reporting limit, then the result is elevated to the reporting limit. No action is taken if the sample result is greater than the action level, or for non-detected results.

Method blanks were analyzed at the appropriate frequency. Various target analytes were detected in the method blanks, however, only the following analytes were qualified as not detected in one or more samples.

SDG OH26: Due to laboratory contamination, benzyl alcohol was detected in the sample, the laboratory control sample (LCS), and the method blank at concentrations greater than the instrument linear calibration range. Due to the significant contamination for benzyl alcohol, all benzyl alcohol results were rejected (R-14).

Field Blanks

SDG OH26: One field blank, ID-104-R, was submitted. After qualification based on method blank contamination, no target analytes were detected in this sample.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

Matrix spike/matrix spike duplicate (MS/MSD) analyses were performed at the required frequency. All MS/MSD percent recovery (%R) values were within the specified control limits, with the exceptions noted below.

SDG OH26: Matrix spike/matrix spike duplicate (MS/MSD) analyses were not performed. Accuracy was assessed using the LCS analysis. Precision could not be evaluated.

SDG OK55: Benzyl alcohol was not recovered in the MS/MSD analyses performed using Sample ID-000-MIX. Benzyl alcohol was not detected in this sample; the reporting limit was rejected (R-8) due to the extreme low bias. Also, the pentachlorophenol percent recovery (%R) values were greater than the upper control limit. Pentachlorophenol was not detected in this sample; no qualification was necessary.

SDG OL50: The pentachlorophenol %R values were greater than the upper control limit in the MS/MSD analyses performed using Sample ID-108-12-18-SD. Pentachlorophenol was not detected in this sample; no qualification was necessary.

Laboratory Control Sample (LCS)

SDG OK55: Benzyl alcohol was not recovered in the laboratory control sample (LCS) associated with Sample ID-000-MIX. Benzyl alcohol was not detected in this sample; the reporting limit was rejected (R-10) due to the extreme low bias.

Reported Results

SDGs OK55 & OL50: Sample ID-000-MIX was analyzed originally in SDG OK55. The sample was reanalyzed per client request and reported in SDG OL50. The reanalysis results confirm the original results. Since two sets of similar results were reported, the results in the reanalysis (in SDG OL50) were labeled do-not-report (DNR-11), and the original data should be used. Since a usable result remains for each compound in this sample, completeness is not affected.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, MS/MSD, and LCS %R values, with the exceptions noted above. Precision was also acceptable as demonstrated by the MS/MSD and field duplicate RPD values, with the exception noted above.

Data were estimated based on calibration outliers and field duplicate precision outliers. Data were qualified as not detected based on contamination in the associated method blank.

One benzyl alcohol result was rejected based on MS/MSD %R and LCS %R values less than 10%. Benzyl alcohol data were also rejected due to laboratory contamination. Data were labeled do-not-report (DNR) in order to report only one set of results for each sample.

Data that have been rejected or labeled DNR should not be used for any purpose.

All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Pesticides by EPA Method SW8081A

This report documents the review of analytical data from the analyses of a sediment sample and the associated laboratory and field quality control (QC) samples. The sample was analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OK55	1 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table:

Holding Times and Sample Preservation
Instrument Breakdown Check
1 Initial Calibration (ICAL)
2 Continuing Calibration (CCAL)
Laboratory Blanks
Surrogate Compounds
2 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Samples (LCS)
Field Duplicates
Internal Standards
Target Analyte List
Reporting Limits
2 Reported Results

---

[1] Quality control results are discussed below, but no data were qualified.

[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Initial Calibration (ICAL)

The percent relative standard deviation (%RSD) values for gamma chlordane, aldrin, and endrin were less than the control limit on the confirmation column from the ICAL analyzed on 2/13/09. The %RSD values were in control on the primary column, therefore no qualification was necessary.

Continuing Calibration (CCAL)

The percent difference (%D) values for six compounds were greater than the control limit of ±25% on both columns from the CCALs analyzed on 2/14/09 at 2:41 and 3:01. The %D values were indicative of a low bias. The reporting limits for 2,4'-DDE, 4,4'-DDE, alpha chlordane, dieldrin, gamma chlordane, and trans-nonachlor were estimated (UJ-5B) in the associated sample.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

Matrix spike/matrix spike duplicate (MS/MSD) analyses were performed at the required frequency. All MS/MSD percent recovery (%R) values were within the specified control limits, with the exceptions noted below.

The MS/MSD analyses were performed using Sample ID-000-MIX. The %R values for 4,4'-DDD and 4,4'-DDT were less than the lower control limits. Due to the potential low bias, the reporting limits for these compounds were estimated (UJ-8) in the parent sample. The MS %R value for dieldrin was less than the lower control limit. No qualifiers were assigned as the dieldrin %R value was within the control limits in the MSD.

Reported Results

Sample ID-000-MIX was initially analyzed at a 5x dilution. No target analytes were detected in this analysis. The sample was reanalyzed undiluted. Both the diluted and the undiluted results were reported for these samples. The dilution results were labeled (DNR-11) in order to avoid duplicate reporting for these samples. Only the original results should be used.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample, and MS/MSD %R values, with the exceptions noted above. Precision was acceptable as demonstrated by the relative percent difference values for the MS/MSD analyses.

Data were estimated based on MS/MSD accuracy outliers. Data were labeled as do-not-report in order to avoid duplicate sample reporting.

Data labeled as do-not-report should not be used for any purpose.

All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Diesel and Residual Range Hydrocarbons by Method NWTPH-Dx

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH26	9 Sediment & 1 Rinsate Blank	Summary
OK55	3 Sediment	Summary
OM70	1 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Holding Times and Sample Preservation
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Blanks (Method)
1 Field Blanks
1 Surrogate Compounds
Matrix Spike/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Samples (LCS/LCSD)
1 Field Duplicates
Target Analyte List
Reporting Limits
2 Reported Results
Compound Identification and Quantification

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[1] *Quality control results are discussed below, but no data were qualified.*
[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Field Blanks

SDG OH26: One rinsate blank, ID-104-R, was submitted. No target analytes were detected.

Surrogate Compounds

SDG OH26: The surrogates were not recovered in Samples ID-104-13-19-SD, ID-106-13-19-SD, and ID-107-8-14-SD due to sample dilution factors of 50x. No action was necessary.

Field Duplicates

The relative percent difference (RPD) value is used to assess precision only if both sample results are greater than 5x the reporting limit (RL) for a given analyte; otherwise, the difference between the two results is used to evaluate precision. For solid matrices, the RPD value control limit is 50% or the difference must be less than 2x the RL.

SDG OH26: One set of field duplicates, ID-103-11-17-SD & ID-103-11-17-D, was submitted. All field precision criteria were met.

Reported Results

SDGs OK55 & OM70: Sample ID-000-MIX was analyzed originally in SDG OK55. The sample was reanalyzed per client request and reported in SDG OM70. The reanalysis results confirm the original results. Since two sets of similar results were reported, the results in the reanalysis (in SDG OM70) were labeled do-not-report (DNR-11), and the original data should be used. Since a usable result remains for each compound in this sample, completeness is not affected.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample percent recovery (%R) values. Precision was also acceptable, as demonstrated by the field duplicate and MS/MSD RPD values, with the exception noted above.

Data were labeled do-not-report (DNR) in order to report only one set of results for each sample.

Data that has been labeled DNR should not be used for any purpose. All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Metals by Methods SW6010B, E200.8, and SW7470A/7471A

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH26	1 Field Blank	Summary
OK55	1 Sediment	Summary
OL50	5 Sediment	Summary

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table:

[1] Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
[2] CRDL Standards
Laboratory Blanks
[1] Field Blanks
Laboratory Control Samples (LCS)
Matrix Spikes (MS)
Laboratory Duplicates
Field Duplicates
Interference Check Samples
Serial Dilutions
Reported Results

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[1] *Quality control results are discussed below, but no data were qualified.*

[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures less than the lower control limit, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Contract Required Detection Limit Standard

Contract required detection limit (CRDL) standards were analyzed at the beginning of each analytical sequence. For recovery values greater than 130% upper control limit, positive results less than two times (<2x) the CRDL are estimated (J) to indicate a potential high bias. For recoveries less than the lower control limit of 70%, positive results less than twice (<2x) the CRDL and the detection limits for non-detects are estimated (J/UJ) to indicate a potential low bias. The following outliers resulted in qualification of data:

SDG OH26: copper, zinc – (UJ) low bias

Field Blank

SDG OH26: One rinsate blank, ID-104-R, was submitted. No target analytes were detected.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory and field replicate RPD values indicated acceptable precision, except as noted above. Accuracy was also acceptable, as demonstrated by the matrix spike and laboratory control sample recoveries.

Data were estimated based on CRDL standard percent recovery outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Washington DOE Toxics Cleanup
Irondale RI/FS
Conventional Parameter Analyses

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. A complete list of samples is provided in the **Sample Index**.

SDG	Number of Samples	Validation Level
OH26	10 Sediment	Summary
OK55	3 Sediment	Summary

The analytical tests that were performed are summarized below:

Parameter	Method
Total Solids (TS)	E160.3
Preserved Total Solids	E160.3
Total Volatile Solids (TVS)	E160.4
Grain Size (GS)	PSEP 1986
Total Organic Carbon (TOC)	Plumb, 1981
Ammonia as Nitrogen	E350.1M
Total Sulfides	E376.2

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

1 Holding Times and Sample Preservation
Initial Calibration
Calibration Verification
Laboratory Blanks
Laboratory Control Samples (LCS)
Matrix Spikes (MS)
2 Laboratory Replicates
1 Field Replicates
Reporting Limits

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[1] *Quality control results are discussed below, but no data were qualified.*
[2] *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. Two coolers were received at the laboratory at temperatures outside of these limits, with temperatures of 0.6° and 1.2°C. These temperature outliers did not impact data quality and no action was taken.

Laboratory Replicates

The percent relative standard deviation (%RSD) for triplicates or relative percent difference (RPD) for duplicates are used to assess precision only if the sample results are greater than 5x the reporting limit for a given analyte; otherwise, the difference between the results is used to evaluate precision. For solid matrices, the % RSD or RPD control limit is 35%, or the difference must be less than 2x the reporting limit. For precision outliers, associated positive results and non-detects were estimated (J/UJ-9).

SDG OH26: QC Sample ID-102-9-15-SD: sulfide (48.4%)

Field Replicates

The %RSD value is used to assess precision only if the sample results are greater than 5x the reporting limit for a given analyte; otherwise, the difference between the results is used to evaluate precision. For solid matrices, the %RSD value control limit is 50% or the difference must be less than 2x the reporting limit.

SDG OH26: One set of field replicates were submitted: ID-103-11-17-SD, ID-103-11-17-D, and ID-103-11-17-T. All field precision criteria were met.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. The laboratory and field replicate RPD values indicated acceptable precision, except as noted above. Accuracy was also acceptable, as demonstrated by the MS and laboratory control sample recoveries.

Data were estimated based on a laboratory duplicate RPD outlier.

All data, as qualified, are acceptable for use.

EcoChem, INC.
Environmental Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS REASON CODES

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DATA VALIDATION QUALIFIER CODES
National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with "R" and "DNR" only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives
22	Elevated Detection Limit Due to Interference (i.e., laboratory, chemical and/or matrix)

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (**EcoChem PJ**)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	<u>Water</u>: J(+)/UJ(-) if ext. > 7 and < 21 days J(+)/R(-) if ext > 21 days (**EcoChem PJ**) <u>Solids/Wastes</u>: J(+)/UJ(-) if ext. > 14 and < 42 days J(+)/R(-) if ext. > 42 days (**EcoChem PJ**) J(+)/UJ(-) if analysis >40 days	1
Tuning	DFTPP Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	**(EcoChem PJ, see TM-06)** If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	**(EcoChem PJ, see TM-06)** J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	**(EcoChem PJ, see TM-06)** If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	**(EcoChem PJ, see TM-06)** If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Field Blanks (Not Required)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% **PJ if only one %R outlier**	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS **low conc. H2O SVOA**	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS **regular SVOA (H2O & solid)**	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R <LCL J(+)/R(-) if %R < 10% **(EcoChem PJ)**	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Minimum of 3 acid and 3 base/neutral compounds Use method acceptance criteria	Do not qualify if only 1 acid and/or 1 B/N surrogate is out unless <10% J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10%	13
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT>30 seconds, **narrate and Notify PM**	19
Field Duplicates	**Use QAPP limits. If no QAPP:** Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project **(EcoChem PJ)**	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants **See Technical Director for ID issues**	4
Quantitation/ Identification	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	**See Technical Director if outliers**	14 21 (false +)

EcoChem Validation Guidelines for Pesticides/PCBs by GC/ECD (Based on Organic NFG 1999 & EPA SW-846 Method 8081/8082)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C **(EcoChem PJ)**	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext/analyzed > HT J(+)/R(-) if ext/analyzed > 3X HT **(EcoChem PJ)**	1
Resolution Check	Beginning of ICAL Sequence Within RTW Resolution >90%	Narrate (Use Professional Judgement to qualify)	14
Instrument Performance (Breakdown)	DDT Breakdown: < 20% Endrin Breakdown: <20% Combined Breakdown: <30% Compounds within RTW	J(+) DDT NJ(+) DDD and/or DDE R(-) DDT - If (+) for either DDE or DDD J(+) Endrin NJ(+) EK and/or EA R(-) Endrin - If (+) for either EK or EA	5A
Retention Times	Surrogates: TCX (+/- 0.05); DCB (+/- 0.10) Target compounds: elute before heptachlor epoxide (+/- 0.05) elute after heptachlor epoxide (+/- 0.07)	NJ(+)/R(-) results for analytes with RT shifts **For full DV, use PJ based on examination of raw data**	5B
Initial Calibration	Pesticides: Low=CRQL, Mid=4X, High=16X Multiresponse - one point Calibration %RSD<20% %RSD<30% for surr; two comp. may exceed if <30% Resolution in Mix A and Mix B >90%	J(+)/UJ(-)	5A
Continuing Calibration	Alternating PEM standard and INDA/INDB standards every 12 hours (each preceeded by an inst. Blank) %D < 25% Resolution >90% in IND mixes; 100% for PEM	J(+)/UJ(-) J(+)R(-) if %D > 90% **PJ for resolution**	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample result is < CRQL and < 5X rule (raise sample value to CRQL) U(+) if sample result is > or equal to CRQL and < 5X rule (at reported sample value)	7
Instrument Blanks	Analyzed at the beginning of every 12 hour sequence No analyte > 1/2 CRQL	Same as Method Blank	7
Field Blanks	Not addressed by NFG No results > CRQL	Apply 5X rule; U(+) < action level	6

EcoChem Validation Guidelines for Pesticides/PCBs by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Method 8081/8082)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One set per matrix per batch Method Acceptance Criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% **PJ if only one %R outlier**	8
MS/MSD (RPD)	One set per matrix per batch Method Acceptance Criteria	J(+) in parent sample if RPD > CL	9
LCS	One per SDG Method Acceptance Criteria	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	TCX and DCB added to every sample %R = 30-150%	J(+)/UJ(-) if both %R = 10 - 60% J(+) if both >150% J(+)/R(-) if any %R <10%	13
Quantitation/ Identification	Quantitated using ICAL calibration factor (CF) RPD between columns <40%	J(+) if RPD = 40 - 60% NJ(+) if RPD >60% **EcoChem PJ - See TM-08**	3
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used to avoid reporting two results for one sample	11
Sample Clean-up	GPC required for soil samples Florisil required for all samples Sulfur is optional Clean-up standard check %R within CLP limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL	14
Field Duplicates	**Use QAPP limits. If no QAPP:** Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate **(Qualifiy if required by project QAPP)**	9

DATA VALIDATION CRITERIA

Table No.: NWTPH-Dx
Revision No.: 2
Last Rev. Date: 8/13/07
Page: 1 of 2

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X **(EcoChem PJ)**	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if $R^2 < 0.990$ J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 85% to 115%	Narrate if frequency not met. J(+)/UJ(-) if %R < 85% J(+) if %R >115%	5B
Method Blank	At least one per batch (≤10 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. **Use PJ if only one %R outlier**	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% **(EcoChem PJ)**	10

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. **(EcoChem PJ)**	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP **EcoChem default:** water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. **(See TM-04)**	11

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration Tissues: Frozen	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r > 0.995	J(+)/UJ(-) if r < 0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		(Refer to TM-02 for additional information)
			7

Reporting Limit Standard	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+) < 2x RL if %R <50% (< 30% Sb, Pb, Tl) J(+) < 2x RL, UJ(-) if %R 50-69% (30-49% Sb, Pb,Tl) J(+) < 2x RL if %R 130-180% (150-200% Sb, Pb, Tl) R(+) < 2x RL if %R > 180% (200% Sb, Pb, Tl)	14
Interference Check Samples (ICSA/ICSAB)	ICSAB %R 80 - 120% for all spiked elements | ICSA | < MDL for all unspiked elements except: K, Na	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R= 50 to 79% Use Professional Judgment for ICSA to determine if bias is present see **TM-09** for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7

DATA VALIDATION CRITERIA

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spikes	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R > 125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R < 30% **or** J(+)/UJ(-) if Post Spike %R 75-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples >RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2x RL for solids) qualify all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample conc. > 50x MDL	J(+)/UJ(-) if %D >10% qualify all samples in batch	16
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Tune	Prior to ICAL monitoring compounds analyzed 5 times wih Std Dev. ≤ 5% mass calibration <0.1 amu from True Value Resolution < 0.9 AMU @ 10% peak height or <0.75 amu @ 5% peak height	Use Professional Judgment to evaluate tune J(+)/UJ(-) if tune criteria not met	5A
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r>0.995	J(+)/UJ(-) if r<0.995 (for multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to **TM-02** for additional details
			7

Reporting Limit Standard (CRI)	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Co,Mn, Zn)	R(-),(+) < 2x RL if %R < 50% (< 30% Co,Mn, Zn) J(+) < 2x RL, UJ(-) if %R 50-69% (30%-49% Co,Mn, Zn) J(+) < 2x RL if %R 130%-180% (150%-200% Co,Mn, Zn) R(+) < 2x RL if %R > 180% (200% Co, Mn, Zn)	14
Interference Check Samples (ICSA/ICSAB)	Required by SW 6020, but not 200.8 ICSAB %R 80% - 120% for all spiked elements | ICSA | < IDL (MDL) for all unspiked elements	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R = 50% to 79% Use Professional Judgment for ICSA to determine if bias is present see **TM-09** for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch Blank Spike: %R within 80%-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 75-125% for samples where results do not exceed 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% **or** J(+)/UJ(-) if Post Spike %R 75%-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, Spike parent sample at 2x the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5 x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample values > 50x MDL	J(+)/UJ(-) if %D >10% All samples in batch	16
Internal Standards	Every sample SW6020: 60%-125% of cal blank IS 200.8: 30%-120% of cal blank IS	J (+)/UJ (-) all analytes associated with IS outlier	19
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Mercury Analysis by CVAA (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	28 days from date sampled Frozen tissues: HT extended to 6 months	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + 4 standards, one at RL r > 0.995	J(+)/UJ(-) if r<0.995	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	after each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to **TM-02** for additional details
			7

Reporting Limit Standard (CRA)	conc at RL - analyzed beginning of run %R = 70-130%	R(-),(+)<2xRL if %R <50% J(+)<2x RL, UJ(-) if %R 50-69% J(+) <2x RL if %R 130-180% R(+)<2x RL if %R>180%	14
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 5% frequency 75-125% for samples less than 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% all samples in batch	8
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Mercury Analysis by CVAA
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5x RL: Water: Diff<RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9

DATA VALIDATION CRITERIA

Table No.: Eco-Conv
Revision No.: 0
Last Rev. Date: FINAL DRAFT
Page: 1 of 2

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler Temperature 4°C ±2°C Preservation: Method Specific	Use Professional Judgment to qualify based to qualify for coole temp outliers J(+)/UJ(-) if preservation requirements not met	1
Holding Time	Method Specific	Professional Judgment J(+)/UJ(-) if holding time exceeded J(+)/R(-) if HT exceeded by > 3X	1
Initial Calibration	Method specific r>0.995	**Use professional judgment** J(+)/UJ(-) for r < 0.995	5A
Initial Calibration Verification (ICV)	Where applicable to method Independent source analyzed immediately after calibration %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5A
Continuing Cal Verification (CCV)	Where applicable to method Every ten samples, immed. following ICV/ICB and end of run %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5B

Initial and Continuing Cal Blanks (ICB/CCB)	Where applicable to method
	After each ICV and CCV every ten samples and end of run
	| blank| < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Method Blank	One per matrix per batch
	(not to exceed 20 samples)
	blank < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blk value, U(+) results < action level
		For (-) blk value, J(+)/UJ(-) results < action level
			7

Laboratory Control Sample	Waters: One per matrix per batch %R (80-120%)	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	Soils: One per matrix per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Matrix Spike	One per matrix per batch; 5% frequency 75-125% for samples less than 4 x spike level	J(+) if %R > 125% or < 75% UJ(-) if %R = 30-74% R(+/-) results < IDL if %R < 30%	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (may use RPD < 35%, Diff < 2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff<RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9

EcoChem, INC.
Environmental Data Quality

APPENDIX B
QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary
Irondale - Sediments

SDG	SAMPLE ID	LAB ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
OH26	ID-102-9-15-SD	09-848-OH26C	Sulfide	742	mg/kg		J	9
OH26	ID-102-9-15-SDLR	09-848-OH26CLR	Sulfide	453	mg/kg		J	9
OH26	ID-104-R	09-856-OH26K	Copper		mg/l	U	UJ	14
OH26	ID-104-R	09-856-OH26K	Zinc		mg/l	U	UJ	14
OH26	ID-104-R	09-856-OH26K	Benzoic Acid		ug/l	U	UJ	5A
OH26	ID-104-R	09-856-OH26K	Benzyl Alcohol	100	ug/l	BE	R	14
OK55	ID-000-MIX	09-3059-OK55A	2,4'-DDE		ug/kg	U	UJ	5B
OK55	ID-000-MIX	09-3059-OK55A	4,4'-DDD		ug/kg	U	UJ	8
OK55	ID-000-MIX	09-3059-OK55A	4,4'-DDE		ug/kg	U	UJ	5B
OK55	ID-000-MIX	09-3059-OK55A	4,4'-DDT		ug/kg	U	UJ	8
OK55	ID-000-MIX	09-3059-OK55A	alpha Chlordane		ug/kg	U	UJ	5B
OK55	ID-000-MIX	09-3059-OK55A	Dieldrin		ug/kg	U	UJ	5B
OK55	ID-000-MIX	09-3059-OK55A	gamma Chlordane		ug/kg	U	UJ	5B
OK55	ID-000-MIX	09-3059-OK55A	trans-Nonachlor		ug/kg	U	UJ	5B
OK55	ID-000-MIX	09-3059-OK55ADL	2,4'-DDD		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	2,4'-DDE		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	2,4'-DDT		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	4,4'-DDD		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	4,4'-DDE		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	4,4'-DDT		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	Aldrin		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	alpha Chlordane		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	cis-Nonachlor		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	Dieldrin		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	gamma Chlordane		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	gamma-BHC (Lindane)		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	Heptachlor		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	oxy Chlordane		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55ADL	trans-Nonachlor		ug/kg	U	DNR	11
OK55	ID-000-MIX	09-3059-OK55A	Benzyl Alcohol		ug/kg	U	R	8,10
OL50	ID-100-15-21-SD	09-3734-OL50D	Benzyl Alcohol		ug/kg	U	R	8
OL50	ID-000-MIX	09-3735-OL50E	1,2,4-Trichlorobenzene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	1,2-Dichlorobenzene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	1,3-Dichlorobenzene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	1,4-Dichlorobenzene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	1-Methylnaphthalene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	2,4-Dimethylphenol		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	2-Methylnaphthalene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	2-Methylphenol		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	4-Methylphenol		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Acenaphthene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Acenaphthylene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Anthracene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Benzo(a)anthracene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Benzo(a)pyrene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Benzo(b)fluoranthene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Benzo(g,h,i)perylene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Benzo(k)fluoranthene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Benzoic Acid		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Benzyl Alcohol		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	bis(2-Ethylhexyl)phthalate		ug/kg	U	DNR	11

Qualified Data Summary
Irondale - Sediments

SDG	SAMPLE ID	LAB ID	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV REASON
OL50	ID-000-MIX	09-3735-OL50E	Butylbenzylphthalate		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Chrysene	21	ug/kg		DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Dibenz(a,h)anthracene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Dibenzofuran		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Diethylphthalate		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Dimethylphthalate		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Di-n-Butylphthalate		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Di-n-Octyl phthalate		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Fluoranthene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Fluorene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Hexachlorobenzene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Hexachlorobutadiene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Indeno(1,2,3-cd)pyrene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Naphthalene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	N-Nitrosodiphenylamine		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Pentachlorophenol		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Phenanthrene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Phenol		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Pyrene	29	ug/kg		DNR	11
OL50	ID-000-MIX	09-3735-OL50E	1,2,4-Trichlorobenzene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	1,2-Dichlorobenzene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	1,4-Dichlorobenzene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	2,4-Dimethylphenol		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	2-Methylphenol		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Benzyl Alcohol		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Butylbenzylphthalate		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Dibenz(a,h)anthracene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Hexachlorobenzene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Hexachlorobutadiene		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	N-Nitrosodiphenylamine		ug/kg	U	DNR	11
OL50	ID-000-MIX	09-3735-OL50E	Pentachlorophenol		ug/kg	U	DNR	11
OM70	ID-000-MIX	09-4522-OM70A	Diesel Range Hydrocarbons	260	mg/kg		DNR	11
OM70	ID-000-MIX	09-4522-OM70A	Motor Oil	240	mg/kg		DNR	11

Appendix C
Biological Laboratory Report

BIOLOGICAL TESTING OF SEDIMENT FOR IRONDALE, WASHINGTON

MARCH 2009

PREPARED FOR:
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
ENVIRONMENTAL SCIENCES DIVISION
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

PREPARED BY:
NEWFIELDS
PO Box 216
4729 View Drive
Port Gamble, Washington 98364

1.0 INTRODUCTION

NewFields conducted toxicity tests with sediment samples collected by Science Applications International Corporation (SAIC) in Irondale, Washington. Biological effects were evaluated relative to the biological criteria defined in the Sediment Management Standards (SMS). This report presents the results of the toxicity testing portion of the Irondale sediment investigation.

2.0 METHODS

This section summarizes the test methods that were followed for this biological characterization. Test methods followed guidance provided by the Puget Sound Estuary Program (PSEP 1995), the Washington State Department of Ecology (WDOE) Sediment Sampling and Analysis Plan Appendix (SSAPA; Ecology 2008), and the various updates presented during the Annual Sediment Management Review meetings (SMARM). Sediment toxicity was evaluated using four standard PSEP bioassays: the 10-day amphipod test, the 20-day juvenile polychaete test, the benthic larval development test, and the Microtox® porewater test. NewFields performed the amphipod, juvenile polychaete and benthic larval tests. The Microtox® test was performed by Nautilus Environmental LLC.

2.1 SAMPLE AND ANIMAL RECEIPT

Nine test sediments and two reference sediments were received by NewFields on January 9 and 29, 2008. Sediment samples were stored in a walk-in cold room at 4 ± 2ºC in the dark. Test sediment was not sieved prior to testing. All tests were conducted within the eight week holding time.

Amphipods (*Eohaustorius estuarius*) were supplied by Northwest Aquatic Sciences in Newport, Oregon. Animals were held in native sediment at 15°C prior to test initiation. Juvenile polychaete worms (*Neanthes arenaceodentata*) were supplied by Donald Reish, Ph.D., Long Beach, California. Juvenile polychaetes were held in seawater at 20°C (*Neanthes* were cultured in water-only and were not held in sediment prior to testing). *Mytilus galloprovincialis* (mussel) broodstock were provided by Carlsbad Aquafarms in Carlsbad, California. Broodstock were held in unfiltered seawater at 16°C prior to spawning.

Native *E. estuarius* sediment from Yaquina Bay, Oregon was provided by Northwest Aquatic Sciences for use as control sediment treatments for the amphipod and juvenile polychaete tests.

2.2 ULTRA-VIOLET LIGHT EXPOSURE

Test sediment samples were exposed to ultra-violet (UV) light during the entire test exposure (except Microtox). The UV light regime followed guidance provided by Sub-Appendix D and in consultation with Ecology. UV light was provided by a fluorescent light ballast containing one Duro-Test Vita-Lite® (40W, 5500°K, 91 CRI) fluorescent bulb and one standard fluorescent bulb (Phillips F40CW). The UV bulbs were placed within 12” above the sediment surface. All test chambers were left uncovered to prevent any UV loss. Tests were conducted on water-tables to ensure that the additional lighting did not alter water temperatures in the test chambers.

2.3 10-DAY AMPHIPOD BIOASSAY

The 10-day acute toxicity test with *E. estuarius* was initiated on February 10, 2009. To prepare the test exposures, approximately 175 mL of sediment was placed in clean, acid and solvent-rinsed 1-L glass jars, which were then filled with 775 mL of 0.45-µm filtered seawater at 28 ppt. Seven replicate chambers were prepared for each test treatment, the two reference sediments, and the native control sediment. The control and reference sediments were tested with the test treatments. Five replicates were used to evaluate sediment toxicity while the remaining two replicates were designated as sacrificial surrogate chambers. One surrogate chamber was sacrificed at test initiation to measure overlying and interstitial ammonia and sulfides. The remaining surrogate chamber was used for measuring daily water quality throughout the test, as well as overlying and interstitial ammonia and sulfides at test termination. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer.

Test chambers were placed in randomly assigned positions in a 15°C water bath and allowed to equilibrate overnight. Trickle-flow aeration was provided to prevent dissolved oxygen concentrations from dropping below acceptable levels.

Immediately prior to test initiation, water quality parameters were measured in the surrogate chamber for each treatment. Dissolved oxygen (DO), temperature, pH, and salinity were then monitored in the surrogate chambers daily until test termination. Target test parameters were:

Dissolved Oxygen:	≥5 mg/L
pH:	7.8 ± 0.5 units
Temperature:	15 ± 1°C
Salinity:	28 ± 1‰

The tests were initiated by randomly allocating 20 *E. estuarius* into each test chamber, ensuring that each of the amphipods successfully buried into the sediment. Amphipods that did not bury within approximately one hour were replaced with healthy amphipods. The 10-day amphipod bioassay was conducted as a static test with no feeding during the exposure period. At test termination, sediment from each test chamber was sieved through a 0.5-mm screen and all recovered amphipods transferred into a Petri dish. A water-only, 4-day reference-toxicant test was conducted concurrently with the sediment test, using cadmium chloride. The cadmium reference-toxicant test was used to ensure animals used in the test were healthy and of similar sensitivity to prior tests.

2.4 20-DAY JUVENILE POLYCHAETE BIOASSAY

The 20-day chronic toxicity test with *N. arenaceodentata* was initiated on February 12, 2009. Test exposures were prepared with approximately 175 mL of sediment placed in clean, acid and solvent-rinsed 1-L glass jars, which were then filled with 775 mL of 0.45-µm filtered seawater at 28 ppt. Seven replicate chambers were prepared for each test treatment, the two reference sediments, and control sediment. Five replicates were used to evaluate sediment toxicity while the remaining two replicates were designated as sacrificial surrogate chambers. One surrogate chamber was sacrificed at test initiation to measure overlying and interstitial ammonia and sulfides. The remaining surrogate chamber was used for measuring daily water quality throughout the test, as well as overlying and interstitial ammonia and sulfides at test termination. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer.

Test chambers were placed in randomly assigned positions in a water bath at 20°C and allowed to equilibrate overnight. Trickle-flow aeration was provided to prevent dissolved oxygen concentrations from dropping below acceptable levels.

Immediately prior to test initiation, water quality parameters were measured. Dissolved oxygen, temperature, pH, and salinity were then monitored in the surrogates daily until test termination. Target test parameters were:

Dissolved Oxygen:	≥5.5 mg/L
pH:	7.8 ± 0.5 units
Temperature:	20 ± 1°C
Salinity:	28 ± 2‰

The juvenile polychaete test was initiated by randomly allocating five *N. arenaceodentata* into each test chamber, and observing whether each of the worms successfully buried into the sediment. Worms that did not bury within approximately one hour were replaced with healthy worms. The 20-day test was conducted as a static-renewal test, with exchanges of 300 mL of water occurring every third day. *N. arenaceodentata* were fed every other day with 40 mg of TetraMarin® (approximately 8 mg dry weight per worm). At test termination, sediment from each test chamber was sieved through a 0.5-mm screen and all recovered worms transferred into a Petri dish. The number of surviving and dead worms was determined. All surviving worms were then transferred to pre-weighed, aluminum foil weigh-boats, and then dried in a drying oven at 60°C for approximately 24 hours. Each weigh-boat was removed, cooled in a dessicator, and then weighed on a microbalance to 0.01 mg. A water-only, 4-day reference-toxicant test was conducted concurrently with the sediment test, using cadmium chloride. The cadmium reference-toxicant test was used to ensure animals used in the test were healthy and of similar sensitivity to prior tests.

2.5 LARVAL DEVELOPMENTAL BIOASSAY

Test sediment was evaluated using the benthic larval development test with the mussel, *Mytilus galloprovincialis.* The mussel larval test was initiated on February 13, 2009. A sea water control and the two reference sediments were tested with the test treatments. To prepare the test exposures, 18 g (±1 g) of test sediment were placed in clean, acid and solvent-rinsed 1-L glass jars, which were then filled to 900 mL with 0.45-µm of filtered seawater. Six replicate chambers were prepared for each test treatment and the two reference sediments. The six control chambers contained filtered seawater without sediment. Five of the replicates were used to evaluate the test; the sixth replicate was used as a water quality surrogate. Each chamber was shaken for 10 seconds and then placed in predetermined randomly-assigned positions in a water bath at 16°C.

To collect gametes for each test, mussels were placed in clean seawater and acclimated at 12°C for approximately 20 minutes. The water bath temperature was then increased over a period of 15 minutes to 20°C. Mussels were held at 20°C and monitored for spawning individuals. Spawning females and males were removed from the water bath and placed in individual containers with seawater. These individuals were allowed to spawn until sufficient gametes were available to initiate the test. After the spawning period, eggs are transferred to fresh seawater and filtered through a .5 mm Nitex® mesh screen to remove large debris, feces, and excess gonadal matter. A composite is made of the sperm and diluted with fresh seawater. The fertilization process was initiated by adding sperm to the isolated egg containers. Egg-sperm solutions were periodically homogenized with a perforated plunger during the fertilization process and sub-samples observed under the microscope for egg and sperm viability. Approximately one to one and a half hours after fertilization, embryo solutions were checked for fertilization rate. Only those embryo stocks with >90% fertilization were used to initiate the tests. Embryo solutions were rinsed free of excess sperm and then combined to create one embryo stock solution. Density of the embryo stock solution was determined by counting the number of embryos in a subsample of homogenized stock solution. This was used to determine the volume of embryo stock solution to deliver approximately 27,000 embryos to each test chamber.

Dissolved oxygen, temperature, pH, and salinity were monitored daily in water quality surrogates to prevent loss or transfer of larvae by adhesion to water-quality probes. Overlying water ammonia and sulfides were measured at test initiation and termination. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer. Target test parameters were as follows:

Dissolved Oxygen:	≥5.0 mg/L
pH:	7.8 ± 0.5 units
Temperature:	16 ± 1°C
Salinity:	28 ± 1‰

The development test was conducted as a static test without aeration. Protocol calls for test termination when 95% of the embryos in the control have reached the prodissoconch I stage (approximately 48-60 hours). At termination, the overlying seawater was decanted into a clean 1-L jar and mixed with a perforated plunger. From this container, a 10 mL subsample was transferred to a scintillation vial and preserved in 5% buffered formalin. Larvae were subsequently stained with a dilute solution of Rose Bengal in 70% alcohol to help visualization of larvae. The number of normal and abnormal larvae was enumerated on an inverted microscope. Normal larvae included all D-shaped prodissoconch I stage larvae. Abnormal larvae included abnormally shaped prodissoconch I larvae and all early stage larvae. A water-only reference-toxicant test with copper sulfate was conducted concurrently with the sediment test.

2.6 MICROTOX® TEST

The Microtox® test was performed by Nautilus Environmental LLC. The Microtox test exposed the luminescent marine bacterium *Vibrio fischeri* to porewater extracted from test sediments. Bacterial light output was measured using the Microtox Model 500 Analyzer at 5 and 15 minutes of exposure. Light output from the test porewater was compared to that of the reference treatments at both time intervals. A complete description of the Microtox test methods is presented in Appendix A.

2.7 DATA ANALYSIS AND QA/QC

All water quality and endpoint data were entered into Excel spreadsheets. Water quality parameters were summarized by calculating the mean, minimum, and maximum values for each test treatment. Endpoint data were calculated for each replicate and mean values and standard deviations were determined for each test treatment.

All hand-entered data was reviewed for data entry errors, which were corrected prior to summary calculations. A minimum of 10% of all calculations and data sorting were reviewed for errors. Review counts were conducted on any apparent outliers.

For the larval test, the normalized combined mortality and abnormality endpoint was used to evaluate the test sediment. This was based on the number of normal larvae in the treatment and reference divided by the number of normal larvae in the control, as defined in Ecology (2005).

For SMS suitability determinations, comparisons were made according to SSAPA (Ecology 2008) and Fox et al. (1998). Data reported as percent mortality or survival were transformed using an arcsine square root transformation prior to statistical analysis. All data were tested for normality using the Wilk-Shapiro test and equality of variance using Levene’s test. Determinations of statistical significance were based on one-tailed Student’s t-tests with an alpha of 0.05. A comparison of the larval endpoint, relative to the reference was made using an alpha level of 0.10. For samples failing to meet assumptions of normality, a Mann-Whitney test was conducted to determine significance. For those samples failing to meet the assumptions of normality and equality of variance, a t-test on rankits was used.

3.0 RESULTS

The results of the sediment testing, including a summary of test results and water quality observations are presented in this section. Data for each of the replicates, as well as laboratory bench sheets are provided in Appendix B and statistical analyses are provided in Appendix C.

3.1 10-DAY AMPHIPOD BIOASSAY

A summary of test conditions is shown in Table 1, *E. estuarius* survival is presented in Table 2, and a summary of water quality observations is presented in Table 3. Mean survival in the control was 100%, above the 90% acceptance criterion. This indicates that the test conditions were suitable for adequate amphipod survival. The LC_{50} for the cadmium reference-toxicant test was 6.3 mg Cd/L, which is within the control chart limits of 4.6 to 12.7 mg Cd/L,. This indicates that the test organisms used in this study were of similar sensitivity to those previously tested at NewFields. Temperature, dissolved oxygen, salinity, and pH measurements were within acceptable limits throughout the test. Initial and final overlying and interstitial ammonia and sulfides were all below NOEC levels.

Mean mortality in the reference treatments were 10% (SB-Ref-ID01) and 4% (SB-Ref-ID02) which met the SMS performance criteria (<25% mortality) and indicated that the reference sediment was acceptable for suitability determination. Mean percentage survival in the test treatments ranged between 15% and 99%.

Table 1. Test Condition Summary for *Eohaustorius estuarius*.

Sample Identification	SB-Ref-ID01, SB-Ref-ID02, ID-100, ID-101, ID-102, ID-108, ID-000-MIX	
Date sampled	January 8 and January 29, 2009	
Date received	January 9, 2009 and January 29, 2009	
Sample storage conditions	4°C, dark	
Weeks of holding	5 weeks	
Source of control sediment	Northwest Aquatic Sciences (Yaquina Bay)	
Test Species	***E. estuarius***	
Supplier	Northwest Aquatic Sciences	
Date acquired	February 5, 2009	
Acclimation/holding time	5 days	
Age class	3-5 mm	
Test Procedures	PSEP 1995 with SMARM revisions	
Regulatory Program	SMS	
Test location	NewFields Northwest Laboratory	
Test type/duration	10-Day static	
Test dates	February 10 -20, 2009	
Control water	0.45 µm-filtered North Hood Canal sea water	
Test temperature	Recommended: 15 ± 1 °C	Achieved: 15.3 – 16.4 °C
Test Salinity	Recommended: 28 ± 2 ppt	Achieved: 26-29 ppt
Test dissolved oxygen	Recommended: > 5 mg/L	Achieved: 6.7-8.7 mg/L
Test pH	Recommended: 7.8 ± 0.5	Achieved: 7.6-8.3
SMS control performance standard	Recommended: Control ≤ 10% mortality	Achieved: 0%
SMS reference performance standard	Recommended: Reference mortality < 25%	Achieved: 10% SB-REF-ID01; 4% SB-REF-ID02
SMS pass/fail SQS	Treatment – Reference < 25% mortality = **PASS**	Fail: ID-000-Mix
SMS pass/fail CSL	Treatment – Reference < 30% mortality = **PASS**	Fail: ID-000-Mix
Reference Toxicant LC50	6.3 mg/L	
Acceptable Range	4.6 – 12.7 mg/L	
Test Lighting	Continuous	
Test chamber	1-Liter Glass Chamber	
Replicates/treatment	5 + 2 surrogates (one that is used for WQ measurements throughout the test)	
Organisms/replicate	20	
Exposure volume	175 mL sediment/ 775 mL water	
Feeding	None	
Water renewal	None	
Deviations from Test Protocol	None	

Table 2. Test Results for *Eohaustorius estuarius*.

Treatment	*Eohaustorius estuarius*		
	Mean survival (%)	Mean mortality (%)	Standard Deviation
Control	100	0	0.0
SB-REF-ID01	90	10	7.9
SB-REF-ID02	96	4	5.5
ID-100	98	2	2.7
ID-101	97	3	4.5
ID-102	92	8	7.6
ID-108	99	1	2.2
ID-000-MIX	15	85	11.7

Table 3. Water Quality Summary for *Eohaustorius estuarius*.

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			Salinity (ppt)			pH (units)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	8.2	7.7	8.4	15.6	15.4	15.9	28.0	28	28	7.9	7.7	8.3
SB-REF-ID01	8.2	7.6	8.5	15.5	15.4	15.7	28.5	28	29	8.1	7.9	8.3
SB-REF-ID02	8.1	7.6	8.5	15.5	15.3	15.7	28.4	28	29	8.1	7.8	8.3
ID-100	8.1	7.6	8.5	15.6	15.3	15.9	27.9	27	28	8.0	7.8	8.2
ID-101	8.0	7.0	8.3	15.5	15.3	15.8	27.0	27	27	8.0	7.8	8.2
ID-102	8.2	7.5	8.7	15.7	15.3	16.4	27.5	27	28	8.0	7.8	8.2
ID-108	8.2	7.6	8.4	15.5	15.3	15.7	26.9	26	27	8.0	7.6	8.2
ID-000-MIX	7.5	6.7	8.2	15.6	15.3	16	27.1	27	28	8.0	7.8	8.1

3.2 20-DAY JUVENILE POLYCHAETE BIOASSAY

A summary of *N. arenaceodentata* test conditions is shown in Table 4. Summaries of test endpoints and water quality measurements are included as Tables 5 and 6. No mortality was observed in the *N. arenaceodentata* control sediment and mean individual growth (MIG) in the control sediment was 0.86 mg/ind/day. This value falls within the test acceptability criteria of <10% mean mortality and ≥0.38 mg/ind/day mean individual growth (Kendall 1996), indicating that the test conditions were suitable for adequate polychaete survival and growth.

The LC_{50} value for the cadmium chloride reference-toxicant test was 9.9 mg/L. This value was within the control chart limits of 2.9 – 17.3 mg/L. This indicates that the test organisms used in this study were of similar sensitivity to those previously tested at NewFields.

Overlying and interstitial water sulfide measurements were all less than NOEC level (3.47 mg/L; Kendall and Barton 2004). All except SB-Ref-ID02 had ammonia levels below the NOEC (10 mg/L total ammonia) in the interstitial water at test initiation. The initial porewater measurement for SB-Ref-ID02 for ammonia was 13.8 mg/L, and the final measurement was 0.92 mg/LThe higher level of ammonia at test initiation does not appear to have affected the treatment performance as indicated by the high survival and growth rate observed.

The recommended SMS performance standard (Ecology 2008) to qualify a reference sample as suitable states that the mean individual growth for the reference sample relative to the control should be greater than 80% of the control. Since both reference samples had greater mean individual growth rates they are acceptable for suitability determinations. Mean individual growth for all control, references, and test sediments are shown in Table 5. Survival in the test treatments ranged from 92 to 100%; MIG in the test treatments ranged from 0.56 to 0.77 mg/ind/day.

Table 4. Test Condition Summary for *Neanthes arenaceodentata*.

Sample Identification	SB-Ref-ID01, SB-Ref-ID02, ID-100, ID-101, ID-102, ID-108, ID-000-MIX	
Date sampled	January 8 and January 29, 2009	
Date received	January 9, 2009 and January 29, 2009	
Sample storage conditions	4°C, dark	
Weeks of holding	5 weeks	
Source of control sediment	Northwest Aquatic Sciences (Yaquina Bay)	
Test Species	***N. arenaceodentata***	
Supplier	Don Reish/ CalState Long Beach	
Date acquired	February 5, 2009	
Acclimation/holding time	7 days	
Age class	Juvenile	
Test Procedures	PSEP 1995 with SMARM revisions	
Regulatory Program	SMS	
Test location	NewFields Northwest Laboratory	
Test type/duration	20-Day static renewal	
Test dates	February 12 to March 4, 2009	
Control water	0.45 µm-filtered North Hood Canal sea water	
Test temperature	**Recommended:** 20 ± 1 °C	**Achieved:** 19.3 – 21.1 °C
Test Salinity	**Recommended:** 28 ± 2 ppt	**Achieved**: 26 – 32 ppt
Test dissolved oxygen	**Recommended:** > 6.0 mg/L	**Achieved**: 6.1 – 7.8 mg/L
Test pH	**Recommended:** 8.0 ± 1.0	**Achieved:** 7.4 – 8.2
Initial biomass	**Recommended:** 0.5 – 1.0 mg DW **Minimum:** 0.25 mg DW	**Achieved:** 1.32mg DW
SMS control performance standard	**Recommended:** Control ≤ 10% mortality	**Achieved**: 0% mortality
	Recommended: Growth (MIG) ≥ 0.72 mg/ind/day **Minimum:** MIG ≥ 0.38 mg/ind/day	**Achieved**: 0.86 mg/ind/day
SMS reference performance standard	**Recommended**: Reference MIG/Control MIG ≥ 80%	**Achieved**:SB-Ref-ID01= 115%, SB-Ref-ID02= 116%
SMS pass/fail SQS	Treatment growth/Reference growth > 70% = **PASS**	ID-000-MIX failed SQS
SMS pass/fail CSL	Treatment growth/Reference growth >50% = **PASS**	All Pass
Reference Toxicant LC50	9.9 mg/L	
Acceptable Range	2.9 – 17.3 mg/L	
Test Lighting	Continuous	
Test chamber	1-Liter Glass Chamber	
Replicates/treatment	5 + 2 surrogates (one that is used for WQ measurements throughout the test)	
Organisms/replicate	5	
Exposure volume	175 mL sediment/ 950 mL water	
Feeding	40 mg/jar every other day	
Water renewal	Water is renewed every third day (1/3 volume of exposure chamber)	
Deviations from Test Protocol	Salinity slightly above recommended range in some treatments	

Table 5. Test Results for *Neanthes arenaceodentata*.

Treatment	Mean Percent Survival	Standard Deviation	Mean Individial Growth Rate (mg/ind/d)	Standard Deviation
Control	100	0.0	0.858	0.1
SB-REF-ID01	100	0.0	0.986	0.1
SB-REF-ID02	100	0.0	0.992	0.2
ID-100	96	8.9	0.721	0.1
ID-101	100	0.0	0.767	0.1
ID-102	92	11.0	0.736	0.1
ID-108	100	0.0	0.748	0.1
ID-000-MIX	92	11.0	0.563	0.1

Table 6. Water Quality Summary for *Neanthes arenaceodentata*.

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			pH (units)			Salinity (ppt)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	7.3	7.0	7.8	20.1	19.3	20.7	7.7	7.4	8.0	29.8	27	31
SB-REF-ID01	7.2	6.6	7.6	20.4	19.6	21.1	7.9	7.6	8.1	29.5	27	31
SB-REF-ID02	7.3	6.5	7.6	20.4	19.7	21.1	8.0	7.8	8.2	30.1	27	31
ID-100	7.2	6.8	7.6	20.3	19.6	21.0	7.8	7.5	8.0	29.5	27	31
ID-101	7.2	6.7	7.7	20.2	19.5	20.9	7.7	7.5	8.0	29.1	27	30
ID-102	7.2	6.8	7.6	20.4	19.7	21.1	8.0	7.6	8.2	29.7	27	31
ID-108	7.2	6.8	7.8	20.4	19.6	21.1	7.9	7.6	8.1	29.9	26	32
ID-000-MIX	6.7	6.1	7.5	20.5	19.9	21.1	7.9	7.6	8.0	29.1	26	30

3.3 LARVAL DEVELOPMENT BIOASSAY

Test conditions for the larval development bioassay are shown in Table 7, a summary of the test results from the mussel larvae test is presented in Table 8 and a summary of water quality observations is shown in Table 9. The larval test was validated by 4.9% mean combined mortality in the control treatment, within the acceptability criteria of <30%. Water quality parameters remained within the target limits throughout the 61-hour test. Ammonia and sulfide values detected in the test chambers were below the NOEC values for *M. galloprovincialis*.

The EC_{50} for the copper reference-toxicant test for combined proportion normal was 11.3 µg Cu/L, within the control chart limits (3.9 to 16.7 µg Cu/L). The results of the reference-toxicant test indicate that the test organisms used in this study were similar in sensitivity to those previously tested at NewFields.

Mean control-normalized normal survivals in the reference sediments were 84% in SB-Ref-ID01 and 89% in SB-Ref-ID02, indicating the references were suitable for comparisons against treatment performances. Survival in test sediments ranged from 11 - 99%.

Table 7. Test Condition Summary for *Mytilus galloprovincialis*.

Sample Identification	SB-Ref-ID01, SB-Ref-ID02, ID-100, ID-101, ID-102, ID-108, ID-000-MIX	
Date sampled	January 8 and January 29, 2009	
Date received	January 9, 2009 and January 29, 2009	
Sample storage conditions	4°C, dark	
Weeks of holding	5 weeks	
Test Species	*Mytilus galloprovenciallis.*	
Supplier	Carlsbad Aquafarms	
Date acquired	February 13, 2009	
Acclimation/holding time	NA	
Age class	<2-h old embryos	
Test Procedures	PSEP 1995 with SMARM revisions	
Regulatory Program	SMS	
Test location	NewFields Northwest Laboratory	
Test type/duration	48-96 Hour static test	
Test dates	February 13 – 16, 2009; – 61 hours	
Control water	0.45 µm-filtered North Hood Canal sea water	
Test temperature	Recommended: 16 ± 1 °C	Achieved: 15.2-16.7 °C
Test Salinity	Recommended: 28 ± 2 ppt	Achieved: 27-28 ppt
Test dissolved oxygen	Recommended: > 5.0 mg/L	Achieved: 6.9- 9.3 mg/L
Test pH	Recommended: 7.8 ± 0.5	Achieved: 7.3-8.0
Stocking Density	Recommended: 20 – 30 embryos/mL	Achieved: 25.0 embryos/mL
SMS control performance standard	Recommended: Control normal survival ≥ 70%	Achieved: 95.8%
SMS reference performance standard	Recommended: Reference survival/Control survival ≥ 65%	Achieved: SB-Ref-ID01 84.4%, SB-Ref-ID02 88.5%
SMS pass/fail SQS	(Treatment normal/Control Normal)/ (Reference normal/ Control Normal) > 0.85 = **PASS**	ID-100 Pass
SMS pass/fail CSL	(Treatment normal/Control Normal)/ (Reference normal/ Control Normal) > 0.70 = **PASS**	ID-100, ID-102, and ID-108 Pass
Reference Toxicant LC50	11.3 ug/L	
Acceptable Range	3.9 – 16.7ug/L	
Test Lighting	14 light:10 Dark	
Test chamber	1-Liter Glass Chamber	
Replicates/treatment	5 + 1 surrogate (used for WQ measurements throughout the test)	
Exposure volume	18 g sediment/ 900 mL water	
Feeding	None	
Water renewal	None	
Deviations from Test Protocol	None	

Table 8. Test Results for *Mytilus galloprovincialis*.

Treatment	Mean Normal Survivorship	Standard Deviation
Control	95.8	4.9
SB-REF-ID01	84.4	7.6
SB-REF-ID02	88.5	7.0
ID-100	99.1	4.9
ID-101	11.0	2.6
ID-102	73.9	11.6
ID-108	79.7	1.4
ID-000-MIX	60.3	11.0

Table 9. Water Quality Summary for *Mytilus galloprovincialis*.

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			pH (units)			Salinity (ppt)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	8.0	7.7	8.2	15.9	15.7	16.2	7.6	7.3	7.9	27.3	27	28
SB-REF-ID01	7.5	6.9	8.1	16	15.4	16.6	7.8	7.6	7.8	27.3	27	28
SB-REF-ID02	8.1	7.1	9.3	15.8	15.4	16.3	7.9	7.8	8.0	27.3	27	28
ID-100	7.7	7.1	80	15.8	15.5	16	7.9	7.8	7.9	27.3	27	28
ID-101	7.5	7.0	7.9	15.8	15.2	16.5	7.8	7.5	7.9	27.3	27	28
ID-102	7.6	7.2	7.8	15.9	15.5	16.7	7.8	7.7	7.9	27.3	27	28
ID-108	7.7	7.1	8.1	15.9	15.4	16.7	7.9	7.8	7.9	27.3	27	28
ID-000-MIX	7.6	7.1	7.9	15.9	15.4	16.7	7.8	7.8	7.9	27	27	27

4.0 DISCUSSION

Sediments were evaluated based on Sediment Management Standards (SMS) criteria. The biological criteria are based on both statistical significance (a statistical comparison) and the degree of biological response (a numerical comparison). The SMS criteria are derived from the Washington Department of Ecology Sampling and Analysis Plan Appendix (WDOE 2008). Comparisons were made for each treatment against each of the reference samples. Two numerical comparisons were made under SMS, the Sediment Quality Standards (SQS) and the Cleanup Standards Limit (CSL).

4.1 AMPHIPOD TEST SUITABILITY DETERMINATION

Under the SMS program, a test treatment will fail SQS if mean mortality in the test treatment is >25% more than the mean mortality in the appropriate reference sediment and the difference is statistically significant ($p \leq 0.05$). Treatments fail the CSL if mean mortality in the test treatment >30% relative to the reference sediment and the difference is statistically significant.

All test treatments met the SQS and CSL criteria for *E. estuarius* except for ID-000-Mix, which had significantly higher mortality than both reference samples and did not meet either SMS or CSL criteria (Table 10).

Table 10. SMS Comparison for Eohaustorius estuarius.

Treatment	Mean Mortality (%)	Statistically higher than SB-Ref-ID01	M_T-M_R	Statistically higher than SB-Ref-ID02	M_T-M_R	Fails SQS?	Fails CSL?
Control	0						
SB-REF-ID01	10						
SB-REF-ID02	4						
ID-100	2	No	-8	No	-2	No	No
ID-101	3	No	-7	No	-1	No	No
ID-102	8	No	-2	No	4	No	No
ID-108	1	No	-9	No	-3	No	No
ID-000-MIX	85	**Yes**	75	**Yes**	81	**Yes**	**Yes**
SQS: Statistical Significance; M_T-M_R >25% CSL: Statistical Significance; M_T-M_R >30%							

4.2 JUVENILE POLYCHAETE TEST SUITABILITY DETERMINATION

Juvenile polychaete test treatments fail to meet SQS criteria when the mean individual growth rate (MIG) in the test sediment is less than 70% of the mean individual growth in the reference sediment and the comparison is statistically significant ($p \leq 0.05$). The CSL criteria state that the test treatment fails if mean individual growth in the test sediment is less than 50% of mean individual growth in the reference and is statistically significant.

All test treatments were significantly less than both reference samples, but only treatment ID-000-Mix failed to meet SQS criteria (Table 11- 12).

Table 11. SMS Comparison for *Neanthes arenaceodentata* using SB-Ref-ID01.

Treatment	Mean Individial Growth Rate (mg/ind/d)	Significanly less than SB-Ref-ID01	MIG_T/ MIG_R	Fails SQS?	Fails CSL?
Control	0.858				
SB-REF-ID01	0.986				
SB-REF-ID02	0.992				
ID-100	0.721	**Yes**	0.731	No	No
ID-101	0.767	**Yes**	0.778	No	No
ID-102	0.736	**Yes**	0.746	No	No
ID-108	0.748	**Yes**	0.758	No	No
ID-000-MIX	0.563	**Yes**	0.571	**Yes**	No
SQS: Statistical Significance and MIG_T / MIG_R <70% CSL: Statistical Significance and MIG_T / MIG_R <50%					

Table 12. SMS Comparison for *Neanthes arenaceodentata* using SB-Ref-ID02.

Treatment	Mean Individial Growth Rate (mg/ind/d)	Significanly less than SB-Ref-ID02	MIG_T/ MIG_R	Fails SQS?	Fails CSL?
Control	0.858				
SB-REF-ID01	0.986				
SB-REF-ID02	0.992				
ID-100	0.721	**Yes**	0.727	No	No
ID-101	0.767	**Yes**	0.773	No	No
ID-102	0.736	**Yes**	0.742	No	No
ID-108	0.748	**Yes**	0.754	No	No
ID-000-MIX	0.563	**Yes**	0.568	**Yes**	No

SQS: Statistical Significance and MIG_T / MIG_R <70%
CSL: Statistical Significance and MIG_T / MIG_R <50%

4.3 LARVAL TEST SUITABILITY DETERMINATION

Larval test treatments fail SQS criteria if the percentage of normal larvae in the test treatment is significantly lower ($p \leq 0.1$) than that of the reference and if the normal larval development in the test treatment is less than 85% of the normal development in the reference. Treatments fail CSL criteria if the normal development is less than 70% of the response observed in the reference and if the difference is statistically significant.

When compared to SB-Ref-ID01, ID-100 and ID-108 were not significantly different and therefore met SMS criteria. ID-101, 102 and 000-Mix were significantly less than SB-Ref-ID01 but only ID-101 and 000-Mix fail SQS with ID-101 also failing CSL (Table 13). In comparison to SB-Ref-ID02, only ID-100 did not have significantly less normal survival. ID-101 and 000-Mix failed to meet both SQS and CSL criteria while ID-102 was slightly under SQS standards. ID-108 was significantly less than SB-Ref-ID02, but met both SMS criteria (Table 14).

Table 13. SMS Comparison for *Mytilus galloprovincialis.* using SB-Ref-ID01.

Treatment	Percent Normal	Statistically less than SB-Ref-ID01	Normal survival comparison to SB-Ref-ID01 $(N_T/N_C)/(N_R/N_C)$	Fails SQS?	Fails CSL?
Control	95.1				
SB-REF-ID01	84.4				
SB-REF-ID02	88.5				
ID-100	95.7	No	1.13	No	No
ID-101	11.0	**Yes**	0.13	**Yes**	**Yes**
ID-102	73.9	**Yes**	0.88	No	No
ID-108	79.7	No	0.94	No	No
ID-000-MIX	60.3	**Yes**	0.71	**Yes**	No
SQS: Statistical Significance; $N_{CT}<0.85*N_{CR}$ CSL: Statistical Significance; $N_{CT}<0.70*N_{CR}$					

Table 14. SMS Comparison for *Mytilus galloprovincialis.* using SB-Ref-ID02.

Treatment	Percent Normal	Statistically less than SB-Ref-ID02	Normal survival comparison to SB-Ref-ID01 $(N_T/N_C)/(N_R/N_C)$	Fails SQS?	Fails CSL?
Control	95.1				
SB-REF-ID01	84.4				
SB-REF-ID02	88.5				
ID-100	95.7	No	1.08	No	No
ID-101	11.0	**Yes**	0.12	**Yes**	**Yes**
ID-102	73.9	**Yes**	0.84	**Yes**	No
ID-108	79.7	**Yes**	0.90	No	No
ID-000-MIX	60.3	**Yes**	0.68	**Yes**	**Yes**
SQS: Statistical Significance; $N_{CT}<0.85*N_{CR}$ CSL: Statistical Significance; $N_{CT}<0.70*N_{CR}$					

5.0 CONCLUSION

Three samples failed to meet SQS or CSL performance criteria for one or more of the toxicity tests performed on the Irondale sediments (Table 15). Treatments ID-100 and ID-108 met all SQS and CSL criteria. Treatment ID-101 failed both criteria for the larval development test when compared to both reference sediments. Treatment ID-102 failed to meet only the SQS criterion in comparison to the reference sediment SB-Ref-ID02. Treatment ID-000-Mix had the lowest overall performance, failing to meet the SQS performance criteria for the amphipod, the juvenile polychaete, and the larval development test when compared to both reference sediments. In addition, treatment ID-000-Mix also failed to meet the CSL performance criteria for the amphipod test (against both references) and the larval development test (against SB-Ref-ID02 only).

Table 15. Treatment failures compared to Reference

Treatment	**Sediment Quality Standards**							**Cleanup Screening Levels**					
	Amphipod		**Polychaete**		**Larval**		**Microtox®**	**Amphipod**		**Polychaete**		**Larval**	
	SB-Ref-ID01	SB-Ref-ID02	SB-Ref-ID01	SB-Ref-ID02	SB-Ref-ID01	SB-Ref-ID02		SB-Ref-ID01	SB-Ref-ID02	SB-Ref-ID01	SB-Ref-ID02	SB-Ref-ID01	SB-Ref-ID02
ID-100													
ID-101					**X**	**X**						**X**	**X**
ID-102						**X**							
ID-108													
ID-000-MIX	**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**				**X**

X= does not meet criterion

6.0 REFERENCES

Ecology 2005. DMMP/SMS Clarification Paper: Interpreting Sediment Toxicity Tests: Consistency between Regulatory Programs. Presented at the 17th Annual Sediment Management Annual Review Meeting by Tom Gries, Toxics Cleanup Program/Sediment Management Unit, Washington Department of Ecology, Olympia, Washington.

Ecology 2008. Sediment Sampling and Analysis Plan Appendix: Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards (Chapter 173-204 WAC), Sediment Management Unit, Department of Ecology, Bellevue, Washington. Revised February 2008.

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Appendix A.

Microtox Report

Nautilus Environmental

Toxicological Evaluation of Sediment
NewFields

Microtox

Report date: February 19, 2009

Submitted to:

NEWFIELDS NORTHWEST
Port Gamble, WA

Washington Laboratory
5009 Pacific Hwy East
Suite 2
Tacoma, WA 98424

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SIGNATURE PAGE

Eric Tollefson

Eric Tollefson
Project Manager

Mary Ann Rempel-Hester
Laboratory Manager

1.0 INTRODUCTION

Sediment samples were collected and evaluated for toxicity as part of a project being conducted by NewFields Northwest. Sediment samples were tested for toxicity using Microtox tests.

2.0 METHODS

2.1 Samples

Five sediment and two reference site subsamples were collected by NewFields personnel on February 3, 2009 and were delivered on February 5, 2009 to the Nautilus Environmental laboratory in Tacoma, WA. The condition of the sample containers was inspected upon receipt and the identities compared with the information provided on the chain-of-custody forms. The samples were stored at 4±2°C in the dark prior to test initiation.

2.2 Test Procedures

The luminescent marine bacterium *Vibrio fischeri* was used as the test organism for the Microtox test. The bacteria were exposed to porewater extracted from sediment samples and light readings were measured after 5 minutes and 15 minutes of exposure. Test equipment included the Microtox Model 500 Analyzer, which measures light output and is equipped with a 15°C chamber to maintain test temperature in the samples and a 4°C chamber to keep the rehydrated bacteria chilled.

Vials of freeze-dried bacteria (Microtox® Acute Reagent Lot # 8M1018, Expiration date 12/2010) were obtained from Strategic Diagnostics, Inc. and stored at -20°C until use. On the day of the test, a vial was rehydrated with 1.0 ml of Microtox Reconstitution Solution, mixed thoroughly, and allowed to equilibrate for 30 minutes at 4°C. The bacteria were used within 2 hours of rehydration.

The tests were conducted in accordance with WDOE (2008) test protocol. These methods are summarized in Table 1. Approximately 25 ml of porewater was extracted from each sample by centrifuging for 30 minutes at 4500 G. The DO in each sample was between 50 and 100 percent saturation (5.0 to 10.2mg/L) and, as a result, the samples did not require aeration. The pH was adjusted to 7.8 to 8.2 using NaOH or HCl, if necessary. Sample salinity was adjusted to 20 ± 2 when necessary using artificial seasalt. The control was deionized water adjusted to 20 ppt with artificial seasalt. Each porewater was tested within 3 hours of extraction.

Tests were conducted using five replicates. Disposable glass cuvettes were placed in the Microtox test wells and 1 ml of salinity adjusted porewater was added. The rehydrated bacteria (reagent) were thoroughly mixed and 10 µl was added to each test cuvette. After an initial incubation period of 5 minutes, the control cuvette was placed in the read chamber of the Microtox Analyzer to set the instrument. Initial light readings (I_0) were then taken by placing each cuvette in the read chamber of the Microtox Analyzer and measurements were recorded on a data sheet. Light output was measured in each cuvette after an additional 5 minutes (I_5) and 15 minutes (I_{15}) of exposure.

Test acceptability criterion was final mean control light output greater than or equal to 80 percent of initial control mean output. The reference sample acceptability criterion was a final mean output greater than or equal to 80 percent of control final mean output. Any test data that were less than 80 percent of reference were evaluated statistically by conducting one-tailed t-tests on the change in output over time for porewater extracts compared to the reference. Where the reference did not meet acceptability criteria, comparisons were made against the alternate reference only.

A reference toxicant test using phenol was conducted in conjunction with the porewater tests to ensure that the sensitivity of the test was within the acceptable range of historical values determined in this laboratory.

Table 1. Summary of methods for the Microtox test.

Test dates	February 10 2008
Test organism source	Strategic Diagnostics
Batch number and expiration date	Lot#8M1018, Expiry 12/2010
Control	Saltwater (20 ppt) prepared with Crystal Sea artificial seasalt
Sample preparation	Centrifugation at 4500 G for 30 minutes; salinity adjustment to 20 ppt using Crystal Sea salt; pH adjustment to 7.8-8.2 ppt
Test chamber	Glass cuvette
Test volume	1 mL
Volume of inoculum/replicate	10 µL
Number of replicates/sample	5
Test temperature	15 ± 1°C
Aeration	None
Reference toxicant	Phenol

3.0 RESULTS

The results of toxicity tests conducted using Microtox are provided in Tables 2 and 3.

Table 2. **Results of Microtox tests showing change in light output of samples as a percentage of change in light output of control after 5 and 15 minute of exposure.**

Sample	Change in light output as a % of Control (5 minutes)	Change in light output as a % of Control (15 minutes)
Test #1		
SB-REF-ID-01	69	76
SB-REF-ID-02	103	114
ID-100	100	104
ID-101	99	101
ID-102	100	105
Test #2		
SB-REF-ID-01	64	66
SB-REF-ID-02	106	110
ID-108	99	99
ID-1XX	100	99

Table 3. Statistical analyses of Microtox results. Shaded data indicates > 20% difference and statistically significant difference ($p<0.05$) relative to the control or reference

	5-minute reading		15 minute reading	
Sample	Mean % of initial light output	Comparison To	Mean % of initital light output	Comparison To
Test 1				
Control	106 ± 4	---	101 ± 4	---
SB-REF-ID-01[1]	73 ± 3	---	77 ± 5	---
SB-REF-ID-02	109 ± 2	---	115 ± 6	---
ID-100	106 ± 5	SB-REF-ID-02	105 ± 7	SB-REF-ID-02
ID-101	105 ± 4	SB-REF-ID-02	102 ± 9	SB-REF-ID-02
ID-102	106 ± 2	SB-REF-ID-02	106 ± 5	SB-REF-ID-02
Test 2				
Control	102 ± 3	---	100 ± 3	---
SB-REF-ID-01[1]	65 ± 2	---	66 ± 2	---
SB-REF-ID-02	108 ± 2	---	109 ± 3	---
ID-108	101 ± 1	SB-REF-ID-02	98 ± 1	SB-REF-ID-02
ID-1XX	101 ± 2	SB-REF-ID-02	99 ± 2	SB-REF-ID-02

[1] Reference did not meet acceptability criteria, comparison made against reference SB-REF-ID-02 only.

3.1 QA/QC

The Microtox tests met control acceptance criteria and there were no deviations from protocol. Results of reference toxicant test conducted in conjunction with this testing program are provided in Table 4. The results of this test fell within the range of mean ± two standard deviations. This puts the results within the acceptable range of historical results for *Vibrio fischeri*, indicating that the sensitivity of the test organisms was appropriate.

Table 4. **Reference toxicant test results.**

Exposure Duration	Test date	Toxicant	EC50	Acceptable Range	CV (%)
5 Minutes	February 10, 2009	Phenol	28.9 mg/L	21.1 - 46.9	19.0
15 Minutes			33.0 mg/L	22.4 - 76.0	27.2

4.0 DISCUSSION

None of the samples exceeded sediment quality standards for microtox analysis per WDOE 2008 guidelines.

The ammonia value for reference SB-REF-ID-01 was relatively high (28.1mg/L) which may have contributed to the toxicity demonstrated.

5.0 REFERENCES

American Society of Testing and Materials (ASTM). 2000. Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates. ASTM Designation E 1706-00.

U.S. Environmental Protection Agency (USEPA). 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-99/064.

Washington Department of Ecology (WDOE). 2008. Sediment Sampling and Analysis Plan Appendix: Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards Publication No. 03-09-043. Revised February 2008.

APPENDIX A – Results Summaries and Statistical Analysis

Appendix Table A. Microtox 100 Percent Sediment Porewater Test
Sites SB-REF-ID-01,SB-REF-ID-02,ID-100,ID-101,ID-102
Client NewFields
Test Date: 2/10/09

Site	Light Reading								$T_{(mean)}/C_{(mean)}$	Quality Control Steps	
		Replicate								Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.		$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
CON	$I_{(0)}$	**94**	**94**	**96**	**98**	**96**	96				
	$I_{(5)}$	**94**	**99**	**107**	**104**	**102**	101			1.06	
	$I_{(15)}$	**90**	**92**	**99**	**104**	**96**	96			1.01	
	$C_{(5)}$	1.00	1.05	1.11	1.06	1.06	1.06	0.04			
	$C_{(15)}$	0.96	0.98	1.03	1.06	1.00	1.01	0.04			
SB-REF-ID-01	$I_{(0)}$	**64**	**65**	**64**	**63**	**64**	64				0.67
	$I_{(5)}$	**68**	**72**	**67**	**72**	**72**	70				
	$I_{(15)}$	**68**	**76**	**77**	**77**	**68**	73				
	$T_{(5)}$	0.71	0.75	0.70	0.75	0.75	0.73	0.03	0.69		
	$T_{(15)}$	0.71	0.79	0.81	0.81	0.71	0.77	0.05	0.76		
SB-REF-ID-02	$I_{(0)}$	**91**	**89**	**91**	**85**	**93**	90				0.94
	$I_{(5)}$	**99**	**96**	**98**	**95**	**102**	98				
	$I_{(15)}$	**112**	**98**	**99**	**96**	**110**	103				
	$T_{(5)}$	1.09	1.08	1.08	1.12	1.10	1.09	0.02	1.03		
	$T_{(15)}$	1.23	1.10	1.09	1.13	1.18	1.15	0.06	1.14		
ID-100	$I_{(0)}$	**111**	**109**	**100**	**103**	**105**	106				1.10
	$I_{(5)}$	**119**	**110**	**113**	**106**	**111**	112				
	$I_{(15)}$	**125**	**105**	**111**	**104**	**107**	110				
	$T_{(5)}$	1.07	1.01	1.13	1.03	1.06	1.06	0.05	1.00		
	$T_{(15)}$	1.13	0.96	1.11	1.01	1.02	1.05	0.07	1.04		
ID-101	$I_{(0)}$	**95**	**97**	**90**	**94**	**92**	94				0.98
	$I_{(5)}$	**98**	**100**	**92**	**106**	**96**	98				
	$I_{(15)}$	**94**	**95**	**93**	**109**	**86**	95				
	$T_{(5)}$	1.03	1.03	1.02	1.13	1.04	1.05	0.04	0.99		
	$T_{(15)}$	0.99	0.98	1.03	1.16	0.93	1.02	0.09	1.01		
ID-102	$I_{(0)}$	**98**	**97**	**90**	**90**	**100**	95				0.99
	$I_{(5)}$	**107**	**100**	**94**	**97**	**106**	101				
	$I_{(15)}$	**112**	**100**	**92**	**97**	**103**	101				
	$T_{(5)}$	1.09	1.03	1.04	1.08	1.06	1.06	0.02	1.00		
	$T_{(15)}$	1.14	1.03	1.02	1.08	1.03	1.06	0.05	1.05		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 80% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	**106%**	**YES**
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	**101%**	**YES**

YES: Control results are acceptable and can be used for statistical analyses.

NO: Control results are unacceptable.

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	**67%**	**NO**
S2	$I_{T(mean)}/I_{C(mean)}$:	**94%**	**YES**
S3	$I_{T(mean)}/I_{C(mean)}$:	**110%**	**YES**
S4	$I_{T(mean)}/I_{C(mean)}$:	**98%**	**YES**
S5	$I_{T(mean)}/I_{C(mean)}$:	**99%**	**YES**

YES: Use initial site values to calculate change in final light readings

NO: Use control initial mean value to calculate change in final light readings for each site.

Appendix Table A. Microtox 100 Percent Sediment Porewater Test
Sites SB-REF-ID-01,SB-REF-ID-02,ID-108,ID-1XX
Client NewFields
Test Date: 2/10/09

Site		Light Reading							$T_{(mean)}/C_{(mean)}$	Quality Control Steps	
		Replicate								Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.		$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
CON	$I_{(0)}$	96	91	90	92	96	93				
	$I_{(5)}$	97	91	90	94	102	95			1.02	
	$I_{(15)}$	97	91	86	91	98	93			1.00	
	$C_{(5)}$	1.01	1.00	1.00	1.02	1.06	1.02	0.03			
	$C_{(15)}$	1.01	1.00	0.96	0.99	1.02	1.00	0.03			
SB-REF-ID-01	$I_{(0)}$	57	58	58	57	62	58				0.63
	$I_{(5)}$	58	59	62	59	63	60				
	$I_{(15)}$	60	61	62	60	64	61				
	$T_{(5)}$	0.62	0.63	0.67	0.63	0.68	0.65	0.02	0.64		
	$T_{(15)}$	0.65	0.66	0.67	0.65	0.69	0.66	0.02	0.66		
SB-REF-ID-02	$I_{(0)}$	83	85	88	85	82	85				0.91
	$I_{(5)}$	90	90	97	91	88	91				
	$I_{(15)}$	92	89	97	94	90	92				
	$T_{(5)}$	1.08	1.06	1.10	1.07	1.07	1.08	0.02	1.06		
	$T_{(15)}$	1.11	1.05	1.10	1.11	1.10	1.09	0.03	1.10		
ID-108	$I_{(0)}$	85	87	82	87	81	84				0.91
	$I_{(5)}$	86	87	84	87	82	85				
	$I_{(15)}$	84	84	80	86	80	83				
	$T_{(5)}$	1.01	1.00	1.02	1.00	1.01	1.01	0.01	0.99		
	$T_{(15)}$	0.99	0.97	0.98	0.99	0.99	0.98	0.01	0.99		
ID-1XX	$I_{(0)}$	79	84	83	79	79	81				0.87
	$I_{(5)}$	81	84	86	79	80	82				
	$I_{(15)}$	78	82	85	76	78	80				
	$T_{(5)}$	1.03	1.00	1.04	1.00	1.01	1.01	0.02	1.00		
	$T_{(15)}$	0.99	0.98	1.02	0.96	0.99	0.99	0.02	0.99		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 80% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	**102%**	**YES**
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	**100%**	**YES**

YES: Control results are acceptable and can be used for statistical analyses.

NO: Control results are unacceptable.

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	**63%**	**NO**
S2	$I_{T(mean)}/I_{C(mean)}$:	**91%**	**YES**
S3	$I_{T(mean)}/I_{C(mean)}$:	**91%**	**YES**
S4	$I_{T(mean)}/I_{C(mean)}$:	**87%**	**YES**

YES: Use initial site values to calculate change in final light readings

NO: Use control initial mean value to calculate change in final light readings for each site.

APPENDIX B – Laboratory Bench Sheets

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields

Test Date: 2/10/09

Sample ID: See Below

Test No.: 0902-T069, T070, T071, T072, T073

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	$I_{(0)}$	5 min	94	94	96	98	96
	$I_{(5)}$	10min	94	99	107	104	102
	$I_{(15)}$	20 min	90	92	99	104	96
SB-REF-ID-01	$I_{(0)}$	5 min	64	65	64	63	64
	$I_{(5)}$	10min	68	72	67	72	72
	$I_{(15)}$	20 min	68	76	77	77	68
SB-REF-ID-02	$I_{(0)}$	5 min	91	89	91	85	93
	$I_{(5)}$	10min	99	96	98	95	102
	$I_{(15)}$	20 min	112	98	99	96	110
ID-100	$I_{(0)}$	5 min	111	109	100	103	105
	$I_{(5)}$	10min	119	110	113	106	111
	$I_{(15)}$	20 min	125	105	111	104	107
ID-101	$I_{(0)}$	5 min	95	97	90	94	92
	$I_{(5)}$	10min	98	100	92	106	96
	$I_{(15)}$	20 min	94	95	93	109	86
ID-102	$I_{(0)}$	5 min	98	97	90	90	100
	$I_{(5)}$	10min	107	100	94	97	106
	$I_{(15)}$	20 min	112	100	92	97	103

Comments:

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields

Sample ID: See Below

Test Date: 2/10/09

Test No.: 0902-T069, T070, T074, T075

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	$I_{(0)}$	5 min	96	91	90	92	96
	$I_{(5)}$	10min	97	91	90	94	102
	$I_{(15)}$	20 min	97	91	86	91	98
SB-REF-ID-01	$I_{(0)}$	5 min	57	58	58	57	62
	$I_{(5)}$	10min	58	59	62	59	63
	$I_{(15)}$	20 min	60	61	62	60	64
SB-REF-ID-02	$I_{(0)}$	5 min	83	85	88	85	82
	$I_{(5)}$	10min	90	90	97	91	88
	$I_{(15)}$	20 min	92	89	97	94	90
ID-108	$I_{(0)}$	5 min	85	87	82	87	81
	$I_{(5)}$	10min	86	87	84	87	82
	$I_{(15)}$	20 min	84	84	80	86	80
ID-1XX	$I_{(0)}$	5 min	79	84	83	79	79
	$I_{(5)}$	10min	81	84	86	79	80
	$I_{(15)}$	20 min	78	82	85	76	78
	$I_{(0)}$	5 min					
	$I_{(5)}$	10min					
	$I_{(15)}$	20 min					

Comments: ______

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy E., Suite 2
Tacoma, WA 98424

Turbidity Measurements

Client: Newfields
Date: 2/18/09 test date 2/10/08
Analyst: Et

Sample ID	Measurement (NTU)
Standard 0-10	4.97
Standard 0-100	49.9
Standard 0-1000	482
DI	0.08
CON	0.27
SBREF-ID-01	26.2
SB-REF-ID-02	8.52
ID-100	1.49
ID-101	4.82
ID-102	3.39
ID-108	13.0
ID-1XX	3.56
Standard 0-10	4.94
Standard 0-100	49.7
Standard 0-1000	483
DI	0.09

Measure standards and DI at beginning and end of analysis.

APPENDIX C – Water Quality Results

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: et

Client : Newfields

Test Date: 2/10/09

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 0902-T069-T075

Test Species: *Vibrio fischeri*

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
CON	20.2	20.2	6.8	6.8	8.33	8.18	0.1N HCl 20µL	99.9%	—
SB-REF-ID-01	31.1	31.1	6.5	6.5	7.17	7.92	150µL 0.1NaOH	99.4%	28.1
SB-REF-ID-02	31.3	31.3	6.5	6.5	7.41	7.99	150µL 0.1NaOH	99.4%	18.7
ID-100	25.0	25.0	6.7	6.7	7.91	—	—	100%	<1.0
ID-101	17.4	20.8	6.3	6.3	7.98	—	—	100%	<1.0
ID-102	20.2 ~~20.8~~ et	20.2	6.6	6.6	7.79	8.02	50µL 0.1NaOH	99.8%	8.2
ID-108	8.7	19.8	6.7	6.7	8.18	—	—	100%	<1.0

Sample Description:

Comments:

QA Check:

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: gt

Client : Newfields

Test Date: 2/10/09

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 0902-T069-T075

Test Species: *Vibrio fischeri*

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
ID-1XX	13.5	20.2	6.7	6.7	7.98	—	—	100%	<1.0

Sample Description: ______________________

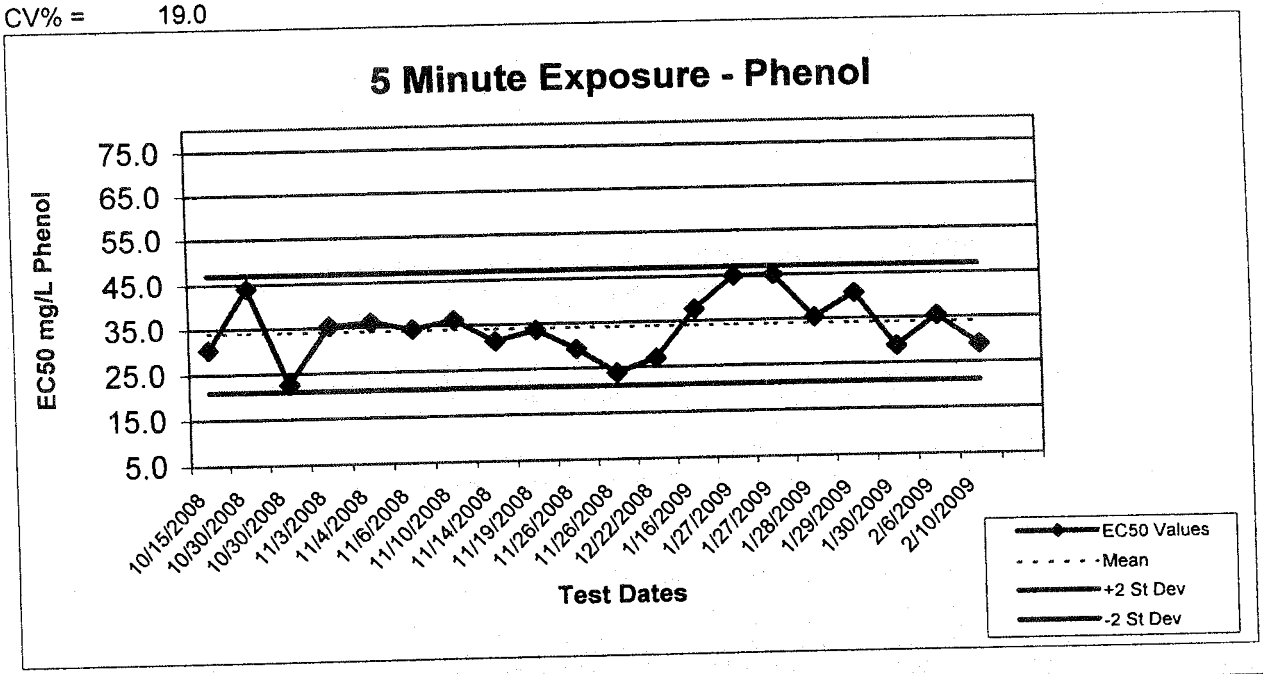
Comments: ______________________

QA Check: ______________________

APPENDIX D - Reference Toxicant Tests

Reference Toxicant Control Chart
Microtox 5-Minute Exposure

CV% = 19.0

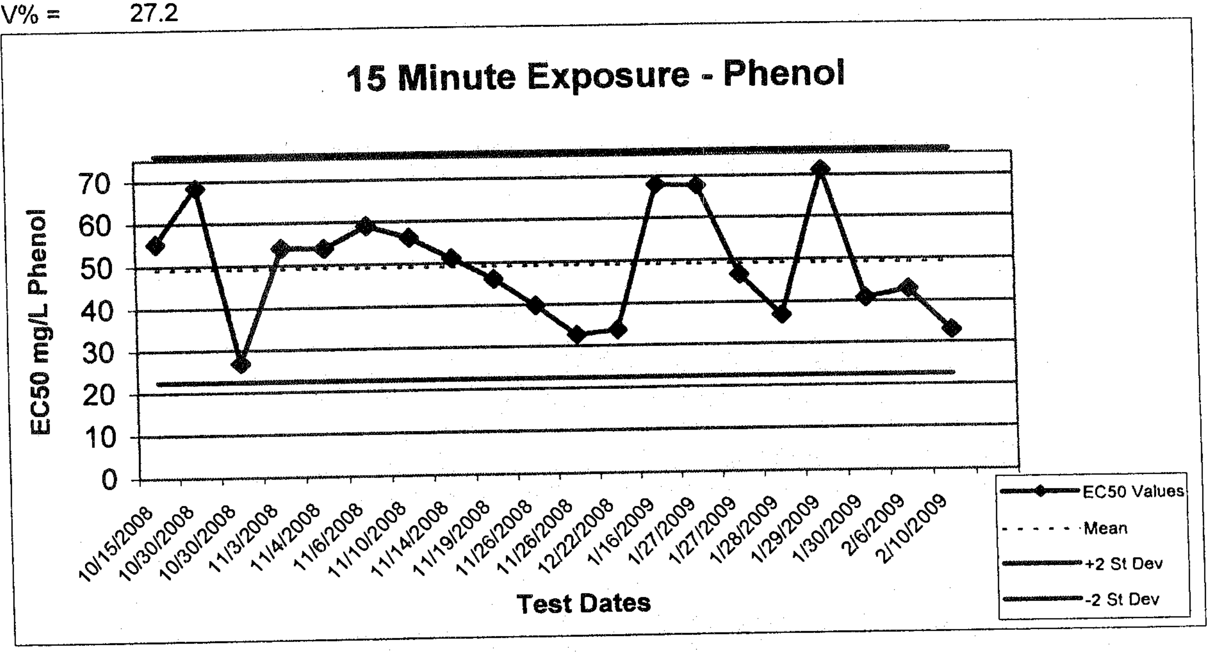


Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
10/15/2008	1242	17.9	30.4	34.0	6.5	21.1	46.9
10/30/2008	1114	25.9	44.0	34.0	6.5	21.1	46.9
10/30/2008	1228	13.3	22.6	34.0	6.5	21.1	46.9
11/3/2008	1440	20.8	35.4	34.0	6.5	21.1	46.9
11/4/2008	1310	21.2	36.0	34.0	6.5	21.1	46.9
11/6/2008	1253	20.2	34.3	34.0	6.5	21.1	46.9
11/10/2008	1256	21.3	36.2	34.0	6.5	21.1	46.9
11/14/2008	1313	18.4	31.3	34.0	6.5	21.1	46.9
11/19/2008	1223	19.8	33.7	34.0	6.5	21.1	46.9
11/26/2008	1352	17.2	29.2	34.0	6.5	21.1	46.9
11/26/2008	1139	14.0	23.8	34.0	6.5	21.1	46.9
12/22/2008	1418	15.8	26.9	34.0	6.5	21.1	46.9
1/16/2009	1009	22.1	37.6	34.0	6.5	21.1	46.9
1/27/2009	1252	26.4	44.9	34.0	6.5	21.1	46.9
1/27/2009	1331	26.5	45.1	34.0	6.5	21.1	46.9
1/28/2009	1245	20.8	35.4	34.0	6.5	21.1	46.9
1/29/2009	1236	23.9	40.6	34.0	6.5	21.1	46.9
1/30/2009	1229	16.9	28.7	34.0	6.5	21.1	46.9
2/6/2009	1513	20.8	35.4	34.0	6.5	21.1	46.9
2/10/2009	1228	17.0	28.9	34.0	6.5	21.1	46.9

a - Highest concentration of Phenol is 170 mg/L as of 10/1/08, 102 mg/L previously

Reference Toxicant Control Chart
Microtox 15-Minute Exposure

CV% = 27.2



Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
10/15/2008	1242	32.5	55.3	49.2	13.4	22.4	76.0
10/30/2008	1114	40.2	68.3	49.2	13.4	22.4	76.0
10/30/2008	1228	15.8	26.9	49.2	13.4	22.4	76.0
11/3/2008	1440	31.8	54.1	49.2	13.4	22.4	76.0
11/4/2008	1310	31.7	53.9	49.2	13.4	22.4	76.0
11/6/2008	1253	34.7	59.0	49.2	13.4	22.4	76.0
11/10/2008	1256	33.0	56.1	49.2	13.4	22.4	76.0
11/14/2008	1313	30.1	51.2	49.2	13.4	22.4	76.0
11/19/2008	1223	27.2	46.2	49.2	13.4	22.4	76.0
11/26/2008	1352	23.4	39.8	49.2	13.4	22.4	76.0
11/26/2008	1139	19.2	32.6	49.2	13.4	22.4	76.0
12/22/2008	1418	19.9	33.7	49.2	13.4	22.4	76.0
1/16/2009	1009	39.9	67.9	49.2	13.4	22.4	76.0
1/27/2009	1252	39.8	67.7	49.2	13.4	22.4	76.0
1/27/2009	1331	27.4	46.6	49.2	13.4	22.4	76.0
1/28/2009	1245	21.7	36.9	49.2	13.4	22.4	76.0
1/29/2009	1236	41.8	71.1	49.2	13.4	22.4	76.0
1/30/2009	1229	24.0	40.8	49.2	13.4	22.4	76.0
2/6/2009	1513	25.2	42.8	49.2	13.4	22.4	76.0
2/10/2009	1228	19.4	33.0	49.2	13.4	22.4	76.0

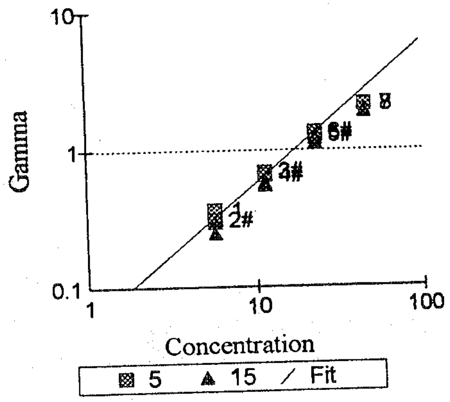
a - Highest concentration of Phenol is 170 mg/L as of 10/1/08, 102 mg/L previously

MicrotoxOmni Test Report

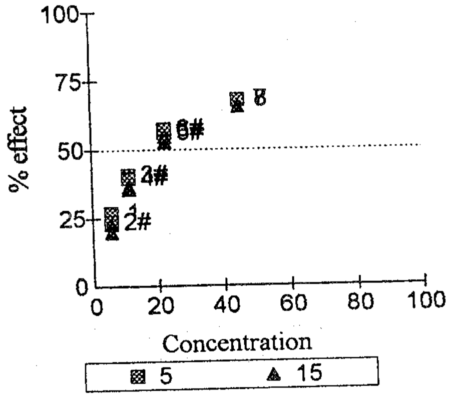
Date: 02/10/2009 12:28 PM

Test Protocol: Basic Test
Sample: 170mg/L Phenol
Toxicant: 170mg/L Phenol
Reagent Lot no.: 8M1018
Test description: Reference Toxicant
Test name: RT021009VF
Database file: C:\Program Files\MicrotoxOmni\Edge Analytical.mdb

Plot of Gamma vs Concentration



Plot of %Effect vs Concentration



			5 Mins Data:			15 Mins Data:		
Sample	Conc	Io	It	Gamma	% effect	It	Gamma	% effect
Control	0.000	97.21	108.15	1.113 #		97.02	0.9980 #	
Control	0.000	99.56	111.58	1.121 #		100.60	1.010 #	
1	5.625	98.39	80.29	0.3684	26.92%	76.09	0.2986	22.99%
2	5.625	104.92	89.39	0.3106 #	23.70%	84.33	0.2494 #	19.96%
3	11.25	106.60	70.32	0.6927 #	40.92%	67.89	0.5769 #	36.58%
4	11.25	105.84	71.37	0.6559 #	39.61%	68.35	0.5551 #	35.69%
5	22.50	106.11	52.09	1.275 #	56.04%	50.28	1.119 #	52.82%
6	22.50	104.95	49.99	1.344 #	57.34%	47.83	1.204 #	54.62%
7	45.00	100.54	36.11	2.109	67.84%	35.16	1.872	65.18%
8	45.00	102.33	36.77	2.108	67.82%	35.50	1.895	65.45%

\# - used in calculation; * - invalid data; D - deleted from calcs.
Autocalc has been used.

Calculations on 5 Mins data:
EC50 Concentration:17.02% (95% confidence range: 15.83 to 18.30)
95% Confidence Factor: 1.075
Estimating Equation:LOG C =0.9701 x LOG G +1.231
Coeff. of Determination (R^2):0.9955
Slope: 1.026
Correction Factor: 1.117

Calculations on 15 Mins data:
EC50 Concentration:19.36% (95% confidence range: 17.96 to 20.87)
95% Confidence Factor: 1.078
Estimating Equation:LOG C =0.9067 x LOG G +1.287
Coeff. of Determination (R^2):0.9962
Slope: 1.099
Correction Factor: 1.004

APPENDIX E – Chain-of Custody Forms

NEWFIELDS

NewFields Northwest, LLC.
Shipping: 4729 NE View Dr.
Mailing: P.O. Box 216
Port Gamble, WA. 98364
Tel: (360) 297-6040, Fax: (360)297-7268

CHAIN OF CUSTODY

13413

Destination Lab: Nautilus
Destination Contact:
Date: 04 Feb. '09
Turn-Around-Time: Standard
Project Name: Irondale
Contract/PO: NA

Sample Originator: NewFields
Contact Name: Brian Hester
Address: Same as above
Phone: ↓
Fax: ↓
E-mail: bhester@newfields.com

Report Results To: NewFields
Contact Name: Brian Hester
Address: Same as above

Phone: Same as above
Fax: ↓
Email: bhester@newfields.com

Invoicing To: NewFields
Comments or Special Instructions:

No.	Sample ID	Matrix	No. & Type of Container	Date & Time	Analysis: MicroTox						Preservation	Sample Temp Upon Receipt	LAB ID
1	SB.Ref.ID.02	Sd/SS	1G	2/3/09, 1130	X						4°C	1.7°C	S09-005
2	SB.Ref.ID.01	↓	↓	1130	X						↓	0.9	S09-006
3	ID.100			1140	X							0.7	S09-007
4	ID.101			1145	X							0.9	S09-008
5	ID.102			1145	X							1.5	S09-009
6	ID.108			1150	X							0.7	S09-010
7	ID.1XX			1410	X							1.7	S09-011
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													

	Relinquished by:	Recieved by:	Relinquished by:	Recieved by:
Print Name:	Mary Bacon	Laura Shanks		
Signature:	Mary Bacon	Laura Shanks		
Affiliation:	NewFields	Nautilus Env.		
Date/Time:	2/4/09, 0945	2/5/09 920		

Matrix Codes
FW = Fresh Water
WW = Waste Water
SB = Salt & Brackish Water
SS = Soil & Sediment
TS = plant & Animal Tissue
OT = Other

WHITE – return to originator • YELLOW – lab • PINK – retained by originator

Appendix B.

NewFields Laboratory Bench Sheets

NEWFIELDS

10 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATA SHEET

CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation
NEWFIELDS JOB NUMBER 0	PROJECT MANAGER Brian Hester

SPECIES *Eohaustorius estuarius*		NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL PSEP 1995
TEST START DATE 10-Feb-09	TIME 1330	TEST END DATE 20-Feb-09	TIME 1000

			Test Conditions	WATER QUALITY DATA DO (mg/L) >5.0 mg/L		Temperature (°C) 15±1		Salinity (ppt) 28±1		pH 7.8±0.5		Tech	Date
Client/NewFields ID	Day	Rep	Jar#	meter	mg/L	meter	deg C	meter	ppt	meter	unit		
Control	0	WQ	22	4	8.2	4	15.7	1	28	1	7.8	MMB	2/10/09
SB-REF-ID01	0	WQ	35	|	8.2	|	15.6	|	28	|	8.0	|	|
SB-REF-ID02	0	WQ	36	|	8.3	|	15.6	|	28	|	8.0	|	|
ID-100	0	WQ	42	|	8.3	|	15.7	|	28	|	8.1	|	|
ID-101	0	WQ	24	|	8.2	|	15.7	|	27	|	7.9	|	|
ID-102	0	WQ	9	|	7.8	|	16.2	|	28	|	7.8	|	|
ID-108	0	WQ	41	|	8.3	|	15.7	|	27	|	8.1	|	|
ID-000-MIX	0	WQ	19	↓	7.7	↓	16.0	↓	28	↓	7.8	↓	↓
Control	1	WQ		4	8.2	4	15.9	1	28	1	7.8	MMB	2/11
SB-REF-ID01	1	WQ		|	8.2	|	15.7	|	28	|	8.0	|	|
SB-REF-ID02	1	WQ		|	8.2	|	15.7	|	28	|	8.0	|	|
ID-100	1	WQ		|	8.2	|	15.7	|	28	|	8.0	|	|
ID-101	1	WQ		|	8.1	|	15.8	|	27	|	7.9	|	|
ID-102	1	WQ		|	8.0	|	16.4	|	27	|	7.8	|	|
ID-108	1	WQ		|	8.3	|	15.7	|	27	|	8.0	|	|
ID-000-MIX	1	WQ		↓	7.9	↓	15.7	↓	27	↓	7.9	↓	↓

NEWFIELDS

10 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATA SHEET

CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation
NEWFIELDS JOB NUMBER 0	PROJECT MANAGER Brian Hester

SPECIES *Eohaustorius estuarius*		NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL PSEP 1995
TEST START DATE 10-Feb-09	TIME	TEST END DATE 20-Feb-09	TIME

WATER QUALITY DATA

Test Conditions				DO (mg/L) >5.0 mg/L		Temperature (°C) 15±1		Salinity (ppt) 28±1		pH 7.8±0.5		Tech	Date
Client/NewFields ID	Day	Rep	Jar#	meter	mg/L	meter	deg C	meter	ppt	meter	unit		
Control	2	WQ		3	7.7	3	15.4	3	28	3	8.1	MMB	2/12/09
SB-REF-ID01	2	WQ		↓	7.6	↓	15.4	↓	28	↓	8.1	↓	↓
SB-REF-ID02	2	WQ		↓	7.8	↓	15.4	↓	28	↓	8.1	↓	↓
ID-100	2	WQ		↓	7.6	↓	15.4	↓	27	↓	7.9	↓	↓
ID-101	2	WQ		↓	7.6	↓	15.4	↓	27	↓	8.1	↓	↓
ID-102	2	WQ		↓	7.5	↓	15.5	↓	27	↓	8.1	↓	↓
ID-108	2	WQ		↓	7.6	↓	15.5	↓	27	↓	7.6	↓	↓
ID-000-MIX	2	WQ		↓	6.7	↓	15.6	↓	27	↓	8.0	↓	↓
Control	3	WQ		3	7.9	3	15.4	3	28	3	7.8	CR	2/13
SB-REF-ID01	3	WQ		↓	8.1	↓	15.4	↓	28	↓	7.9	↓	↓
SB-REF-ID02	3	WQ		↓	8.1	↓	15.4	↓	28	↓	8.0	↓	↓
ID-100	3	WQ		↓	8.0	↓	15.4	↓	28	↓	8.1	↓	↓
ID-101	3	WQ		↓	8.1	↓	15.3	↓	27	↓	8.1	↓	↓
ID-102	3	WQ		↓	8.0	↓	15.3	↓	27	↓	8.1	↓	↓
ID-108	3	WQ		↓	8.1	↓	15.3	↓	26	↓	8.1	↓	↓
ID-000-MIX	3	WQ		↓	6.9	↓	15.3	↓	27	↓	8.0	↓	↓

NEWFIELDS

10 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATA SHEET

CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation	SPECIES *Eohaustorius estuarius*		NEWFIELDS LABORATORY Port Gamble Bath 3		PROTOCOL PSEP 1995
NEWFIELDS JOB NUMBER 0	PROJECT MANAGER Brian Hester	TEST START DATE 10-Feb-09	TIME	TEST END DATE 20-Feb-09	TIME	

				WATER QUALITY DATA									
			Test Conditions	DO (mg/L) >5.0 mg/L		Temperature (°C) 15±1		Salinity (ppt) 28±1		pH 7.8±0.5		Tech	Date
Client/NewFields ID	Day	Rep	Jar#	meter	mg/L	meter	deg C	meter	ppt	meter	unit		
Control	4	WQ		3	8.1	3	15.4	3	28	3	7.9	CR	2/14/09
SB-REF-ID01	4	WQ		↓	8.2	↓	15.5	↓	28	↓	8.1	↓	↓
SB-REF-ID02	4	WQ		↓	8.1	↓	15.5	↓	28	↓	8.0	↓	↓
ID-100	4	WQ		↓	8.1	↓	15.4	↓	28	↓	8.1	↓	↓
ID-101	4	WQ		↓	8.0	↓	15.5	↓	27	↓	8.1	↓	↓
ID-102	4	WQ		↓	8.2	↓	15.6	↓	27	↓	8.1	↓	↓
ID-108	4	WQ		↓	8.2	↓	15.6	↓	27	↓	8.1	↓	↓
ID-000-MIX	4	WQ		↓	6.7	↓	15.6	↓	27	↓	8.1	↓	↓
Control	5	WQ		3	② ~~6.1~~ 8.4	3	15.4	3	28	3	7.7	CR	2/15/09
SB-REF-ID01	5	WQ		↓	~~5.6~~ 8.5	↓	① ~~29~~ 15.4	↓	29	↓	8.0	↓	↓
SB-REF-ID02	5	WQ		↓	~~5.6~~ 8.5	↓	15.4	↓	28	↓	8.1	↓	↓
ID-100	5	WQ		↓	8.4	↓	15.9	↓	28	↓	7.8	↓	↓
ID-101	5	WQ		↓	8.3	↓	15.5	↓	27	↓	7.8	↓	↓
ID-102	5	WQ		↓	8.5	↓	15.5	↓	27	↓	7.8	↓	↓
ID-108	5	WQ		↓	8.4	↓	15.4	↓	27	↓	7.8	↓	↓
ID-000-MIX	5	WQ		↓	7.9	↓	15.8		27	↓	7.9	↓	↓

① ~~WE~~ 2/15/09 CR

② probe not functioning properly - repaired and calibrated now functioning normally CR 2/15/09

NEWFIELDS

10 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATA SHEET

CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation
NEWFIELDS JOB NUMBER 0	PROJECT MANAGER Brian Hester

SPECIES *Eohaustorius estuarius*		NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL PSEP 1995
TEST START DATE 10-Feb-09	TIME	TEST END DATE 20-Feb-09	TIME

				WATER QUALITY DATA									
			Test Conditions	DO (mg/L) >5.0 mg/L		Temperature (°C) 15±1		Salinity (ppt) 28±1		pH 7.8±0.5		Tech	Date
Client/NewFields ID	Day	Rep	Jar#	meter	mg/L	meter	deg C	meter	ppt	meter	unit		
Control	6	WQ		3	8.2	3	15.4	3	28	3	8.3	MMB	2/16/09
SB-REF-ID01	6	WQ		↓	8.3	↓	15.4	↓	29	↓	8.3	↓	↓
SB-REF-ID02	6	WQ		↓	8.3	↓	15.3	↓	29	↓	8.3	↓	↓
ID-100	6	WQ		↓	8.3	↓	15.3	↓	28	↓	8.2	↓	↓
ID-101	6	WQ		↓	8.2	↓	15.3	↓	27	↓	8.2	↓	↓
ID-102	6	WQ		↓	8.5	↓	15.5	↓	28	↓	8.2	↓	↓
ID-108	6	WQ		↓	8.2	↓	15.4	↓	27	↓	8.2	↓	↓
ID-000-MIX	6	WQ		↓	7.9	↓	15.4	↓	27	↓	8.1	↓	↓
Control	7	WQ		3	8.1	3	15.8	3	28	3	7.9	BH	2/17/09
SB-REF-ID01	7	WQ		↓	8.4	↓	15.6	↓	29	↓	8.0	↓	↓
SB-REF-ID02	7	WQ		↓	8.2	↓	15.6	↓	29	↓	8.1	↓	↓
ID-100	7	WQ		↓	8.4	↓	15.6	↓	28	↓	8.0	↓	↓
ID-101	7	WQ		↓	8.2	↓	15.5	↓	27	↓	8.0	↓	↓
ID-102	7	WQ		↓	8.6	↓	15.7	↓	28	↓	8.1	↓	↓
ID-108	7	WQ		↓	8.4	↓	15.6	↓	27	↓	8.0	↓	↓
ID-000-MIX	7	WQ		↓	8.2	↓	15.6	↓	27	↓	8.0	↓	↓

NEWFIELDS

10 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATA SHEET

CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation	SPECIES *Eohaustorius estuarius*		NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL PSEP 1995
NEWFIELDS JOB NUMBER 0	PROJECT MANAGER Brian Hester	TEST START DATE 10-Feb-09	TIME	TEST END DATE 20-Feb-09	TIME

				WATER QUALITY DATA									
			Test Conditions	DO (mg/L) >5.0 mg/L		Temperature (°C) 15±1		Salinity (ppt) 28±1		pH 7.8±0.5		Tech	Date
Client/NewFields ID	Day	Rep	Jar#	meter	mg/L	meter	deg C	meter	ppt	meter	unit		
Control	8	WQ		3	8.4	3	15.6	3	28	3	8.1	KKF	2/18/09
SB-REF-ID01	8	WQ		↓	7.9	↓	15.6	↓	29	↓	8.2	↓	↓
SB-REF-ID02	8	WQ		↓	7.6	↓	15.5	↓	29	↓	8.2	↓	↓
ID-100	8	WQ		↓	7.6	↓	15.6	↓	28	↓	8.1	↓	↓
ID-101	8	WQ		↓	7.0	↓	15.6	↓	27	↓	8.0	↓	↓
ID-102	8	WQ		↓	8.5	↓	15.7	↓	28	↓	7.8	↓	↓
ID-108	8	WQ		↓	8.0	↓	15.6	↓	27	↓	8.1	↓	↓
ID-000-MIX	8	WQ		↓	7.2	↓	15.6	↓	27	↓	7.8	↓	↓
Control	9	WQ		3	8.3	3	15.5	3	28	3	7.9	MMB	2/19/09
SB-REF-ID01	9	WQ		↓	8.4	↓	15.5	↓	29	↓	7.9	↓	↓
SB-REF-ID02	9	WQ		↓	8.2	↓	15.5	↓	29	↓	7.8	↓	↓
ID-100	9	WQ		↓	8.5	↓	15.6	↓	28	↓	7.8	↓	↓
ID-101	9	WQ		↓	8.3	↓	15.5	↓	27	↓	7.8	↓	↓
ID-102	9	WQ		↓	8.7	↓	15.5	↓	28	↓	8.1	↓	↓
ID-108	9	WQ		↓	8.4	↓	15.5	↓	27	↓	7.8	↓	↓
ID-000-MIX	9	WQ		↓	8.0	↓	15.6	↓	27	↓	8.0	↓	↓

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NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	Organism:	NewFields Test ID:	Test Duration (days):
Irondale	Eohs		

PRETEST / [✓ INITIAL] / FINAL / OTHER (circle one) DAY of TEST: 0

[✓ OVERLYING (OV)] / POREWATER (PW) (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
Control	surr	TS 2/10/09	<0.5	17	TS 2/10/09	N	NA →		0.006
Ref ID01			1.99						0.016
Ref ID02			1.50						0.009
ID-100			<0.5						0.007
101			<0.5						0.020
102			<0.5						0.013
108			<0.5						0.030
000-mix	↓	↓	<0.5	↓	↓	↓	↓		0.020

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NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project: Irondale	**Organism:** Eohs	**NewFields Test ID:**	**Test Duration (days):**

PRETEST / [✓ INITIAL] / FINAL / OTHER (circle one) **DAY of TEST:** 0
OVERLYING (OV) / [✓ POREWATER (PW)] (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
Control	surr	TS 2/10/09	<0.5	17	TS 2/10/09	N	6.7	28	0.072
Ref ID01	↓	↓	3.55	↓	↓	↓	6.9	28	0.162
Ref ID02	↓	↓	3.87	↓	↓	↓	7.0	27	0.126
ID-100	↓	↓	<0.5	↓	↓	↓	7.3	28	0.133
101	↓	↓	<0.5	↓	↓	↓	7.4	27	0.200
102	↓	↓	1.11	↓	↓	↓	7.5	27	0.053
108	↓	↓	<0.5	↓	↓	↓	7.5	27	0.258
000-MIX	↓	↓	<0.5	↓	↓	↓	7.5	27	0.201

P:\BIOASSAY FILES\Lab Logs & Forms\Ammonia Analysis Record.doc
Last printed 1/23/2009 10:48:00 AM

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NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project: Irondale	**Organism:** Eohs	**NewFields Test ID:**	**Test Duration (days):** 10 day

PRETEST / INITIAL / [✓ FINAL] / OTHER (circle one) **DAY of TEST:** 10
[✓ OVERLYING (OV)] / POREWATER (PW) (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
2.20.09	18.5	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
Control	Surr	2.20.09 BH	<0.5	17°	2.20.09 BH	N			0.000
SB-Ref-1D01	↓	↓	<0.5	↓	↓	Y			— ②
SB-Ref-1D02	↓	↓	<0.5	↓	↓	N			0.003
1D-100	↓	↓	<0.5	↓	↓	N			0.003
1D-101	↓	↓	<0.5	↓	↓	N			0.005
1D-102	↓	↓	<0.5	↓	↓	N			0.004
1D-108	↓	↓	<0.5	↓	↓	N			0.009
1D-000-MIX	↓	↓	<0.5 ①	↓	↓	N			0.007

① All values 0.000 mg/L except 1D-000 mix @ 0.0526 mg/L
② sample not taken. surrogate broken down for animal recovery

NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	**Organism:**	**NewFields Test ID:**	**Test Duration (days):**
SAIC Irondale	Eoh		10day

PRETEST / INITIAL / [✓ FINAL] / OTHER (circle one) **DAY of TEST:** 10
~~OVERLYING (OV)~~ / [✓ POREWATER (PW)] (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
2.20.09	18.5°	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
Control		2.20.09 CR	<0.5	17.5	2.20.09 BH	N	③ 7.5 ~~7.4~~	28	0.150 ②
~~SB-Ref-1001~~									① ↓
SB Ref 1002		↓	<0.5	17.5	2.20.09 BH	N	③ 7.5 ~~7.3~~	29	0.425
ID-100		↓	<0.5	↓	↓	↓	7.6	28	0.250
ID-101		↓	<0.5	↓	↓	↓	7.7	30	1.225
ID-102		↓	<0.5	↓	↓	↓	7.7	30	0.175
ID-108		↓	<0.5	↓	↓	↓	7.7	30	0.350
ID-000-~~XX~~ MIX		↓	<0.5	↓		↓	7.5	30	1.650

① Sample Broken down for animal recovery. No PW

② Samples diluted 1ml/25mL for sulfide measurement due to low PW recovery value overestimate due to dilution factor (x25)

③ mR 2.20.09 BH

NEWFIELDS

10-DAY SOLID PHASE TEST OBSERVATION DATA

CLIENT SAIC	**PROJECT** Irondale Intertidal Sediment Investigation	**SPECIES** *Eohaustorius estuarius*	**NEWFIELDS LABORATORY** Port Gamble Bath 3	**PROTOCOL** PSEP 1995
NEWFIELDS JOB NUMBER 0	**PROJECT MANAGER** Brian Hester	**TEST START DATE** 10-Feb-09	**TEST END DATE** 20-Feb-09	

#E = Emergence
#M = Number of Mortality
G = Growth
(fungal, bacterial, or algal)
D = No Air Flow (DO?)
N = Normal

Initial # of Organisms: 20

Client/NewFields ID	Rep	Jar #	Day 1 Date 2/11 Technician CR	Day 2 Date 2/12 Technician MMB	Day 3 Date 2/13 Technician CR	Day 4 Date 2/14 Technician CR	Day 5 Date 2/15 Technician CR	Day 6 Date 2/16 Technician MMB	Day 7 Date 2/17 Technician BH	Day 8 Date 2/18 Technician KKF	Day 9 Date 2/19 Technician MMB	Day 10 Date 2/20 Technician TS	Number Alive	
Control	1		N	N	N	N	N	N	N	N	N	N	20	
	2												20	
	3												20	
	4												20	
	5							↓					20	
SB-REF-ID01	1		↓		↓			N					0	-not added
	2		1E		1E			1M					18	Surr.=16,2M
	3		2E	↓	N			N					20	
	4		N	G									17	1M
	5			N									19	1M
SB-REF-ID02	1												18	2M
	2												20	
	3												20	
	4									↓			20	
	5									1E			18	1M
ID-100	1									N			20	
	2												19	
	3												19	
	4		↓										20	
	5		1E	↓	↓	↓	↓	↓	↓	↓	↓	↓	20	

NEWFIELDS

10-DAY SOLID PHASE TEST OBSERVATION DATA

CLIENT SAIC	**PROJECT** Irondale Intertidal Sediment Investigation	**SPECIES** *Eohaustorius estuarius*	**NEWFIELDS LABORATORY** Port Gamble Bath 3	**PROTOCOL** PSEP 1995
NEWFIELDS JOB NUMBER 0	**PROJECT MANAGER** Brian Hester	**TEST START DATE** 10-Feb-09	**TEST END DATE** 20-Feb-09	

#E = Emergence
#M = Number of Mortality
G = Growth
(fungal, bacterial, or algal)
D = No Air Flow (DO?)
N = Normal

Initial # of Organisms: 20

ENDPOINT DATA AND OBSERVATIONS

Client/NewFields ID	Rep	Jar #	Day 1 Date 2/11 Technician CR	Day 2 Date 2/12 Technician MMB	Day 3 Date 2/13 Technician CR	Day 4 Date 2/14 Technician CR	Day 5 Date 2/15 Technician CR	Day 6 Date 2/16 Technician MMB	Day 7 Date 2/17 Technician BH	Day 8 Date 2/18 Technician KKF	Day 9 Date 2/19 Technician MMB	Day 10 Date 2/20 Technician TB	Number Alive	
ID-101	1		1E	1E	N	1E	N	N	N	N	N	N	20	
	2		1E	2E	2E	1E	3E	1E		2E			18	
	3		1E	2E	N	N	3E	1E		N	↓		19	
	4		N	N	1E	1E	N	N		↓	2E		20	
	5		N	3E	2E	N	1E	1E		1E	N		40	- double added
ID-102	1		N	1E	1E	N	N	N		1E	N		20	
	2		1E	1E, 1M	N	N				1E	N		16	
	3		N	N		N				1E	1E		18	
	4					1E				N	1E		19	
	5					N					N		19	
ID-108	1										N		20	
	2												19	
	3									↓			20	
	4									④ N			20	
	5		↓	↓	↓		↓	↓	↓	N	↓		20	
ID-000-MIX	1		①	1E ②	1E ②	②	②	5M ②	3M	③ 2E	5M		6	7M
	2			1M	N		1E	9M	6M	③ 6E	9M		1	3M
	3							3M	3M	③ 4E	5M		5	2M
	4							9M	7M	③ 4E	9M		1	6M
	5		↓	↓	↓ ↓	↓ ↓	↓	2M ↓	1M	③ 3E	3M	↓	2	5M

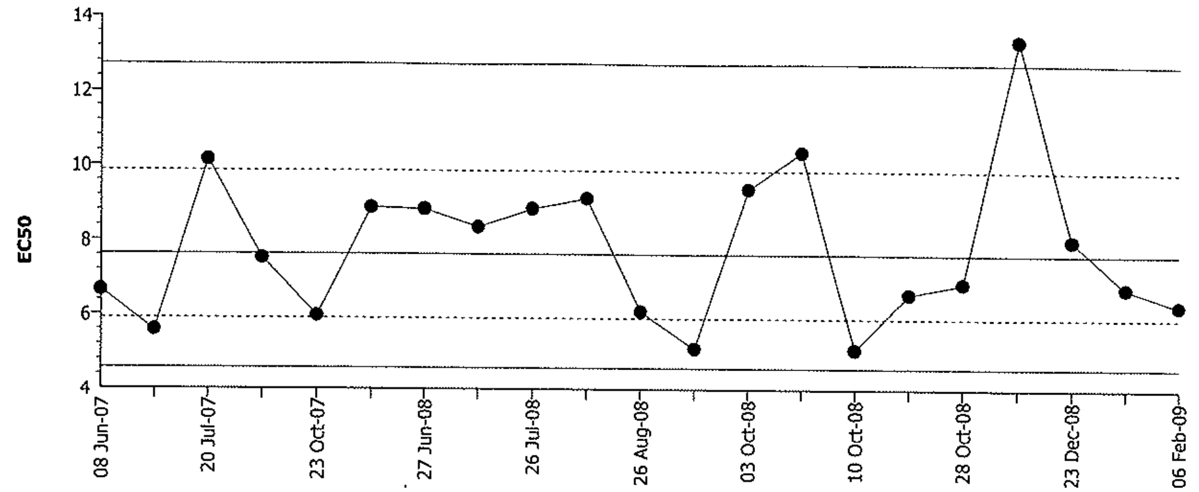
① Thick slick of oil on surface of water CR
② Thinner oil slick on surface, MMB 2/12/09.
③ Oil sheen on surface
④ Lady bug removed

CETIS QC Chart

Report Date: 20 Mar-09 11:15 AM

Eohaustorius 10-d Survival and Reburial Sediment Test **NewFields**

Test Type: Survival-Reburial
Protocol: EPA/600/R-94/025 (1994)
Organism: Eohaustorius estuarius (Amphipod)
Endpoint: Proportion Survived
Material: Cadmium chloride
Source: Reference Toxicant-REF



Mean: 7.62659
Sigma:
Count: 20
CV: 29.19%
-1s Warning Limit: 5.90342
+1s Warning Limit: 9.85274
-2s Action Limit: 4.56959
+2s Action Limit: 12.7287

Quality Control Data

Point	Year	Month	Day	Data	Delta	Sigma	Warning	Action	Test Link	Analysis
1	2007	Jun	8	6.65260	-0.97399	-0.53350			08-1478-6281	07-1616-4889
2			12	5.57512	-2.05147	-1.22341	(-)		12-4873-2529	01-1576-1244
3		Jul	20	10.14752	2.52093	1.11511	(+)		03-1740-6698	15-0085-4047
4		Sep	17	7.52045	-0.10614	-0.05472			13-0115-1998	01-0589-8584
5		Oct	23	5.97296	-1.65363	-0.95427			06-8083-9702	00-5598-3388
6	2008	May	30	8.87317	1.24658	0.59112			13-3382-4100	20-7672-2429
7		Jun	27	8.83113	1.20455	0.57258			14-3368-4084	04-4152-2772
8		Jul	16	8.35797	0.73139	0.35756			09-4785-0917	05-8512-9332
9			26	8.84336	1.21677	0.57798			04-2285-3356	06-1210-3839
10		Aug	1	9.11399	1.48740	0.69568			16-8866-7768	08-6766-3207
11			26	6.09565	-1.53093	-0.87488			05-3187-8218	10-7868-4568
12		Sep	23	5.09679	-2.52980	-1.57366	(-)		02-2340-6976	12-6046-2683
13		Oct	3	9.37148	1.74490	0.80447			12-9882-1875	12-8093-3143
14			9	10.36136	2.73477	1.19653	(+)		07-7236-5738	09-5362-0444
15			10	5.07151	-2.55507	-1.59308	(-)		08-5307-5163	12-8225-3680
16			21	6.56493	-1.06166	-0.58529			02-5567-7485	08-9907-2675
17			28	6.85362	-0.77297	-0.41726			11-3814-9085	05-5479-4141
18		Nov	14	13.35570	5.72911	2.18775	(+)	(+)	10-0142-7604	10-4633-3899
19		Dec	23	8.02451	0.39792	0.19859			04-4756-6255	16-0393-7069
20	2009	Jan	13	6.73179	-0.89480	-0.48729			02-2312-8980	19-2857-8265
21		Feb	6	6.26547	-1.36112	-0.76759			15-7764-3447	07-6235-2432

Analyst: BH

Approval: BH

CETIS Test Summary

Report Date: 20 Mar-09 11:15 AM
Test Link: 15-7764-3447/P080418.46

Eohaustorius 10-d Survival and Reburial Sediment Test

NewFields

Test No:	15-4957-1261	**Test Type:**	Survival-Reburial	**Duration:**	95h
Start Date:	06 Feb-09 02:30 PM	**Protocol:**	EPA/600/R-94/025 (1994)	**Species:**	Eohaustorius estuarius
Ending Date:	10 Feb-09 01:15 PM	**Dil Water:**	Laboratory Seawater	**Source:**	Northwestern Aquatic Science, OR
Setup Date:	06 Feb-09 02:30 PM	**Brine:**	Not Applicable		

Sample No:	07-3895-4083	**Code:**	P080418.46	**Client:**	Internal Lab
Sample Date:	20 Mar-09 11:10 AM	**Material:**	Cadmium chloride	**Project:**	Reference Toxicant
Receive Date:	20 Mar-09 11:10 AM	**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**	P080418.46		

Comparison Summary

Analysis	Endpoint	NOEL	LOEL	ChV	PMSD	Method
17-4936-0899	Proportion Survived	2.5	5	3.53553	15.37%	Dunnett's Multiple Comparison

Point Estimate Summary

Analysis	Endpoint	% Effect	Conc-mg/L	95% LCL	95% UCL	Method
07-6235-2432	Proportion Survived	10	3.888915	2.486991	4.809654	Linear Regression
		15	4.260344	2.884105	5.16747	
		20	4.580683	3.23917	5.479695	
		25	4.874635	3.572749	5.771702	
		40	5.70174	4.527675	6.645278	
		50	6.265468	5.164955	7.311876	

Test Acceptability

Analysis	Endpoint	Attribute	Statistic	TAC Range	Overlap	Decision
07-6235-2432	Proportion Survived	Control Response	0.96667	0.9 - NL	Yes	Passes acceptability criteria
17-4936-0899	Proportion Survived	Control Response	0.96667	0.9 - NL	Yes	Passes acceptability criteria

Proportion Survived Summary

Conc-mg/L	Control Type	Reps	Mean	Minimum	Maximum	SE	SD	CV
0	Dilution Water	3	0.96667	0.90000	1.00000	0.03333	0.05774	5.97%
2.5		3	0.93333	0.90000	1.00000	0.03333	0.05774	6.19%
5		3	0.70000	0.60000	0.80000	0.05774	0.10000	14.29%
10		3	0.10000	0.00000	0.20000	0.05774	0.10000	100.00
20		3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00%
40		3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00%

Proportion Survived Detail

Conc-mg/L	Control Type	Rep 1	Rep 2	Rep 3
0	Dilution Water	1.00000	0.90000	1.00000
2.5		1.00000	0.90000	0.90000
5		0.60000	0.80000	0.70000
10		0.00000	0.20000	0.10000
20		0.00000	0.00000	0.00000
40		0.00000	0.00000	0.00000

Analyst: BH Approval: BH

CETIS Data Worksheet

Report Date: 20 Mar-09 11:14 AM
Link: 15-7764-3447/P080418.46

Eohaustorius 10-d Survival and Reburial Sediment Test **NewFields**

Start Date:	06 Feb-09 02:30 PM	**Species:**	Eohaustorius estuarius	**Sample Code:**	P080418.46
Ending Date:	10 Feb-09 01:15 PM	**Protocol:**	EPA/600/R-94/025 (1994)	**Sample Source:**	Reference Toxicant
Sample Date:	20 Mar-09 11:10 AM	**Material:**	Cadmium chloride	**Sample Station:**	P080418.46

Conc-mg/L	Code	Rep	Pos	# Exposed	# Survived	# Reburied	Notes
0	D	1	18	10	10		
0	D	2	2	10	9		
0	D	3	7	10	10		
2.5		1	3	10	10		
2.5		2	12	10	9		
2.5		3	17	10	9		
5		1	1	10	6		
5		2	10	10	8		
5		3	13	10	7		
10		1	16	10	0		
10		2	6	10	2		
10		3	14	10	1		
20		1	15	10	0		
20		2	5	10	0		
20		3	9	10	0		
40		1	8	10	0		
40		2	4	10	0		
40		3	11	10	0		

Analyst: BH

Reviewed By: BH

NEWFIELDS

REFERENCE TOXICANT TEST SURVIVAL DATASHEET

SPECIES	*Eohaustorius estuarius*

CLIENT	PROJECT	NEWFIELDS JOB #	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL
City of Newport Beach	Grain Size Study	1105-004-860	Bill Gardiner	Port Gamble	USEPA/USCOE 1991

SURVIVAL & BEHAVIOR DATA

OBSERVATION KEY
N = normal
LOE= loss of equilibrium
Q = quiescent
DC = discoloration
NB = no body
F= Floating on Surface

INITIAL # OF ORGANISMS 10

	DAY 1	DAY 2	DAY 3	DAY 4
DATE	2/7/09	2/8	2/9	2/10/09
TECHNICIAN	BH	TS	MMB	MMB

CLIENT/ NEWFIELDS ID	CONC. value	CONC. units	REP	INITIAL NUMBER	DAY 1 #ALIVE	DAY 1 #DEAD	DAY 1 OBS	DAY 2 #ALIVE	DAY 2 #DEAD	DAY 2 OBS	DAY 3 #ALIVE	DAY 3 #DEAD	DAY 3 OBS	DAY 4 #ALIVE	DAY 4 #DEAD	DAY 4 OBS
Ref.Tox.-cadmium	0	mg/L	1	▨	10	0	3F	10	0	6F	10	0	5F	10	0	5F
			2	▨	10	0	4F	10	0	5F	10	0	5F	9	1	4F
			3	▨	10	0	2F	10	0	2F	10	0	2F	10	0	3F
Ref.Tox.-cadmium	2.5	mg/L	1	▨	10	0	3F	10	0	6F	10	0	2F	10	0	4F
			2	▨	10	0	3F	10	0	4F	10	0	4F	9	1	3F
			3	▨	10	0	2F	10	0	3F	9	1	4F	9	0	4F
Ref.Tox.-cadmium	5	mg/L	1	▨	10	0	4F	10	0	4F	8	2	2F	6	2	1F
			2	▨	10	0	3F	9	1	4F	9	0	2F	8	1	4F
			3	▨	10	0	4F	9	1	4F	8	1	3F	7	1	2F
Ref.Tox.-cadmium	10	mg/L	1	▨	10	0	2F	8	2	1F	4	4	DC	0	4	DC
			2	▨	10	0	3F	10	0	N	4	6	DC, 1F	2	2	DC
			3	▨	10	0	N	8	2	1F	4	4	1F	1	3	N
Ref.Tox.-cadmium	20	mg/L	1	▨	10	0	5F	5	5	3F	3	2	Q	0	3	N
			2	▨	10	0	2F	6	4	2F	1	5	1F, Q	0	1	↓
			3	▨	10	0	4F	5	5	3F	2	3	Q	0	2	↓
Ref.Tox.-cadmium	40	mg/L	1	▨	9	1	3F	1 ~~8~~ ①	8 ~~1~~	N	0	1	DC			
			2	▨	9	1	3F	2	7	1F	0	2	↓			
			3	▨	10	0	4F	4	6	3F	0	4	↓			

① WE TS 2/9/08

NEWFIELDS

REFERENCE TOXICANT TEST
WATER QUALITY DATASHEET

CLIENT City of Newport Beach	PROJECT Grain Size Study	SPECIES *Eohaustorius estuarius*	NEWFIELDS LABORATORY Port Gamble	PROTOCOL USEPA/USCOE 1991
NEWFIELDS JOB NUMBER 1105-004-860	PROJECT MANAGER Bill Gardiner	QUANTITY OF STOCK TARGET: 6.0 mL ACTUAL: 6.01 mg	QUANTITY OF DILUENT: 1500mL ACTUAL: 1500.2 mg	INIT MMB DATE PREP 2/6/09
TEST ID P080418.46	LOT #: 065107C	TEST START DATE 06Feb09	TIME 1430	TEST END DATE 10Feb09	TIME 1315

WATER QUALITY DATA

DILTIN.WAT.BATCH	TEMP REC#	REFERENCE TOX. MATERIAL	REFERENCE TOXXICANT	LOT NO.	96-H LC_{50}
FSW020509.01	NA	cadmium chloride	cadmium		

TEST CONDITIONS	DO (mg/L)	TEMP(C)	SAL (ppt)	pH	TECHNICIAN	AMMONIA	SULFIDES
	≥ 5.0	15 ± 1	30 ~~28~~ ± 1	8.0 ± 0.5			

CLIENT/ NEWFIELDS ID	CONCENTRATION		DAY	REP	D.O.		TEMP.		SALINITY		pH		WQ TECH	AMMONIA		Tech	SULFIDES		Tech
	value	units			meter	mg/L	meter	°C	meter	ppt	meter	unit		METER	mg/L		meter	mg/L	
Ref.Tox.-cadmium	0	mg/L	0	Stock	4	8.5	4	16.2	1	30	1	7.8	BH 2/6/09						
			1	Surr	4	7.3	4	16.0	1	30	1	7.8	CW 2/7/09						
			2	Surr	4	7.0	4	16.4	1	30	1	7.6	TS 2/8						
			3	Surr	4	7.1	4	16.3	1	29	1	7.5	MMB 2/9						
			4	Surr	4	7.3	4	16.0	1	29	1	7.5	MMB 2/10/09						
Ref.Tox.-cadmium	2.5	mg/L	0	Stock	4	8.6	4	16.0	1	30	1	7.8	BH 2/6						
			1	Surr	4	7.3	4	16.0	1	30	1	7.8	CW 2/7/09						
			2	Surr	4	7.3	4	16.0	1	30	1	7.7	TS 2/8						
			3	Surr	4	7.5	4	15.8	1	29	1	7.8	MMB 2/9						
			4	Surr	4	7.7	4	15.7	1	29	1	7.7	MMB 2/10/09						
Ref.Tox.-cadmium	5	mg/L	0	Stock	4	8.7	4	16.0	1	30	1	7.8	BH 2/6						
			1	Surr	4	7.5	4	16.0	1	30	1	7.8	CW 2/7/09						
			2	Surr	4	7.4	4	16.0	1	30	1	7.8	TS 2/8						
			3	Surr	4	7.8	4	15.6	1	29	1	7.9	MMB 2/9						
			4	Surr	4	7.7	4	15.6	1	29	1	7.8	MMB 2/10/09						

NEWFIELDS

REFERENCE TOXICANT TEST
WATER QUALITY DATASHEET

CLIENT City of Newport Beach	PROJECT Grain Size Study	SPECIES *Eohaustorius estuarius*	NEWFIELDS LABORATORY Port Gamble	PROTOCOL USEPA/USCOE 1991
NEWFIELDS JOB NUMBER 1105-004-860	PROJECT MANAGER Bill Gardiner	QUANTITY OF STOCK TARGET: 6.0 mL ACTUAL:	QUANTITY OF DILUENT: 1500mL ACTUAL:	INIT DATE PREP
TEST ID	LOT #:	TEST START DATE 06Feb09	TIME	TEST END DATE 10Feb09	TIME

WATER QUALITY DATA

DILTIN.WAT.BATCH	TEMP REC#	REFERENCE TOX. MATERIAL	REFERENCE TOXXICANT	LOT NO.	96-H LC_{50}
FSW020509.01	NA	cadmium chloride	cadmium		

TEST CONDITIONS	DO (mg/L)	TEMP(C)	SAL (ppt)	pH	TECHNICIAN	AMMONIA	SULFIDES
	≥ 5.0	15 ± 1	~~30~~28 ± 1	8.0 ± 0.5			

CLIENT/ NEWFIELDS ID	CONCENTRATION		DAY	REP	D.O.		TEMP.		SALINITY		pH		WQ TECH	AMMONIA		Tech	SULFIDES		Tech
	value	units			meter	mg/L	meter	°C	meter	ppt	meter	unit		METER	mg/L		meter	mg/L	
Ref.Tox.-cadmium	10	mg/L	0	Stock	4	8.7	4	16.0	1	30	1	7.8	BH 2/6						
			1	Surr	4	7.4	4	15.8	1	30	1	7.8	Cw 2/7						
			2	Surr	4	7.4	4	16.0	1	30	1	7.8	TS 2/8						
			3	Surr	4	7.8	4	15.7	1	29	1	7.9	MMB 2/9						
			4	Surr	4	7.7	4	15.6	1	29	1	7.8	MMB 2/10/09						
Ref.Tox.-cadmium	20	mg/L	0	Stock	4	8.7	4	16.0	1	30	1	7.8	BH 2/6						
			1	Surr	4	7.7	4	16.2	1	30	1	7.7	Cw 2/7						
			2	Surr	4	7.4	4	15.9	1	30	1	7.8	TS 2/8						
			3	Surr	4	8.0	4	15.5	1	29	1	7.9	MMB 2/9						
			4	Surr	4	7.8	4	15.5	1	29	1	7.9	MMB 2/10/09						
Ref.Tox.-cadmium	40	mg/L	0	Stock	4	8.7	4	16.0	1	30	1	7.8	BH 2/6						
			1	Surr	4	7.5	4	15.9	1	30	1	7.7	Cw 2/7						
			2	Surr	4	7.6	4	15.9	1	30	1	7.8	TS 2/8						
			3	Surr	4	8.1	4	15.5	1	29	1	8.0	MMB 2/9/09						
			4	Surr															

NEWFIELDS

ORGANISM RECEIPT LOG

Date: 2/5/09	**Time:** 1320	**NewFields Batch No.** NAS 9833

Organism: Eohs	**Source:** Northwestern Aquatic Science
Address: On File	**Invoice Attached** [✓ Yes] No
Phone: On File	**Contact:** On File

No. Ordered: 3200	**No. Received:** 3520	**Source Batch:** Field

Condition of Organisms: Good	**Approximate Size or Age:** 3-5mm
Shipper: FedEx	**B of L (Tracking No.)** 8662 6076 9833
Condition of Container: Good	**Received By:**
Confirmation of ID of Organism: Yes [✓ No]	**Technician (Initials):** MMB

Notes:

pH (Units)	Temp. (°C)	D.O. (mg/L)	Conductivity or Salinity (Include Units)	Technician (Initials)
7.2	13.2	7.0	25 ppt	MMB

Notes:

NEWFIELDS

20 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATASHEET

CLIENT SAIC	PROJECT Irondale Intertidal	START TIME/ END TIME 1500 /	DILUTION WATER BATCH FSW021109.01	PROTOCOL PSEP 1995	TEST START DATE 12-Feb-2009
JOB NUMBER	PROJECT MANAGER B. Hester	NEWFIELDS LABORATORY	TEMP. RECDR./HOBO#	TEST SPECIES *Neanthes arenaceodentata*	TEST END DATE 4-Mar-2009

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) > 6.0		TEMP (C) 20 ± 1		SALINITY (ppt) 28 ± 1		pH 8.0±1.0				
				D.O.		TEMP		SALINITY		pH				
CLIENT/NEWFIELDS ID	DAY	REP	JAR	meter	mg/L	meter	°C	meter	ppt	meter	unit	WATER RENEWAL	Feeding	TECH/DATE
Control /	0	Surr	3	3	7.0	3	20.0	3	27	3	7.4		CR	MMB 2/12/09
Control /	1	Surr		3	7.8	3	19.9	3	28	3	7.6			CR 2/13
Control /	2	Surr		3	7.6	3	20.1	3	28	3	7.7		CR	CR 2/14
Control /	3	Surr		3	7.0	3	19.9	3	29	3	7.7	CR		CR 2/15
Control /	4	Surr		3	7.7	3	19.8	3	29	3	7.5		MMB	MMB 2/16
Control /	5	Surr		3	7.2	3	20.2	3	30	3	7.7			BH 2/17
Control /	6	Surr		3	7.4	3	20.0	3	30	3	8.0	MMB	MMB	MMB 2/18
Control /	7	Surr		3	7.1	3	20.0	3	30	3	7.7			MMB 2/19
Control /	8	Surr		3	7.3	3	19.8	3	30	3	7.8			2/20
Control /	9	Surr		3	7.1	3	19.8	3	31	3	7.6	MMB		MMB 2/21
Control /	10	Surr		3	7.0	3	20.1	3	30	3	7.5		MMB	MMR 2/22
Control /	11	Surr		3	7.0	3	20.0	3	31	3	7.8			MMB 2/23
Control /	12	Surr		4	7.3	4	20.4	1	31	1	7.8	TS	TS	TS 2/24
Control /	13	Surr		3	7.1	3	20.0	3	30	3	7.5			CR 2/25
Control /	14	Surr		3	7.5	3	19.3	3	31	3	7.6		KP	KP 2-26
Control /	15	Surr		3	7.3	3	19.7	3	30	3	7.6	TS		TS 2/27
Control /	16	Surr		5	7.6	5	20.2	1	30	1	7.8		TS	TS 2/28
Control /	17	Surr		5	7.4	5	20.6	1	30	1	7.7			TS 3/1
Control /	18	Surr		3	7.0	3	20.6	3	31	3	7.7	MB	CR	CR 3/2
Control /	19	Surr		3	7.3	3	20.7	3	30	3	7.5			3/3
Control /	20	Surr		5	7.4	5	20.2	1	30	1	7.9			TS 3/4

NEWFIELDS

20 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATASHEET

CLIENT SAIC	**PROJECT** Irondale Intertidal	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW021109.01	**PROTOCOL** PSEP 1995	**TEST START DATE** 12-Feb-2009
JOB NUMBER	**PROJECT MANAGER** B. Hester	**NEWFIELDS LABORATORY**	**TEMP. RECDR./HOBO#**	**TEST SPECIES** *Neanthes arenaceodentata*	**TEST END DATE** 4-Mar-2009

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) > 6.0		TEMP (C) 20 ± 1		SALINITY (ppt) 28 ± 1		pH 8.0±1.0				
				D.O.		TEMP		SALINITY		pH				
CLIENT/NEWFIELDS ID	DAY	REP	JAR	meter	mg/L	meter	°C	meter	ppt	meter	unit	WATER RENEWAL	Feeding	TECH/DATE
SB-REF-ID01 / P090129.04	0	Surr	14	3	6.6	3	20.1	3	27	3	7.7		CR	MMB 2/12/09
SB-REF-ID01 / P090129.04	1	Surr		3	7.2	3	20.3	3	28	3	7.8			CR 2/13
SB-REF-ID01 / P090129.04	2	Surr		3	7.0	3	20.2	3	28	3	7.8		CR	CR 2/14
SB-REF-ID01 / P090129.04	3	Surr		3	6.6	3	20.4	3	29	3	7.8	CR		CR 2/15
SB-REF-ID01 / P090129.04	4	Surr		3	7.3	3	20.1	3	29	3	7.8		MMB	MMB 2/16
SB-REF-ID01 / P090129.04	5	Surr		3	6.9	3	20.3	3	30	3	7.8			BH 2/17
SB-REF-ID01 / P090129.04	6	Surr		3	7.1	3	20.1	3	30	3	8.0	MMB	MMB	MMB 2/18
SB-REF-ID01 / P090129.04	7	Surr		3	6.9	3	20.0	3	29	3	7.6			MMB 2/19
SB-REF-ID01 / P090129.04	8	Surr		3	7.1	3	20.1	3	30	3	8.0		✓	2/20
SB-REF-ID01 / P090129.04	9	Surr		3	7.4	3	20.2	3	29	3	8.0	MMB		MMB 2/21
SB-REF-ID01 / P090129.04	10	Surr		3	7.5	3	20.4	3	30	3	8.1		MMB	MMB 2/22
SB-REF-ID01 / P090129.04	11	Surr		3	7.0	3	20.2	3	31	3	7.9			MMB 2/23
SB-REF-ID01 / P090129.04	12	Surr		4	7.5	4	20.5	1	30	1	8.1	TS	TS	TS 2/24
SB-REF-ID01 / P090129.04	13	Surr		3	7.3	3	20.3	3	29	3	7.6			CR 2/25
SB-REF-ID01 / P090129.04	14	Surr		3	7.6	3	19.6	3	30	3	8.1		KP	KP 2-26
SB-REF-ID01 / P090129.04	15	Surr		3	7.3	3	20.1	3	30	3	7.9	TS		TS 2/27
SB-REF-ID01 / P090129.04	16	Surr		5	7.6	5	20.8	1	30	1	8.1		TS	TS 2/28
SB-REF-ID01 / P090129.04	17	Surr		5	7.3	5	21.1	1	30	1	8.0			TS 3/1
SB-REF-ID01 / P090129.04	18	Surr		3	7.2	3	21.0	3	30	3	7.9	MB	CR	CR 3/2
SB-REF-ID01 / P090129.04	19	Surr		3	7.3	3	20.9	3	30	3	8.0			Kv 3/3
SB-REF-ID01 / P090129.04	20	Surr		5	7.5	5	20.8	1	30	1	8.0			TS 3/4

NEWFIELDS

20 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATASHEET

CLIENT SAIC	PROJECT Irondale Intertidal	START TIME/ END TIME /	DILUTION WATER BATCH FSW021109.01	PROTOCOL PSEP 1995	TEST START DATE 12-Feb-2009
JOB NUMBER	PROJECT MANAGER B. Hester	NEWFIELDS LABORATORY	TEMP. RECDR./HOBO#	TEST SPECIES *Neanthes arenaceodentata*	TEST END DATE 4-Mar-2009

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) > 6.0		TEMP (C) 20 ± 1		SALINITY (ppt) 28 ± 1		pH 8.0±1.0				
CLIENT/NEWFIELDS ID	DAY	REP	JAR	D.O. meter	D.O. mg/L	TEMP meter	TEMP °C	SALINITY meter	SALINITY ppt	pH meter	pH unit	WATER RENEWAL	Feeding	TECH/DATE
SB-REF-ID02 / P090129.05	0	Surr	40	3	6.5	3	20.4	3	27	3	7.8		CR	MMB 2/12/09
SB-REF-ID02 / P090129.05	1	Surr		3	7.6	3	20.3	3	28	3	7.9			CR 2/13
SB-REF-ID02 / P090129.05	2	Surr		3	7.3	3	20.1	3	28	3	7.9		CR	CR 2/14
SB-REF-ID02 / P090129.05	3	Surr		3	7.1	3	20.5	3	30	3	7.9	CR		CR 2/15
SB-REF-ID02 / P090129.05	4	Surr		3	7.5	3	20.2	3	30	3	8.0		MMB	MMB 2/16
SB-REF-ID02 / P090129.05	5	Surr		3	7.2	3	20.6	3	31	3	8.0			BH 2/17
SB-REF-ID02 / P090129.05	6	Surr		3	7.2	3	20.4	3	31	3	8.2	MMB	MMB	MMB 2/18
SB-REF-ID02 / P090129.05	7	Surr		3	7.2	3	20.1	3	30	3	7.8			MMB 2/19
SB-REF-ID02 / P090129.05	8	Surr		3	7.4	3	20.1	3	31	3	8.2		✓	✓ 2/20
SB-REF-ID02 / P090129.05	9	Surr		3	7.2	3	20.3	3	31	3	8.1	MMB		MMB 2/21
SB-REF-ID02 / P090129.05	10	Surr		3	7.1	3	20.5	3	31	3	8.2		MMB	MMB 2/22
SB-REF-ID02 / P090129.05	11	Surr		3	7.0	3	20.4	3	31	1	8.1			
SB-REF-ID02 / P090129.05	12	Surr		4	7.4	4	20.7	1	31	1	8.2	TS	TS	TS 2/24
SB-REF-ID02 / P090129.05	13	Surr		3	7.1	3	20.4	3	29	3	7.8			CR 2/25
SB-REF-ID02 / P090129.05	14	Surr		3	7.5	3	19.7	3	31	3	8.2		KP	KP 2-26
SB-REF-ID02 / P090129.05	15	Surr		3	7.1	3	20.1	3	30	3	8.1	TS		TS 2/27
SB-REF-ID02 / P090129.05	16	Surr		5	7.5	5	20.9	1	31	1	8.2		TS	TS 2/28
SB-REF-ID02 / P090129.05	17	Surr		5	7.3	5	21.1	1	31	1	8.1			TS 3/1
SB-REF-ID02 / P090129.05	18	Surr		3	7.6	3	21.0	3	31	3	81	MB	CR	CR 3/2
SB-REF-ID02 / P090129.05	19	Surr		3	7.2	3	208	3	30	3	8.1			JW 3/3
SB-REF-ID02 / P090129.05	20	Surr		5	7.6	5	20.7	1	30	1	8.1			TS 3/4

NEWFIELDS

20 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATASHEET

CLIENT SAIC	**PROJECT** Irondale Intertidal	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW021109.01	**PROTOCOL** PSEP 1995	**TEST START DATE** 12-Feb-2009
JOB NUMBER .	**PROJECT MANAGER** B. Hester	**NEWFIELDS LABORATORY**	**TEMP. RECDR./HOBO#**	**TEST SPECIES** *Neanthes arenaceodentata*	**TEST END DATE** 4-Mar-2009

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) > 6.0		TEMP (C) 20 ± 1		SALINITY (ppt) 28 ± 1		pH 8.0±1.0				
				D.O.		TEMP		SALINITY		pH				
CLIENT/NEWFIELDS ID	DAY	REP	JAR	meter	mg/L	meter	°C	meter	ppt	meter	unit	WATER RENEWAL	Feeding	TECH/DATE
ID-100 / P090107.06	0	Surr	11	3	6.9	3	20.1	3	27	3	7.9		CR	MMB 2/12/09
ID-100 / P090107.06	1	Surr		3	7.5	3	20.3	3	28	3	7.8			CR 2/13
ID-100 / P090107.06	2	Surr		3	7.4	3	20.0	3	28	3	7.8		CR	CR 2/14
ID-100 / P090107.06	3	Surr		3	6.8	3	20.4	3	29	3	7.7	CR		CR 2/15
ID-100 / P090107.06	4	Surr		3	7.6	3	20.1	3	29	3	7.8		MMB	MMB 2/16
ID-100 / P090107.06	5	Surr		3	6.9	3	20.2	3	30	3	7.7			BH 2/17
ID-100 / P090107.06	6	Surr		3	7.2	3	20.0	3	30	3	8.0	MMB	MMB	MMB 2/18
ID-100 / P090107.06	7	Surr		3	6.8	3	20.0	3	29	3	7.6			MMB 2/19
ID-100 / P090107.06	8	Surr		3	7.1	3	20.1	3	30	3	7.9		✓	✓ 2/20
ID-100 / P090107.06	9	Surr		3	7.0	3	20.2	3	29	3	7.8	MMB		MMB 2/21
ID-100 / P090107.06	10	Surr		3	7.1	3	20.4	3	30	3	7.9		MMB	MMB 2/22
ID-100 / P090107.06	11	Surr		3	7.0	3	20.2	3	31	3	7.9			MMB 2/23
ID-100 / P090107.06	12	Surr		4	7.4	4	20.5	1	30	1	8.0	TS	T	TS 2/24
ID-100 / P090107.06	13	Surr		3	7.0	3	20.2	3	29	3	7.5			CR 2/25
ID-100 / P090107.06	14	Surr		3	7.4	3	19.6	3	30	3	8.0	KP		KP 2-26
ID-100 / P090107.06	15	Surr		3	7.0	3	20.0	3	30	3	7.8	TS		TS 2/27
ID-100 / P090107.06	16	Surr		5	7.5	5	20.7	1	30	1	8.0		TS	TS 2/28
ID-100 / P090107.06	17	Surr		5	7.3	5	21.0	1	30	1	7.9			TS 3/1
ID-100 / P090107.06	18	Surr		3	7.2	3	20.9	3	30	3	7.8	MB	CR	CR 3/2
ID-100 / P090107.06	19	Surr		3	7.1	3	20.8	3	30	3	7.9			✓ 3/3
ID-100 / P090107.06	20	Surr		5	7.5	5	20.7	1	31	1	8.0			TS 3/4

NEWFIELDS

20 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATASHEET

CLIENT SAIC	**PROJECT** Irondale Intertidal	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW021109.01	**PROTOCOL** PSEP 1995	**TEST START DATE** 12-Feb-2009
JOB NUMBER	**PROJECT MANAGER** B. Hester	**NEWFIELDS LABORATORY**	**TEMP. RECDR./HOBO#**	**TEST SPECIES** *Neanthes arenaceodentata*	**TEST END DATE** 4-Mar-2009

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) > 6.0		TEMP (C) 20 ± 1		SALINITY (ppt) 28 ± 1		pH 8.0±1.0				
				D.O.		TEMP		SALINITY		pH				
CLIENT/NEWFIELDS ID	DAY	REP	JAR	meter	mg/L	meter	°C	meter	ppt	meter	unit	WATER RENEWAL	Feeding	TECH/DATE
ID-101 / P090107.01	0	Surr	5	3	6.7	3	20.1	3	27	3	7.6		CR	MMB 2/12/09
ID-101 / P090107.01	1	Surr		3	7.4	3	20.1	3	27	3	7.7			CR 2/13
ID-101 / P090107.01	2	Surr		3	7.3	3	20.1	3	28	3	7.7		CR	CR 2/14
ID-101 / P090107.01	3	Surr		3	6.7	3	20.2	3	28	3	7.7	CR		CR 2/15
ID-101 / P090107.01	4	Surr		3	7.6	3	19.9	3	29	3	7.7		MMB	MMB 2/16
ID-101 / P090107.01	5	Surr		3	6.8	3	20.2	3	28	3	7.6			BH 2/17
ID-101 / P090107.01	6	Surr		3	7.1	3	20.0	3	29	3	8.0	MMB	MMB	MMB 2/18
ID-101 / P090107.01	7	Surr		3	6.7	3	20.0	3	29	3	7.6			MMB 2/19
ID-101 / P090107.01	8	Surr		3	6.9	3	20.0	3	29	3	7.8		Le	L 2/20
ID-101 / P090107.01	9	Surr		3	6.9	3	20.0	3	30	3	7.7	MMB		MMB 2/21
ID-101 / P090107.01	10	Surr		3	7.7	3	20.2	3	30	3	7.7		MMB	MMB 2/22
ID-101 / P090107.01	11	Surr		3	6.8	3	20.1	3	30	3	7.8			MMB 2/23
ID-101 / P090107.01	12	Surr		4	7.3	4	20.4	1	30	1	7.9	TS	TS	TS 2/24
ID-101 / P090107.01	13	Surr		3	7.1	3	20.1	3	29	3	7.5			CR 2/25
ID-101 / P090107.01	14	Surr		3	7.3	3	19.5	3	30	3	7.8		KP	KP 2-26
ID-101 / P090107.01	15	Surr		3	7.2	3	19.8	3	30	3	7.8	TS		TS 2/27
ID-101 / P090107.01	16	Surr		5	7.6	5	20.7	1	30	1	7.9		TS	TS 2/28
ID-101 / P090107.01	17	Surr		5	7.4	5	20.9	1	30	1	7.8			TS 3/1
ID-101 / P090107.01	18	Surr		5	7.4	5	20.7	1	30	1	7.7	MB	CR	CR 3/2
ID-101 / P090107.01	19	Surr		3	7.4	3	20.9	3	28	3	7.7			Lw 3/3
ID-101 / P090107.01	20	Surr		5	7.6	5	20.6	1	30	1	8.0			TS 3/4

NEWFIELDS

20 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATASHEET

CLIENT SAIC	**PROJECT** Irondale Intertidal	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW021109.01	**PROTOCOL** PSEP 1995	**TEST START DATE** 12-Feb-2009
JOB NUMBER .	**PROJECT MANAGER** B. Hester	**NEWFIELDS LABORATORY**	**TEMP. RECDR./HOBO#**	**TEST SPECIES** *Neanthes arenaceodentata*	**TEST END DATE** 4-Mar-2009

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) > 6.0		TEMP (C) 20 ± 1		SALINITY (ppt) 28 ± 1		pH 8.0±1.0				
				D.O.		TEMP		SALINITY		pH				
CLIENT/NEWFIELDS ID	DAY	REP	JAR	meter	mg/L	meter	°C	meter	ppt	meter	unit	WATER RENEWAL	Feeding	TECH/DATE
ID-102 / P090107.02	0	Surr	47	3	6.8	3	20.3	3	27	3	7.8		CR	MMB 2/12/09
ID-102 / P090107.02	1	Surr		3	7.6	3	20.3	3	27	3	8.0			CR 2/13
ID-102 / P090107.02	2	Surr		3	7.4	3	20.2	3	28	3	8.0		CR	CR 2/14
ID-102 / P090107.02	3	Surr		3	6.8	3	20.6	3	28	3	8.0	CR		CR 2/15
ID-102 / P090107.02	4	Surr		3	7.5	3	20.3	3	29	3	8.1		MMB	MMB 2/16
ID-102 / P090107.02	5	Surr		3	7.0	3	20.5	3	30	3	8.0			BH 2/17
ID-102 / P090107.02	6	Surr		3	7.1	3	20.3	3	30	3	8.0	MMB	MMB	MMB 2/18
ID-102 / P090107.02	7	Surr		3	6.9	3	20.1	3	30	3	7.6			MMB 2/19
ID-102 / P090107.02	8	Surr		3	7.3	3	20.2	3	30	3	8.1		✓	✓ 2/20
ID-102 / P090107.02	9	Surr		3	7.3	3	20.2	3	31	3	8.1	MMB		MMB 2/21
ID-102 / P090107.02	10	Surr		3	7.2	3	20.5	3	30	3	8.2		MMB	MMB 2/22
ID-102 / P090107.02	11	Surr		3	6.9	3	20.2	3	31	3	7.8			MMB 2/23
ID-102 / P090107.02	12	Surr		4	7.4	4	20.7	1	31	1	8.1	TS	TS	TS 2/24
ID-102 / P090107.02	13	Surr		3	7.1	3	20.4	3	29	3	7.8			CR 2/25
ID-102 / P090107.02	14	Surr		3	7.5	3	19.7	3	31	3	8.2		KP	KP 2-26
ID-102 / P090107.02	15	Surr		3	7.2	3	20.2	3	30	3	8.1	TS		TS 2/27
ID-102 / P090107.02	16	Surr		5	7.5	5	20.9	1	30	1	8.1		TS	TS 2/28
ID-102 / P090107.02	17	Surr		5	7.3	5	21.1	1	31	1	8.1			TS 3/1
ID-102 / P090107.02	18	Surr		3	7.0	3	21.1	3	30	3	8.1	MB	CR	CR 3/2
ID-102 / P090107.02	19	Surr		3	7.3	3	20.8	3	30	3	8.1			Jw 3/3
ID-102 / P090107.02	20	Surr		5	7.5	5	20.8	1	31	1	8.1			TS 3/4

NEWFIELDS

20 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATASHEET

CLIENT SAIC	**PROJECT** Irondale Intertidal	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW021109.01	**PROTOCOL** PSEP 1995	**TEST START DATE** 12-Feb-2009
JOB NUMBER .	**PROJECT MANAGER** B. Hester	**NEWFIELDS LABORATORY**	**TEMP. RECDR./HOBO#**	**TEST SPECIES** *Neanthes arenaceodentata*	**TEST END DATE** 4-Mar-2009

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) > 6.0		TEMP (C) 20 ± 1		SALINITY (ppt) 28 ± 1		pH 8.0±1.0				
				D.O.		TEMP		SALINITY		pH				
CLIENT/NEWFIELDS ID	DAY	REP	JAR	meter	mg/L	meter	°C	meter	ppt	meter	unit	WATER RENEWAL	Feeding	TECH/DATE
ID-108 / P090107.08	0	Surr	39	3	6.8	3	20.3	3	26	3	7.9		CR	MMB 2/12/09
ID-108 / P090107.08	1	Surr		3	7.7	3	20.0	3	27	3	7.9			CR 2/13
ID-108 / P090107.08	2	Surr		3	7.4	3	20.1	3	27	3	7.9		CR	CR 2/14
ID-108 / P090107.08	3	Surr		3	6.9	3	20.4	3	28	3	7.8	CR		CR 2/15
ID-108 / P090107.08	4	Surr		3	7.8	3	19.9	3	29	3	7.9		MMB	MMB 2/16
ID-108 / P090107.08	5	Surr		3	7.1	3	20.4	3	29	3	7.8			BH 2/17
ID-108 / P090107.08	6	Surr		3	7.3	3	20.3	3	30	3	8.1	MMB	MMB	MMB 2/18
ID-108 / P090107.08	7	Surr		3	7.1	3	20.1	3	29	3	7.7			MMB 2/19
ID-108 / P090107.08	8	Surr		3	7.2	3	20.0	3	30	3	8.0		✓	✓ 2/20
ID-108 / P090107.08	9	Surr		3	7.1	3	20.2	3	31	3	7.9	MMB		MMB 2/21
ID-108 / P090107.08	10	Surr		3	6.9	3	20.5	3	31	3	8.0		MMB	MMB 2/22
ID-108 / P090107.08	11	Surr		3	6.9	3	20.3	3	31	3	8.0			MMB 2/23
ID-108 / P090107.08	12	Surr		4	7.5	4	20.5	1	31	1	8.0	TS	TS	TS 2/24
ID-108 / P090107.08	13	Surr		3	7.0	3	203	3	30	3	7.6			CR 2/25
ID-108 / P090107.08	14	Surr		3	7.5	3	19.6	3	31	3	8.1		KP	KP 2-26
ID-108 / P090107.08	15	Surr		3	7.2	3	19.9	3	31	3	7.9	TS		TS 2/27
ID-108 / P090107.08	16	Surr		5	7.4	5	20.9	1	31	1	8.0		TS	TS 2/28
ID-108 / P090107.08	17	Surr		5	7.3	5	21.1	1	32	1	8.0			TS 3/1
ID-108 / P090107.08	18	Surr		3	7.2	3	21.0	3	32	3	8.0	MB	CR	CR 3/2
ID-108 / P090107.08	19	Surr		3	7.2	3	208	3	31	3	8.0			Jw 3/3
ID-108 / P090107.08	20	Surr		5	7.5	5	20.8	1	31	1	8.0			TS 3/4

NEWFIELDS

20 DAY SOLID PHASE BIOASSAY
WATER QUALITY DATASHEET

CLIENT SAIC	**PROJECT** Irondale Intertidal	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW021109.01	**PROTOCOL** PSEP 1995	**TEST START DATE** 12-Feb-2009
JOB NUMBER	**PROJECT MANAGER** B. Hester	**NEWFIELDS LABORATORY**	**TEMP. RECDR./HOBO#**	**TEST SPECIES** *Neanthes arenaceodentata*	**TEST END DATE** 4-Mar-2009

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) > 6.0		TEMP (C) 20 ± 1		SALINITY (ppt) 28 ± 1		pH 8.0±1.0				
CLIENT/NEWFIELDS ID	DAY	REP	JAR	D.O. meter	D.O. mg/L	TEMP meter	TEMP °C	SALINITY meter	SALINITY ppt	pH meter	pH unit	WATER RENEWAL	Feeding	TECH/DATE
ID-000-MIX / P090129.06	0	Surr	37	~~37~~	6.7	3	20.4	3	26	3	7.8		CR	MMB 2/12/09
ID-000-MIX / P090129.06	1	Surr		3	6.7	3	20.4	3	27	3	7.9			CR 2/13
ID-000-MIX / P090129.06	2	Surr		3	6.8	3	20.1	3	27	3	7.9		CR	CR 2/14
ID-000-MIX / P090129.06	3	Surr		3	6.1	3	20.6	3	28	3	7.7	CR		CR 2/15
ID-000-MIX / P090129.06	4	Surr		3	7.1	3	20.5	3	29	3	8.0		MMB	MMB 2/16
ID-000-MIX / P090129.06	5	Surr		3	6.5	3	20.6	3	29	3	7.8			BH 2/17
ID-000-MIX / P090129.06	6	Surr		3	6.8	3	20.5	3	29	3	8.0	MMB	MMB	MMB 2/18
ID-000-MIX / P090129.06	7	Surr		3	6.3	3	20.2	3	29	3	7.7			MMB 2/19
ID-000-MIX / P090129.06	8	Surr		3	6.8	3	20.3	3	29	3	7.9		✓	✓ 2/20
ID-000-MIX / P090129.06	9	Surr		3	6.6	3	20.3	3	29	3	7.9	MMB		MMB 2/21
ID-000-MIX / P090129.06	10	Surr		3	6.6	3	20.5	3	30	3	7.9		MMB	MMB 2/22
ID-000-MIX / P090129.06	11	Surr		3	6.1	3	20.5	3	30	3	7.8			MMB 2/23
ID-000-MIX / P090129.06	12	Surr		4	6.7	4	20.6	1	30	1	8.0	TS	TS	TS 2/24
ID-000-MIX / P090129.06	13	Surr		3	6.6	3	20.5	3	29	3	7.6			CR 2/25
ID-000-MIX / P090129.06	14	Surr		3	7.0	3	19.9	3	30	3	8.0		KP	KP 2-26
ID-000-MIX / P090129.06	15	Surr		3	6.5	3	20.3	3	30	3	7.9	TS		2/27 TS
ID-000-MIX / P090129.06	16	Surr		5	7.2	5	20.9	1	30	1	8.0		TS	2/28 TS
ID-000-MIX / P090129.06	17	Surr		5	7.2	5	21.1	1	30	1	8.0			TS 3/1
ID-000-MIX / P090129.06	18	Surr		3	6.6	3	21.0	3	30	3	8.0	MB	CR	CR 3/2
ID-000-MIX / P090129.06	19	Surr		3	7.0	3	20.9	3	30	3	8.0			VN 3/3
ID-000-MIX / P090129.06	20	Surr		5	7.5	5	20.8	1	30	1	8.0			TS 3/4

NEWFIELDS

20-DAY SOLID PHASE BIOASSAY
OBSERVATION DATASHEET

CLIENT	PROJECT	JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
SAIC	Irondale Intertidal		B. Hester	Port Gamble Bath 7	PSEP 1995	*Neanthes arenaceodentata*

ENDPOINT DATA & OBSERVATIONS

#S= Number on the Surface
#M= Number of Mortality
L=Anoxic Surface
F=Fungal Patches
A=Algal Patches
D=No Air Flow (DO?)
U=Excess food
N=Normal
B=No Burrows

G = Growth

INITIAL # OF ORGANISMS: 5

CLIENT/ NEWFIELDS ID	REP	JAR	INITIAL #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	NUMBER REMAINING	TARE WEIGHT (mg)	TOTAL WEIGHT (mg)	Boat #
Date and Initials				2/13 CR	2/14 CR	2/15 CR	2/16 MMB	2/17 BH	2/18 MMB	2/19 MMB	2/20 ✓	2/21 MMB	2/22 MMB	2/23 MMB	2/24 CR	2/25 CR	2/26 CR	2/27 TS	2/28 TS	3/1 TS	3/2 CR	3/3 ✓	3/4 TS				
Control /	1		5	N	N	U	n	N	N	N	G	N	N	N	N	N	N	N	N	N	N	N	N	5	127.67	218.33	1
	2		5	↓	↓	↓	↓	↓	G	G	G	IS	↓	↓	↓	IS	↓	N	↓	↓	↓	↓	↓	5	133.21	226.45	2
	3		5	↓	↓	↓	↓	↓	N	N	N	N	↓	↓	↓	N	↓	N	↓	↓	↓	↓	↓	5	117.89	207.92	3
	4		5	↓	↓	↓	IS	↓	IS	↓	↓	↓	↓	IS	IS	↓	↓	IS	↓	↓	↓	↓	↓	5	113.96	222.45	4
	5		5	↓	↓	↓	n	↓	N	↓	↓	↓	↓	N	N	↓	↓	IS	↓	↓	↓	↓	↓	5	130.37	210.06	5
SB-REF-ID01 / P090129.04	1		5	↓	↓	↓	n	↓	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	5	125.95	222.49	6
	2		5	↓	↓	↓	↓	↓	G	↓	G	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5	131.83	242.51	7
	3		5	↓	↓	↓	↓	↓	N	↓	G	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5	103.71	196.45	8
	4		5	↓	↓	↓	↓	↓	G	↓	G	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5	162.40	279.72	9
	5		5	↓	↓	↓	↓	↓	G	↓	G	↓	IS, G	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5	173.86	282.75	10
SB-REF-ID02 / P090129.05	1		5	↓	↓	↓	↓	↓	G	G	G	G	G	G	G	↓	↓	G	↓	↓	↓	↓	G	5	131.10	263.52	11
	2		5	↓	↓	↓	↓	↓	G	↓	G	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5	147.46	269.79	12
	3		5	↓	↓	↓	↓	↓	N	↓	G	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5	128.17	223.49	13
	4		5	↓	↓	↓	↓	↓	G	↓	G	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5	149.79	247.76	14
	5		5	↓	↓	↓	↓	↓	G	↓	G	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5	124.45	205.40	15

NEWFIELDS

20-DAY SOLID PHASE BIOASSAY
OBSERVATION DATASHEET

CLIENT	PROJECT	JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
SAIC	Irondale Intertidal	.	B. Hester	Port Gamble Bath 7	PSEP 1995	*Neanthes arenaceodentata*

ENDPOINT DATA & OBSERVATIONS

#S= Number on the Surface
#M= Number of Mortality
L=Anoxic Surface
F=Fungal Patches
A=Algal Patches
D=No Air Flow (DO?)
U=Excess food
N=Normal
B=No Burrows

INITIAL # OF ORGANISMS: 5

CLIENT/ NEWFIELDS ID	REP	JAR	Date and Initials INITIAL #	2/13 CR 1	2/14 CR 2	2/15 CR 3	2/16 MMB 4	2/17 BH 5	2/18 MMB 6	2/19 MMB 7	2/20 ✓ 8	2/21 MMB 9	2/22 MMB 10	2/23 MMB 11	2/24 CR 12	2/25 CR 13	2/26 CR 14	2/27 TS 15	2/28 TS 16	3/1 TS 17	3/2 CR 18	3/3 ✓ 19	3/4 TS 20	NUMBER REMAINING	TARE WEIGHT (mg)	TOTAL WEIGHT (mg)	Boat #
ID-100 / P090107.06	1		5	N	N	U	u	N	N	N	N	N	N	N	G	G	G	G	G	G	G	G	G	5	141.55	210.62	16
	2		5								G	G	G	G										5	148.56	211.61	17
	3		5				↓				N	N	N	N										4	132.10	242.14	18
	4		5				1S						G	G										5	144.54	223.79	19
	5		5				u					↓	N	N	↓								↓	5	134.18	228.85	20
ID-101 / P090107.01	1		5				u					N	N	N	G	↓							G	5	140.96	224.83	21
	2		5												N	N								5	145.80	223.91	22
	3		5												G	G	↓							5	127.32	212.59	23
	4		5												N	N	N							5	128.72	206.86	24
	5		5									↓	↓	↓	G	G	G						↓	5	153.76	244.92	25
ID-102 / P090107.02	1		5									N	N	N	G							↓	G	5	165.05	242.84	26
	2		5									G	G	G								2EG		4	147.52	207.14	27
	3		5								↓	G	G	1S, G								G		4	152.37	234.38	28
	4		5								G	G	G	G	↓	↓	↓							5	141.10	203.29	29
	5		5	↓	↓	↓	↓	↓	↓	↓	N	N	N	N	N	N	N	↓	↓	↓	↓	↓	↓	5	120.16	204.21	40*

*out of order - 3/4/09 TS *

NEWFIELDS

20-DAY SOLID PHASE BIOASSAY
OBSERVATION DATASHEET

CLIENT	PROJECT	JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
SAIC	Irondale Intertidal	.	B. Hester	Port Gamble Bath 7	PSEP 1995	*Neanthes arenaceodentata*

ENDPOINT DATA & OBSERVATIONS

#S= Number on the Surface
#M= Number of Mortality
L=Anoxic Surface
F=Fungal Patches
A=Algal Patches
D=No Air Flow (DO?)
U=Excess food
N=Normal
B=No Burrows

INITIAL # OF ORGANISMS 5

CLIENT/ NEWFIELDS ID	REP	JAR	Date and Initials / INITIAL #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	NUMBER REMAINING	TARE WEIGHT (mg)	TOTAL WEIGHT (mg)	Boat #
				2/13 CR	2/14 CR	2/15 CR	2/16 MMB	2/17 BH	2/18 MMB	2/19 MMB	2/20 ✓	2/21 MMB	2/22 MMB	2/23 MMB	2/24 CR	2/25 CR	2/26 CR	2/27 TS	2/28 TS	3/1 TS	3/2 CR	3/3 ✓	3/4 TS				
ID-108 / P090107.08	1		5	N	N	U	u	N	N	N	N	N	IS, N	N	G	G	G	G	G, IE	G	G	G	G	5	149.98	231.18	30
	2		5										N						G					5	162.74	246.82	31
	3		5																	↓				5	102.76	194.6	32
	4		5																	G, IE				5	131.55	210.12	33
	5		5	↓	↓	↓	↓	↓			↓	↓	↓	↓	↓	↓	↓	↓	↓	G	↓	↓	↓	5	148.90	220.19	34
ID-000-MIX / P090129.06	1		5	①	①	①	①	6			①	N	N	N	N	N	N	N	N	N	N	N	N	4	141.69	191.49	35
	2		5															N						4	125.61	183.28	36
	3		5															N						5	97.73 ② ~~97.73~~	165.79	37
	4		5															N						5	136.62	194.64	38
	5		5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	N	↓	↓	↓	↓	↓	5	141.62	195.9	39

① Oil slick floating on surface

② WE 3/4/09 TS

Weighboats	Tare Wt.	Final Wt.
1	85.96 mg	91.87 mg
2	101.13 mg	106.07 mg
3	88.34 mg	97.35 mg

Page ____of____

NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	**Organism:**	**NewFields Test ID:**	**Test Duration (days):**
SAIC / Irondale	Neanthes		20

PRETEST / [✓ INITIAL] / FINAL / OTHER (circle one) **DAY of TEST:** 0

[✓ OVERLYING (OV)] / POREWATER (PW) (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
12 Feb.'09	17.5	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
0	Swzz.	2/12/09 MMB	<0.5	18.0	2/12/09 MMB	N			0.005
REF ID01	↓	↓	4.18	↓	↓	↓			0.025
REF ID02			3.99						0.011
ID 100			<0.5						0.016
ID 101			<0.5						0.020
ID 102			<0.5						0.022
ID 108			<0.5						0.031
ID · 000. MIX			<0.5						0.012

Page ____ of ____

NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project: SAIC / Irondale	**Organism:** Neanthes	**NewFields Test ID:**	**Test Duration (days):** 20

PRETEST / [✓ INITIAL] / FINAL / OTHER (circle one) **DAY of TEST:** 0
OVERLYING (OV) / [✓ POREWATER (PW)] (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
12 Feb. '09	17.5	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
0	Swwr.	2/12/09 MMB	<0.5	16.5	2/12/09 MMB	N	7.2	26	0.087
REFID01	↓	↓	8.86	↓	↓	↓	7.2	28	0.134
REFID02	↓	↓	13.8	↓	↓	↓	7.2	28	0.153
ID 100	↓	↓	<0.5	↓	↓	↓	7.2	26	0.265
ID 101	↓	↓	<0.5	↓	↓	↓	7.3	27	0.241
ID 102	↓	↓	1.40	↓	↓	↓	7.3	26	0.392 ①
ID 108	↓	↓	<0.5	↓	↓	↓	7.4	22	0.720 ①
ID. 000. MIX	↓	↓	<0.5	↓	↓	↓	7.5	26	0.222

Y:\Projects\BIOASSAY FILES\Lab Logs & Forms\Ammonia Analysis Record.doc
Last printed 1/12/2009 9:53:00 AM

① used 2x multiplier, MMB 2/12/09.

Page ____ of ____

NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	Organism:	NewFields Test ID:	Test Duration (days):
SAIC/Irondale	Neanthes		

PRETEST / INITIAL / [✓ FINAL] / OTHER (circle one) DAY of TEST: _____

[✓ OVERLYING (OV)] / POREWATER (PW) (circle one)

Calibration Standards Temperature		
Date:	**Temperature:**	Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
3/4/09	19.0	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
Control	Surr.	03/04/09 CR	<0.5	19.0	03/04/09 CR	N			0.014
SB-REF-ID01	↓	↓	<0.5	↓	↓	↓			0.011
SB-REF-ID02			<0.5						0.011
ID-100			2.77						0.005
ID-101			<0.5						0.008
ID-102			<0.5						0.010
ID-108			<0.5						0.012
ID-000-MIX			3.38						0.007

Page ____of____

NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	**Organism:**	**NewFields Test ID:**	**Test Duration (days):**
SAIC/Irondale			

PRETEST / INITIAL / [✓ FINAL] / OTHER (circle one) **DAY of TEST:** _____
OVERLYING (OV) / [✓ POREWATER (PW)] (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
3/4/09	19.0	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
Control	Surr.	03/04/09 CR	<0.5	19.0	03/04/09 CR	N	7.2	32	NA*
SB-REF-ID01			0.577				7.3	31	NA*
SB-REF-ID02			0.916				7.6	32	NA*
ID-100			2.82				7.7	32	0.096①
ID-101			<0.5				7.7	30	0.161①
ID-102			1.04				7.7	30	0.170
ID-108			0.693				7.6	31	0.422
ID-000-MIX			3.06				7.6	32	0.192

*insufficient porewater to measure

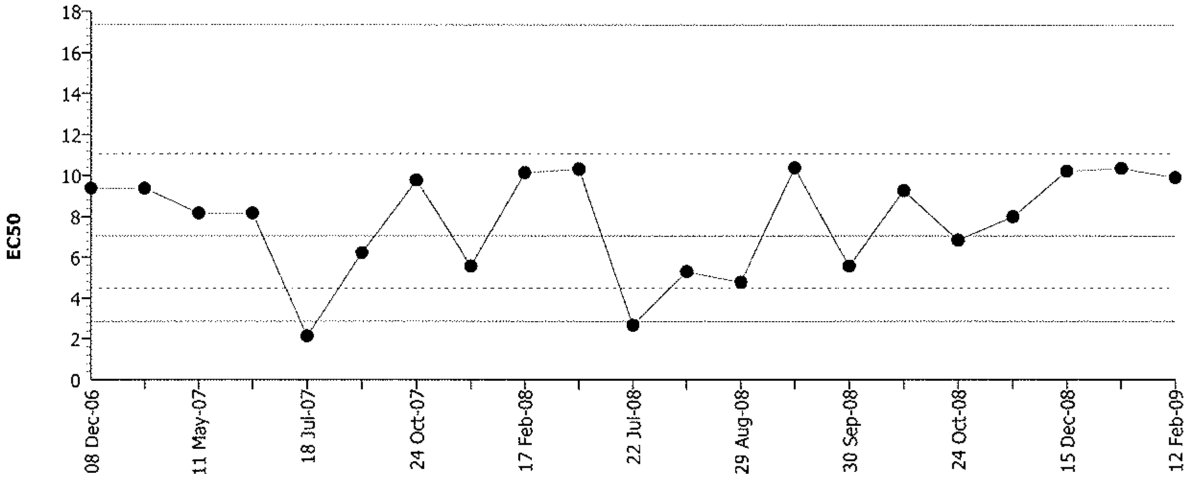
① porewater diluted by 1/2, actual concentrations = 0.192 for ID-100 and 0.322 for ID-101

CETIS QC Chart

Report Date: 23 Mar-09 3:12 PM

Neanthes 10-d Survival and Growth Sediment Test **NewFields**

Test Type:	Survival-Growth	**Organism:**	Neanthes arenaceodentata (Polycha	**Material:**	Cadmium chloride
Protocol:	PSEP (1995)	**Endpoint:**	Proportion Survived	**Source:**	Reference Toxicant-REF



Mean:	7.04453	**Count:**	20	**-1s Warning Limit:**	4.48996	**-2s Action Limit:**	2.86176
Sigma:		**CV:**	56.90%	**+1s Warning Limit:**	11.0525	**+2s Action Limit:**	17.3409

Quality Control Data

Point	Year	Month	Day	Data	Delta	Sigma	Warning	Action	Test Link	Analysis
1	2006	Dec	8	9.37175	2.32722	0.63376			10-5822-0812	08-7192-3895
2			8	9.37175	2.32722	0.63376			10-5822-0812	10-0140-9364
3	2007	May	11	8.16253	1.11800	0.32704			03-7778-9913	06-1785-2165
4		Jun	26	8.16258	1.11805	0.32706			09-6212-3109	14-8493-4946
5		Jul	18	2.13748	-4.90706	-2.64788	(-)	(-)	09-5163-0637	11-9760-1230
6		Sep	25	6.20193	-0.84260	-0.28284			06-6354-6111	12-2113-4941
7		Oct	24	9.76006	2.71553	0.72389			05-9113-1606	14-0319-5260
8			30	5.55412	-1.49042	-0.52777			03-0327-1386	13-6201-5780
9	2008	Feb	17	10.12762	3.08309	0.80597			11-6935-8907	04-7495-8038
10		Jul	2	10.30107	3.25654	0.84367			07-0160-7176	03-3190-0644
11			22	2.65108	-4.39345	-2.16978	(-)	(-)	12-3989-8103	10-4556-3131
12		Aug	5	5.30308	-1.74145	-0.63046			12-5764-3928	08-5080-2403
13			29	4.77241	-2.27213	-0.86455			04-2068-8020	17-2391-7369
14		Sep	26	10.37648	3.33195	0.85987			12-2518-6391	15-3142-3234
15			30	5.55412	-1.49042	-0.52777			14-9908-4079	13-4530-5299
16		Oct	9	9.26124	2.21671	0.60742			06-2717-9387	09-3671-8537
17			24	6.83792	-0.20661	-0.06609			19-3732-1210	15-3671-1948
18		Nov	6	7.98431	0.93978	0.27803			15-0302-5653	02-0509-3199
19		Dec	15	10.20151	3.15698	0.82211			12-5691-1479	14-1608-5886
20			23	10.35175	3.30722	0.85457			17-9927-6897	13-4293-3597
21	2009	Feb	12	9.89631	2.85178	0.75467			00-4858-6176	11-2471-0306

Analyst:________ Approval:________

Comparisons: Page 1 of 2
Report Date: 23 Mar-09 3:11 PM
Analysis: 01-2733-1727

CETIS Analysis Detail

Neanthes 10-d Survival and Growth Sediment Test **NewFields**

Test No:	18-6852-8066	**Test Type:**	Survival-Growth	**Duration:**	95h
Start Date:	12 Feb-09 03:45 PM	**Protocol:**	PSEP (1995)	**Species:**	Neanthes arenaceodentata
Ending Date:	16 Feb-09 02:50 PM	**Dil Water:**	Laboratory Seawater	**Source:**	Other
Setup Date:	12 Feb-09 03:45 PM	**Brine:**	Not Applicable		

Comments: P080418.47

Sample No:	10-3636-1315	**Code:**	1036361315	**Client:**	Internal Lab
Sample Date:	12 Feb-09 03:45 PM	**Material:**	Cadmium chloride	**Project:**	Reference Toxicant
Receive Date:		**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**	P080418.47		

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	00-4858-6176	00-4858-6176	23 Mar-09 3:11 PM	CETISv1.1.2

Method	Alt H	Data Transform	Zeta	NOEL	LOEL	Toxic Units	ChV	PMSD
Dunnett's Multiple Comparison	C > T	Angular (Corrected)		3.75	7.5	26.6667	5.30330	9.26%

Group Comparisons

Control vs	Conc-mg/L	Statistic	Critical	P-Value	MSD	Decision(0.05)
Dilution Water	1.875	0	2.41651	0.7500	0.15050	Non-Significant Effect
	3.75	0	2.41651	0.7500	0.15050	Non-Significant Effect
	7.5	2.50394	2.41651	0.0439	0.15050	Significant Effect

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	0.0547180	0.0182394	3	3.13	0.08720	Non-Significant Effect
Error	0.0465461	0.0058183	8			
Total	0.10126412	0.0240576	11			

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Modified Levene	465.09850	7.59099	0.00000	Unequal Variances
Distribution	Shapiro-Wilk W	0.61528		0.00014	Non-normal Distribution

Data Summary

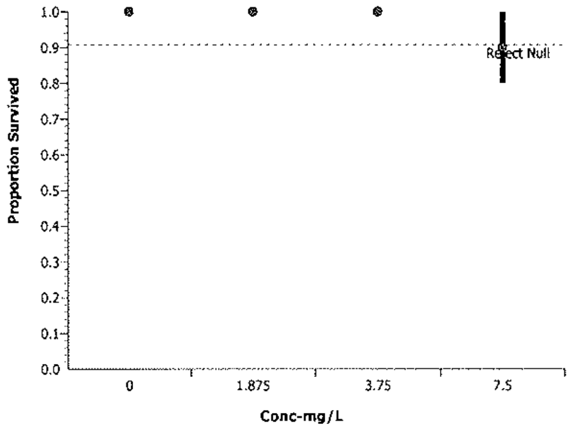
			Original Data				Transformed Data			
Conc-mg/L	Control Type	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0	Dilution Water	3	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00029
1.875		3	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00029
3.75		3	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00029
7.5		3	0.90000	0.80000	1.00000	0.10000	1.25607	1.10715	1.41202	0.15256

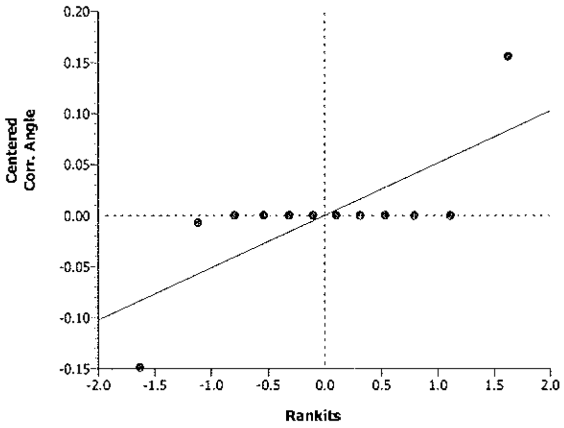
CETIS Analysis Detail

Data Detail

Conc-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1.00000	1.00000	1.00000							
1.875		1.00000	1.00000	1.00000							
3.75		1.00000	1.00000	1.00000							
7.5		0.90000	1.00000	0.80000							

Graphics





CETIS Analysis Detail

Report Date: 23 Mar-09 3:12 PM
Analysis: 11-2471-0306

Neanthes 10-d Survival and Growth Sediment Test **NewFields**

Test No:	18-6852-8066	**Test Type:**	Survival-Growth	**Duration:**	95h
Start Date:	12 Feb-09 03:45 PM	**Protocol:**	PSEP (1995)	**Species:**	Neanthes arenaceodentata
Ending Date:	16 Feb-09 02:50 PM	**Dil Water:**	Laboratory Seawater	**Source:**	Other
Setup Date:	12 Feb-09 03:45 PM	**Brine:**	Not Applicable		
Comments:	P080418.47				

Sample No:	10-3636-1315	**Code:**	1036361315	**Client:**	Internal Lab
Sample Date:	12 Feb-09 03:45 PM	**Material:**	Cadmium chloride	**Project:**	Reference Toxicant
Receive Date:		**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**	P080418.47		

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Trimmed Spearman-Karber	00-4858-6176	00-4858-6176	23 Mar-09 3:12 PM	CETISv1.1.2

Spearman-Karber Options

Threshold Option	Lower Threshold	Trim	Mu	Sigma
Control Threshold	0	0.00%	0.9954733	0.01648809

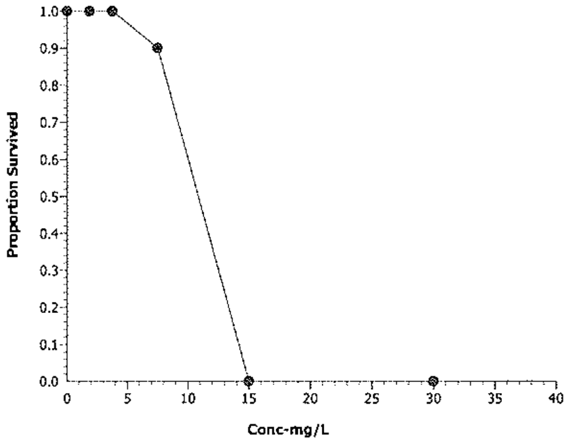
Point Estimates

EC50/LC50	95% LCL	95% UCL
9.89631	9.17270	10.67700

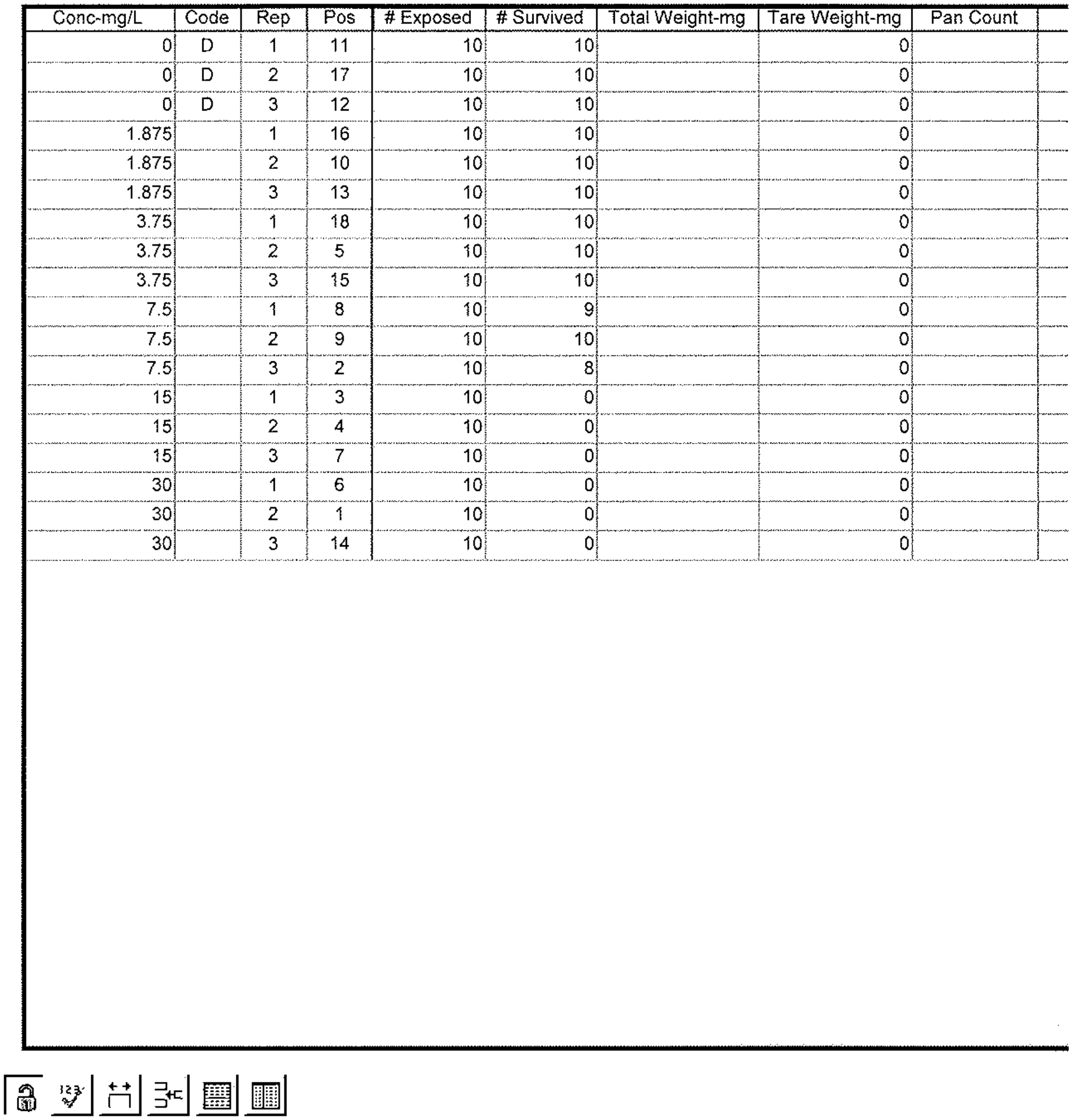
Data Summary

			Calculated Variate(A/B)						
Conc-mg/	Control Type	Count	Mean	Minimum	Maximum	SE	SD	A	B
0	Dilution Water	3	1.00000	1.00000	1.00000	0.00000	0.00000	30	30
1.875		3	1.00000	1.00000	1.00000	0.00000	0.00000	30	30
3.75		3	1.00000	1.00000	1.00000	0.00000	0.00000	30	30
7.5		3	0.90000	0.80000	1.00000	0.02041	0.10000	27	30
15		3	0.00000	0.00000	0.00000	0.00000	0.00000	0	30
30		3	0.00000	0.00000	0.00000	0.00000	0.00000	0	30

Graphics



Analyst:________ Approval:________



Conc-mg/L	Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count
0	D	1	11	10	10		0	
0	D	2	17	10	10		0	
0	D	3	12	10	10		0	
1.875		1	16	10	10		0	
1.875		2	10	10	10		0	
1.875		3	13	10	10		0	
3.75		1	18	10	10		0	
3.75		2	5	10	10		0	
3.75		3	15	10	10		0	
7.5		1	8	10	9		0	
7.5		2	9	10	10		0	
7.5		3	2	10	8		0	
15		1	3	10	0		0	
15		2	4	10	0		0	
15		3	7	10	0		0	
30		1	6	10	0		0	
30		2	1	10	0		0	
30		3	14	10	0		0	

NEWFIELDS

96-HOUR REFERENCE TOXICANT TEST OBSERVATION DATASHEET

			SPECIES *Neanthes arenaceodentata*		
CLIENT SAIC	PROJECT Irondale Intertidal	NEWFIELDS JOB # .	PROJECT MANAGER B. Hester	NEWFIELDS LAB Port Gamble Bath 7	PROTOCOL PSEP 1995

SURVIVAL & BEHAVIOR DATA

#S= Number on the Surface
#M= Number of Mortality
L=Anoxic Surface
F=Fungal Patches
D=No Air Flow (DO?)
U=Excess food
N=Normal
B=No Burrows

INITIAL # OF ORGANISMS

					DAY 1			DAY 2			DAY 3			DAY 4		
					DATE 2/13			DATE			DATE 2/15/09			DATE 2/16/09		
					TECHNICIAN CR			TECHNICIAN			TECHNICIAN CR			TECHNICIAN MMB		
CLIENT/ NEWFIELDS ID	CONC. value	CONC. units	REP	INITIAL NUMBER	#ALIVE	#DEAD	OBS	#ALIVE	#DEAD	OBS	#ALIVE	#DEAD	OBS	#ALIVE	#DEAD	OBS
Ref.Tox.-cadmium	0	mg/L	1		10	0	N				10	0	N	10	0	N
			2		10	0	N				10	0	↓	10	0	↓
			3		10	0	N				10	0	↓	10	0	↓
Ref.Tox.-cadmium	1.875	mg/L	1		10	0	N				10	0	↓	10	0	N
			2		10	0	N				10	0	↓	10	0	↓
			3		10	0	N				10	0	↓	10	0	↓
Ref.Tox.-cadmium	3.75	mg/L	1		10	0	N				10	0	↓	10	0	N
			2		10	0	N				10	0	↓	10	0	↓
			3		10	0	N				10	0	↓	10	0	↓
Ref.Tox.-cadmium	7.5	mg/L	1		10	0	N				10	0	Q	9	1	Q
			2		10	0	N				10	0	Q	10	0	↓
			3		10	0	N				10	0	Q	8	2	↓
Ref.Tox.-cadmium	15	mg/L	1		9	1	Q				0	9	N	—	—	—
			2		9	1	Q				0	9	N	—	—	—
			3		8	2	Q				0	8	N	—	—	—
Ref.Tox.-cadmium	30	mg/L	1		0	10	—	—	—	—	—	—	—	—	—	—
			2		2	0	Q				0	2	N	—	—	—
			3		0	10	—	—	—	—	—	—	—	—	—	—

96-HOUR REFERENCE TOXICANT TEST WATER QUALITY DATASHEET

NEWFIELDS

CLIENT	PROJECT	SPECIES	NEWFIELDS LABORATORY	PROTOCOL
SAIC	Irondale Intertidal	*Neanthes arenaceodentata*	Port Gamble Bath 7	PSEP 1995
NEWFIELDS JOB NUMBER	PROJECT MANAGER	QUANTITY OF STOCK : 4.5 mL	QUANTITY OF DILUENT: 1500mL	INIT MMB
.	B. Hester	ACTUAL: 4.507 ~~mg~~	ACTUAL: 1500.2 g	DATE PREP 2/11/09
Test ID	LOT #:	TEST START DATE:	TIME / TEST END DATE	TIME
P08048.47	06510TC	12Feb09	1545 / 16Feb09	1450

WATER QUALITY DATA

DILTIN.WAT.BATCH	TEMP REC#	REFERENCE TOX. MATERIAL	REFERENCE TOXICANT
FSW021109.01		cadmium chloride	cadmium

TEST CONDITIONS	DO (mg/L)	TEMP(C)	SAL (ppt)	pH	TECHNICIAN
	> 6.0	20 ± 1	28 ± 1	8.00 ± 1	

CLIENT/ NEWFIELDS ID	CONCENTRATION value	CONCENTRATION units	DAY	REP	D.O. meter	D.O. mg/L	TEMP. meter	TEMP. °C	SALINITY meter	SALINITY ppt	pH meter	pH unit	WQ TECH
Ref.Tox.-cadmium	0	mg/L	0	Stock	3	7.3	3	20.2	3	27	3	7.9	MMB 2/12/09
			1	Rep	4	7.2	4	19.5	1	28	1	7.7	CR
			2	Rep	3	6.9	3	19.6	3	28	3	7.8	CR
			3	Rep	3	6.8	3	19.8	3	28	3	7.8	CR
			4	Rep	3	7.5	3	19.7	3	28	3	7.8	MMB 2/16/09
Ref.Tox.-cadmium	1.875	mg/L	0	Stock	3	7.3	3	20.1	3	27	3	7.9	MMB 2/12/09
			1	Rep	4	7.5	4	19.9	1	28	1	7.8	CR
			2	Rep	3	7.0	3	19.8	3	28	3	7.8	CR
			3	Rep	3	7.1	3	19.9	3	29	3	7.9	CR
			4	Rep	3	7.8	3	19.7	3	29	3	8.0	MMB 2/16/09
Ref.Tox.-cadmium	3.75	mg/L	0	Stock	3	7.3	3	20.0	3	27	3	8.0	MMB 2/12/09
			1	Rep	4	7.5	4	20.1	1	28	1	7.9	CR
			2	Rep	3	7.1	3	19.9	3	28	3	7.8	CR
			3	Rep	3	6.9	3	20.2	3	28	3	7.9	CR
			4	Rep	3	7.5	3	19.9	3	28	3	8.0	MMB 2/16/09

NEWFIELDS

96-HOUR REFERENCE TOXICANT TEST WATER QUALITY DATASHEET

CLIENT	PROJECT	SPECIES	NEWFIELDS LABORATORY		PROTOCOL
SAIC	Irondale Intertidal	*Neanthes arenaceodentata*	Port Gamble Bath 7		PSEP 1995
NEWFIELDS JOB NUMBER	PROJECT MANAGER	QUANTITY OF STOCK : 4.5 mL	QUANTITY OF DILUENT: 1500mL		INIT
	B. Hester	ACTUAL:	ACTUAL:		DATE PREP
Test ID	LOT #:	TEST START DATE:	TIME	TEST END DATE	TIME
		12Feb09		16Feb09	

WATER QUALITY DATA

DILTN.WAT.BATCH	TEMP REC#	REFERENCE TOX. MATERIAL	REFERENCE TOXICANT
FSW021109.01		cadmium chloride	cadmium

TEST CONDITIONS					DO (mg/L)		TEMP(C)		SAL (ppt)		pH	TECHNICIAN
					> 6.0		20 ± 1		28 ± 1		8.00 ± 1	
Ref.Tox.-cadmium	7.5 mg/L	0	Stock	3	7.3	3	20.0	3	27	3	8.0	MMB 2/12/09
		1	Rep	4	7.7	4	20.1	1	28	1	7.9	CR
		2	Rep	3	7.2	3	20.0	3	28	3	7.8	CR
		3	Rep	3	7.0	3	20.3	3	28	3	7.9	CR
		4	Rep	3	7.7	3	19.7	3	29	3	8.1	MMB 2/16/09
Ref.Tox.-cadmium	15 mg/L	0	Stock	3	7.3	3	20.0	3	27	3	8.0	MMB 2/12/09
		1	Rep	4	7.4	4	20.1	1	28	1	8.0	CR
		2	Rep	3	7.0	3	20.0	3	28	3	7.9	CR
		3	Rep	3	6.9	3	20.2	3	29	3	7.9	CR
		4	Rep									
Ref.Tox.-cadmium	30 mg/L	0	Stock	3	7.5	3	20.1	3	27	3	8.0	MMB 2/12/09
		1	Rep	4	7.4	4	20.1	1	28	1	8.0	CR
		2	Rep	3	7.0	3	20.0	3	28	3	7.9	CR
		3	Rep	3	7.0	3	20.2	3	29	3	7.9	CR
		4	Rep									

NEWFIELDS

ORGANISM RECEIPT LOG

Date: 2/5/09

Time: 1400

NewFields Batch No. DR 0128

Organism: Neanthes

Source: Don Reish

Address: On File

Invoice Attached Yes [✓ No]

Phone: On File

Contact: On File

No. Ordered:

No. Received:

Source Batch: Culture

Condition of Organisms: Good

Approximate Size or Age: 3-5 mm

Shipper: Fed Ex

B of L (Tracking No.) 8682 4360 0128

Condition of Container: Good

Received By: MMB

Confirmation of ID of Organism: Yes [✓ No]

Technician (Initials): MMB

Notes:

pH (Units)	Temp. (°C)	D.O. (mg/L)	Conductivity or Salinity (Include Units)	Technician (Initials)
7.3	16.7	7.9	36 ppt	MMB

Notes:

NEWFIELDS

SEDIMENT BIOASSAY TEST - EMBRYO DEVELOPMENT WATER QUALITY DATA

CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation	SPECIES *Mytilus galloprovencialis*	NEWFIELDS LAB / LOCATION Port Gamble / Bath 5	PROTOCOL PSEP (1995)
JOB NUMBER 1101-009-860	PROJECT MANAGER B. Hester	TEST START DATE 13Feb09 TIME 2100	TEST END DATE 2/16/09	TIME

* Day 3 observations needed only if development endpoint not met by day 2

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) >4.8		Temp (°C) 16 ± 1		Sal (ppt) 28 ~~31~~ ± 1		pH 7.8 ± 0.5		Ammonia NA		Sulfide NA		TECH	DATE
				D.O.		TEMP.		SALINITY		pH		AMMONIA		SULFIDE			
CLIENT/ NEWFIELDS ID	DAY	Random #	REP	meter	mg/L	meter	°C	meter	ppt	meter	unit	Techn.	mg/L (total)	Techn.	mg/L ~~ug/L~~ (Total)		
Control /	0	39	WQ Surr	3	① 8.2 ~~8.2~~ ~~7.6~~	3	15.7	3	27	3	7.6	BH	<0.5	BH	0.001	BH	2/13/09
Control /	1		WQ Surr	3	7.7	3	16.2	3	27	3	7.7					CR	2/14
Control /	2		WQ Surr	3	8.0	3	16.1	3	27	3	7.9					CR	2/15
Control /	3*		WQ Surr	3	8.2	3	15.7	3	28	3	7.3	BH	<0.5	BH	0.022	NMB	2/16
SB-REF-ID01 / P090129.04	0	13	WQ Surr	3	7.3	3	15.4	3	27	3	7.8	BH	<0.5	BH	0.039	TB	2/13
SB-REF-ID01 / P090129.04	1		WQ Surr	3	6.9	3	16.1	3	27	3	7.8					CR	2/14
SB-REF-ID01 / P090129.04	2		WQ Surr	3	7.7	3	16.6	3	27	3	7.8					CR	2/15
SB-REF-ID01 / P090129.04	3*		WQ Surr	3	8.1	3	15.7	3	28	3	7.6	BH	<0.5	BH	0.007	NMB	2/16
SB-REF-ID02 / P090129.05	0	42	WQ Surr	3	7.5	3	15.4	3	27	3	7.8	BH	<0.5	BH	0.010	TB	2/13
SB-REF-ID02 / P090129.05	1		WQ Surr	3	7.1	3	16.0	3	27	3	7.8					CR	2/14
SB-REF-ID02 / P090129.05	2		WQ Surr	3	8.6	3	16.3	3	27	3	7.9					CR	2/15
SB-REF-ID02 / P090129.05	3		WQ Surr	3	9.3	3	15.6	3	28	3	8.0	BH	<0.5	BH	0.003	NMB	2/16

① WE 2/13/09 TB

NEWFIELDS

SEDIMENT BIOASSAY TEST - EMBRYO DEVELOPMENT WATER QUALITY DATA

CLIENT	PROJECT	SPECIES		NEWFIELDS LAB / LOCATION	PROTOCOL
SAIC	Irondale Intertidal Sediment Investigation	*Mytilus galloprovencialis*		Port Gamble / Bath 5	PSEP (1995)
JOB NUMBER	**PROJECT MANAGER**	**TEST START DATE**	**TIME**	**TEST END DATE**	**TIME**
1101-009-860	B. Hester	13Feb09	2115	2/16/09	1030

* Day 3 observations needed only if development endpoint not met by day 2

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) >4.8		Temp (°C) 16 ± 1		Sal (ppt) 28 ~~31~~ ± 1		pH 7.8 ± 0.5		Ammonia NA		Sulfide NA		TECH	DATE
CLIENT/ NEWFIELDS ID	DAY	Random #	REP	D.O.		TEMP.		SALINITY		pH		AMMONIA		SULFIDE			
				meter	mg/L	meter	°C	meter	ppt	meter	unit	Techn.	mg/L (total)	Techn.	Mg/L (Total)		
ID-100 / P090107.06	0	26	WQ Surr	3	7.7	3	15.5	3	27	3	7.8	BH	<0.5	BH	0.049	TS	2/13
ID-100 / P090107.06	1		WQ Surr	3	7.1	3	15.9	3	27	3	7.8					CR	2/14
ID-100 / P090107.06	2		WQ Surr	3	8.0	3	16.0	3	27	3	7.9					CR	2/15
ID-100 / P090107.06	3*		WQ Surr	3	8.0	3	15.7	3	28	3	7.9	BH	<0.5	BH	0.007	MMB	2/16
ID-101 / P090107.01	0	40	WQ Surr	3	7.5	3	15.2	3	27	3	7.8	BH	<0.5	BH	0.081	TS	2/13
ID-101 / P090107.01	1		WQ Surr	3	7.0	3	15.9	3	27	3	7.8					CR	2/14
ID-101 / P090107.01	2		WQ Surr	3	7.9	3	16.5	3	27	3	7.5					CR	2/15
ID-101 / P090107.01	3		WQ Surr	3	7.5	3	15.7	3	28	3	7.9	BH	<0.5	BH	0.007	MMB	2/16
ID-102 / P090107.02	0	43	WQ Surr	3	7.7	3	15.5	3	27	3	7.7	BH	<0.5	BH	0.028	TS	2/13
ID-102 / P090107.02	1		WQ Surr	3	7.2	3	15.8	3	27	3	7.8					CR	2/14
ID-102 / P090107.02	2		WQ Surr	3	7.6	3	16.7	3	27	3	7.9					CR	2/15
ID-102 / P090107.02	3*		WQ Surr	3	7.8	3	15.6	3	28	3	7.9	BH	<0.5	BH	0.014	MMB	2/16

NEWFIELDS

SEDIMENT BIOASSAY TEST - EMBRYO DEVELOPMENT
WATER QUALITY DATA

CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation	SPECIES *Mytilus galloprovencialis*		NEWFIELDS LAB / LOCATION Port Gamble / Bath 5	PROTOCOL PSEP (1995)
JOB NUMBER 1101-009-860	PROJECT MANAGER B. Hester	TEST START DATE 13Feb09	TIME	TEST END DATE	TIME

* Day 3 observations needed only if development endpoint not met by day 2

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) >4.8		Temp (°C) 16 ± 1		Sal (ppt) 31 ± 1		pH 7.8 ± 0.5		Ammonia NA		Sulfide NA		TECH	DATE
				D.O.		TEMP.		SALINITY		pH		AMMONIA		SULFIDE			
CLIENT/ NEWFIELDS ID	DAY	Random #	REP	meter	mg/L	meter	°C	meter	ppt	meter	unit	Techn.	mg/L (total)	Techn.	ug/L (Total)		
ID-108 / P090107.08	0	32	WQ Surr	3	7.4	3	15.4	3	27	3	7.8	BH	<0.5	BH	0.091	TS	2/13
ID-108 / P090107.08	1		WQ Surr	3	7.1	3	15.8	3	27	3	7.8					CR	2/14
ID-108 / P090107.08	2		WQ Surr	3	8.1	3	16.7	3	27	3	7.9					CR	2/15
ID-108 / P090107.08	3		WQ Surr	3	7.9	3	15.6	3	28	3	7.9	BH	<0.5	BH	0.007	MMB	2/16
ID-000-MIX / P090129.06	0	1	WQ Surr	3	7.7	3	15.4	3	27	3	7.8	BH	<0.5	BH	0.060	TS	2/13
ID-000-MIX / P090129.06	1		WQ Surr	3	7.1	3	15.8	3	27	3	7.8					CR	2/14
ID-000-MIX / P090129.06	2		WQ Surr	3	7.9	3	16.7	3	27	3	7.8					CR	2/15
ID-000-MIX / P090129.06	3*		WQ Surr	3	7.7	3	15.6	3	27	3	7.9	BH	<0.5	BH	0.004	MMB	2/16
Sediment Control /	0	54	WQ Surr	3	7.6	3	16.1	3	27	3	7.6	BH	<0.5	BH	0008	TS	2/13
Sediment Control /	1		WQ Surr	3	7.0	3	15.9	3	27	3	7.7					CR	2/14
Sediment Control /	2		WQ Surr	3	7.8	3	16.7	3	27	3	7.9					CR	2/15
Sediment Control /	3*		WQ Surr	3	7.9	3	15.7	3	28	3	7.9	BH	<0.5	BH	0.002	MMB	2/16

NEWFIELDS

SEDIMENT BIOASSAY TEST - EMBRYO DEVELOPMENT OBSERVATIONS

			SPECIES *Mytilus galloprovencialis*			
CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation	JOB NUMBER 1101-009-860	PROJECT MANAGER B. Hester	NEWFIELDS LAB / LOCATION Port Gamble / Bath 5	PROTOCOL PSEP (1995)	

LARVAL OBSERVATION DATA

CLIENT/ NEWFIELDS ID	REP	NUMBER NORMAL	NUMBER ABNORMAL	DATE	TECHNICIAN	COMMENTS
STOCKING DENSITY	1		228			
	2		271			
	3		223			
	4		259			
	5		269			
Control /	1	235	5	3/6/09	CR	
	2	233	7			
	3	221	5			
	4	257	4			
	5	251	9			
SB-REF-ID01 / P090129.04	1	193	4			
	2	198	3			
	3	186	9			
	4	228	3			
	5	211	3			2 small amphipods
SB-REF-ID02 / P090129.05	1	228	3			
	2	204	3			
	3	208	1			
	4	190	1			
	5	229	6			

NEWFIELDS

SEDIMENT BIOASSAY TEST - EMBRYO DEVELOPMENT OBSERVATIONS

			SPECIES *Mytilus galloprovencialis*		
CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation	JOB NUMBER 1101-009-860	PROJECT MANAGER B. Hester	NEWFIELDS LAB / LOCATION Port Gamble / Bath 5	PROTOCOL PSEP (1995)

LARVAL OBSERVATION DATA

CLIENT/ NEWFIELDS ID	REP	NUMBER NORMAL	NUMBER ABNORMAL	DATE	TECHNICIAN	COMMENTS
ID-100 / P090107.06	1	211	3	3/6/09	GR	
	2	228	1			
	3	251	4			
	4	268	4			
	5	228	1			
ID-101 / P090107.01	1	29	73	3/9/09	GR	
	2	33	96			
	3	18	102			
	4	30	111			
	5	22	113			
ID-102 / P090107.02	1	166	6			
	2	144	6			
	3	179	3			
	4	220	7			
	5	176	5			
ID-108 / P090107.08	1	186	3			
	2	194	4			
	3	194	3			
	4	191	1			
	5	189	2			

NEWFIELDS

SEDIMENT BIOASSAY TEST - EMBRYO DEVELOPMENT OBSERVATIONS

SPECIES
Mytilus galloprovencialis

CLIENT	PROJECT	JOB NUMBER	PROJECT MANAGER	NEWFIELDS LAB / LOCATION	PROTOCOL
SAIC	Irondale Intertidal Sediment Investigation	1101-009-860	B. Hester	Port Gamble / Bath 5	PSEP (1995)

LARVAL OBSERVATION DATA

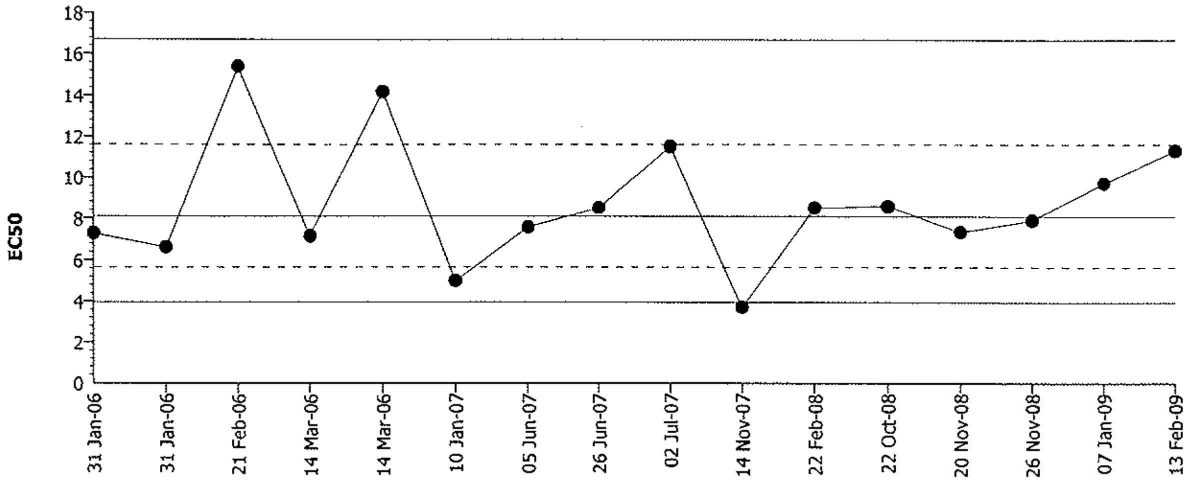
CLIENT/ NEWFIELDS ID	REP	NUMBER NORMAL	NUMBER ABNORMAL	DATE	TECHNICIAN	COMMENTS
ID-000-MIX / P090129.06	1	132	14	3/9/09	CR	
	2	125	6			
	3	183	7			
	4	122	9			
	5	160	25			
Sediment Control /	1	188	1			
	2	232	7			
	3	209	2			
	4	201	6			
	5	219	2	↓	↓	

CETIS QC Chart

Report Date: 09 Mar-09 9:41 AM

Mussel Shell Development Test **NewFields**

Test Type:	Development-Survival	**Organism:**	Mytilus species (Mussel)	**Material:**	Copper sulfate
Protocol:	EPA/600/R-95/136 (1995)	**Endpoint:**	Combined Proportion Normal	**Source:**	Reference Toxicant-REF



Mean:	8.09496	**Count:**	15	**-1s Warning Limit:**	5.63863	**-2s Action Limit:**	3.92764
Sigma:		**CV:**	43.56%	**+1s Warning Limit:**	11.6214	**+2s Action Limit:**	16.6839

Quality Control Data

Point	Year	Month	Day	Data	Delta	Sigma	Warning	Action	Test Link	Analysis
1	2006	Jan	31	7.27814	-0.81682	-0.29415			07-7532-7374	03-9619-0590
2			31	6.61806	-1.47690	-0.55707			13-7720-1086	09-0953-9971
3		Feb	21	15.39971	7.30475	1.77849	(+)		13-4991-4803	05-4083-6897
4		Mar	14	7.14387	-0.95109	-0.34565			06-2606-4386	01-1874-9985
5			14	14.18912	6.09416	1.55208	(+)		04-5028-3346	02-3972-6078
6	2007	Jan	10	4.98039	-3.11457	-1.34329	(-)		14-3905-0090	14-8759-6838
7		Jun	5	7.58039	-0.51457	-0.18163			13-7829-5492	02-0555-4940
8			26	8.51244	0.41748	0.13907			01-3435-1614	10-7297-9254
9		Jul	2	11.50108	3.40612	0.97123			05-4911-0140	15-1586-2946
10		Nov	14	3.68371	-4.41125	-2.17732	(-)	(-)	15-3555-7493	15-2027-0867
11	2008	Feb	22	8.50255	0.40759	0.13585			06-6162-8975	04-4740-6893
12		Oct	22	8.57836	0.48340	0.16040			13-5164-0440	13-1167-6043
13		Nov	20	7.33284	-0.76212	-0.27345			09-2389-8810	07-3147-8972
14			26	7.91375	-0.18121	-0.06261			15-3498-9291	14-5622-3642
15	2009	Jan	7	9.69234	1.59738	0.49805			10-8012-7714	12-5942-1542
16		Feb	13	11.30617	3.21121	0.92396			06-5042-8719	03-4482-1393

Analyst: BH

Approval: BH

CETIS Analysis Detail

Spearman-Karber:	Page 1 of 1
Report Date:	08 Mar-09 4:17 PM
Analysis:	03-4482-1393/P070930.10

Mussel Shell Development Test **NewFields**

Endpoint	**Analysis Type**	**Sample Link**	**Control Link**	**Date Analyzed**	**Version**
Combined Proportion Normal	Trimmed Spearman-Karber	06-5042-8719	06-5042-8719	08 Mar-09 4:17 PM	CETISv1.1.2

Spearman-Karber Options

Threshold Option	**Lower Threshold**	**Trim**	**Mu**	**Sigma**
Control Threshold	0.06861314	0.00%	1.053315	0.005519106

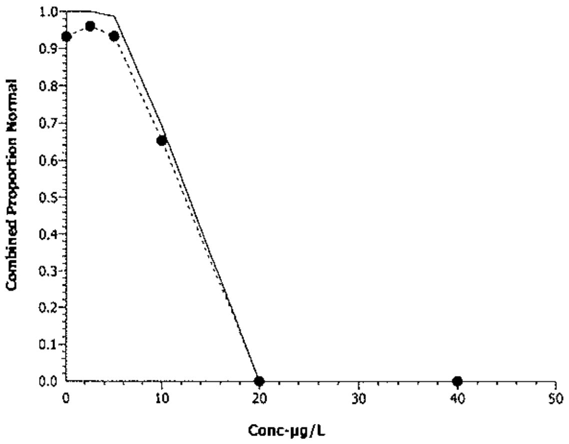
Point Estimates

EC50/LC50	**95% LCL**	**95% UCL**
11.30617	11.02242	11.59721

Data Summary

			Calculated Variate(A/B)						
Conc-µg/L	**Control Type**	**Count**	**Mean**	**Minimum**	**Maximum**	**SE**	**SD**	**A**	**B**
0	Dilution Water	3	0.93081	0.85333	0.97021	0.01370	0.06710	638	685
2.5		3	0.96000	0.90667	1.00000	0.00981	0.04807	651	678
5		3	0.93204	0.85333	0.98723	0.01428	0.06998	639	685
10		3	0.65333	0.63111	0.69333	0.00709	0.03471	441	675
20		3	0.00000	0.00000	0.00000	0.00000	0.00000	0	675
40		2	0.00000	0.00000	0.00000	0.00000	0.00000	0	450

Graphics



Analyst: BH Approval: BH

Comparisons:	Page 1 of 1
Report Date:	08 Mar-09 4:16 PM
Analysis:	02-8071-9842/P070930.10

CETIS Analysis Detail

Mussel Shell Development Test NewFields

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Combined Proportion Normal	Comparison	06-5042-8719	06-5042-8719	08 Mar-09 4:16 PM	CETISv1.1.2

Method	Alt H	Data Transform	Zeta
Fisher Exact/Bonferroni-Holm	C > T	Untransformed	

NOEL	LOEL	Toxic Units	ChV	PMSD
5	10	20	7.07107	

Group Comparisons

Control	vs	Conc-µg/L	Statistic	P-Value	Decision(0.05)
Dilution Water		2.5	1.00000	1.00000	Non-Significant Effect
Dilution Water		5	1.00000	1.00000	Non-Significant Effect
Dilution Water		10	0.00000	0.00000	Significant Effect
Dilution Water		20	0.00000	0.00000	Significant Effect
Dilution Water		40	0.00000	0.00000	Significant Effect

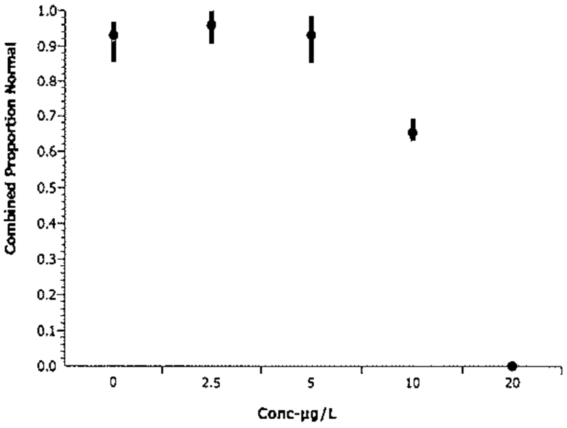
Data Summary

Conc-µg/L	Control Type	Non-Responders	Responders	Total Observed
0	Dilution Water	638	47	685
2.5		651	27	678
5		639	46	685
10		441	234	675
20		0	675	675
40		0	450	450

Data Detail

Conc-µg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	0.97021	0.85333	0.96889							
2.5		0.90667	1.00000	0.97333							
5		0.85333	0.95556	0.98723							
10		0.69333	0.63111	0.63556							
20		0.00000	0.00000	0.00000							
40		0.00000	0.00000								

Graphics



Analyst:______ Approval:______

Report Date: 08 Mar-09 4:17 PM
Link: 06-5042-8719/P070930.10

CETIS Data Worksheet

Mussel Shell Development Test **NewFields**

Start Date:	13 Feb-09 09:15 PM	**Species:**	Mytilus species	**Sample Code:**	P070930.101
Ending Date:	16 Feb-09 10:30 AM	**Protocol:**	EPA/600/R-95/136 (1995)	**Sample Source:**	Reference Toxicant
Sample Date:	08 Mar-09 03:49 PM	**Material:**	Copper sulfate	**Sample Station:**	P070930.101

Conc-µg/L	Code	Rep	Pos	Initial Density	Final Density	# Counted	# Normal	Notes
0	D	1	15	225	235	235	228	
0	D	2	9	225	197	197	192	
0	D	3	2	225	227	227	218	
2.5		1	4	225	214	214	204	
2.5		2	13	225	228	228	228	
2.5		3	7	225	225	225	219	
5		1	16	225	199	199	192	
5		2	18	225	221	221	215	
5		3	12	225	235	235	232	
10		1	10	225	222	222	156	
10		2	6	225	250	250	142	
10		3	11	225	204	204	143	
20		1	14	225	212	212	0	
20		2	17	225	183	183	0	
20		3	8	225	198	198	0	
40		1	1	225	10	10	0	
40		2	5	225	8	8	0	
40		3	3	225	4	4		

Analyst: BH Reviewed By: BH

SEDIMENT BIOASSAY TEST -EMBRYO DEVELOPMENT
REF TOX OBSERVATIONS

NEWFIELDS

			SPECIES *Mytilus galloprovencialis*		
CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation	JOB NUMBER 1101-009-860	PROJECT MANAGER B. Hester	NEWFIELDS LAB / LOCATION Port Gamble / Incubator	PROTOCOL PSEP (1995)

LARVAL OBSERVATION DATA

CLIENT/ NEWFIELDS ID	CONC. value	CONC. units	VIAL NUMBER	REP	NUMBER NORMAL	NUMBER ABNORMAL	DATE	TECHNICIAN	COMMENTS
Ref.Tox. - Copper	0	µg/L		1	228	7	2/23/09	CR	
				2	192	5			
				3	218	9	↓	↓	
Ref.Tox. - Copper	2.5	µg/L		1	204	10	2/25/09	CR	
				2	228	0			
				3	219	6			
Ref.Tox. - Copper	5	µg/L		1	192	7			
				2	215	6			
				3	232	3	↓	↓	
Ref.Tox. - Copper	10	µg/L		1	156	66	2/26/09	CR	
				2	142	108			
				3	143	61			
Ref.Tox. - Copper	20	µg/L		1	0	212			
				2	0	183			
				3	0	198			
Ref.Tox. - Copper	40	µg/L		1	0	10			
				2	0	8	↓	↓	
				3	0	4			

STOCKING DENSITY		1		201	3/5/09	CR	
		2		263			
		3		211	↓	↓	

NEWFIELDS

SEDIMI BIOASSAY TEST - EMBRYO DEVELOP NT
REF TOX WQ

CLIENT SAIC	PROJECT Irondale Intertidal Sediment Investigation	SPECIES *Mytilus galloprovencialis*	NEWFIELDS LAB / LOCATION Port Gamble Bath 5	PROTOCOL PSEP (1995)
B NUMBER 1101-009-860	PROJECT MANAGER B. Hester	QUANTITY OF TOXICANT: 0.039 mL 0.039mL	QUANTITY OF DILUENT: 500mL ACTUAL: ~~500.00~~ 500.0g	INIT BH 2/13/09
TEST ID P070930.101	LOT #: 1704237	TEST START DATE: 2/13/09	TIME 2115 | TEST END DATE 2/16/09	TIME 1030

WATER QUALITY DATA

DILTIN.WAT.BATCH					TEMP REC#		REFERENCE TOX. MATERIAL				REFERENCE TOXXICANT			
~~ESW014409.01~~ 021309							Copper Sulfate				Copper			
TEST CONDITIONS					DO (mg/L)		TEMP(C)		SAL (ppt)		pH		TECH.	DATE
					>4.8		16 ~~15~~ ± 1		28 ~~31~~ ± 1		7.8 ± 0.5			
CLIENT/ NEWFIELDS ID	CONCENTRATION		DAY	REP	D.O.		TEMP.		SALINITY		pH			
	value	units			meter	mg/L	meter	°C	meter	ppt	meter	unit		
Ref.Tox.-Copper	0	µg/L	0	Stock	4	8.6	4	16.3	1	27	1	7.9	BH	2/13/09
			1	Stock	①									
			2	Stock	3	7.9	3	16.7	3	27	3	7.5	CR	2/15/09
			3	Stock	3	8.0	3	16.3	3	27	3	8.0	MMB	2/16
			4	Stock										
Ref.Tox.-Copper	2.5	µg/L	0	Stock	4	8.5	4	16.3	1	27	1	7.9	BH	2/13
			1	Stock										
			2	Stock	3	8.1	3	16.5	3	27	3	7.6	CR	2/15
			3	Stock	3	8.0	3	16.4	3	27	3	8.0	MMB	2/16
			4	Stock										
Ref.Tox.-Copper	5	µg/L	0	Stock	4	8.6	4	16.3	1	27	1	7.9	BH	2/13
			1	Stock										
			2	Stock	3	8.1	3	16.4	3	27	3	7.7	CR	2/15
			3	Stock	3	8.0	3	16.3	3	27	3	8.0	MMB	2/16
			4	Stock										
Ref.Tox.-Copper	10	µg/L	0	Stock	4	8.4	4	16.2	1	27	1	7.9	BH	2/13
			1	Stock										
			2	Stock	3	8.2	3	16.4	3	27	3	7.8	CR	2/15
			3	Stock	3	8.0	3	16.4	3	28	3	8.0	MMB	2/16
			4	Stock										
Ref.Tox.-Copper	20	µg/L	0	Stock	4	8.5	4	16.4	1	27	1	7.9	BH	2/13
			1	Stock										
			2	Stock	3	8.2	3	16.5	3	27	3	7.8	CR	2/15
			3	Stock	3	8.0	3	16.4	3	28	3	8.1	MMB	2/16
			4	Stock										
Ref.Tox.-Copper	40	µg/L	0	Stock	4	8.5	4	15.9	1	27	1	7.9	BH	2/13
			1	Stock										
			2	Stock	3	8.1	3	16.4	3	27	3	7.8	CR	2/15
			3	Stock	3	8.0	3	16.3	3	27	3	8.1	MMB	2/16
			4	Stock										

① WQ not recorded on day 1. 3.9.09 BH

NEWFIELDS

ORGANISM RECEIPT LOG

Date: 2/13/09	**Time:** 1235	**NewFields Batch No.** CA 2928
Organism: Mytilus	**Source:** Carlsbad Aquafarm	
Address: On File	**Invoice Attached** Yes [✓ No]	
Phone: On File	**Contact:** On File	
No. Ordered:	**No. Received:**	**Source Batch:**
Condition of Organisms: Good	**Approximate Size or Age:** Adult	
Shipper: FedEx	**B of L (Tracking No.)** 7973 3504 2928	
Condition of Container: Good	**Received By:** MMB	
Confirmation of ID of Organism: Yes [✓ No]	**Technician (Initials):** MMB	

Notes:

pH (Units)	Temp. (°C)	D.O. (mg/L)	Conductivity or Salinity (Include Units)	Technician (Initials)
* →			→	MMB

Notes: *: Received dry.

Appendix C.

Statistical Analyses

One-Tailed T-test Result Summary

Test	Endpoint	Treatment	Comparison	Probability Normal	Probability Homogeneous	Test Type	Test Probability	Significant?	One-Tail Comparison
Eohaustorius	Percent Mortality	SB-REF-ID01	Control	0.044	0.016	Rankit Unequal Var	0.014	Yes	Treatment > Comparison
Eohaustorius	Percent Mortality	SB-REF-ID02	Control	0.022	0.000	Rankit Unequal Var	0.089		Treatment <= Comparison
Eohaustorius	Percent Mortality	ID-000-MIX	SB-REF-ID01	0.247	0.909	T-test Equal Var	0.000	Yes	Treatment > Comparison
Eohaustorius	Percent Mortality	ID-100	SB-REF-ID01	0.282	0.572	T-test Equal Var	0.957		Treatment <= Comparison
Eohaustorius	Percent Mortality	ID-101	SB-REF-ID01	0.513	0.939	T-test Equal Var	0.928		Treatment <= Comparison
Eohaustorius	Percent Mortality	ID-102	SB-REF-ID01	0.475	0.781	T-test Equal Var	0.618		Treatment <= Comparison
Eohaustorius	Percent Mortality	ID-108	SB-REF-ID01	0.138	0.260	T-test Equal Var	0.983		Treatment <= Comparison
Eohaustorius	Percent Mortality	ID-000-MIX	SB-REF-ID02	0.031	0.659	Mann-Whitney	0.016	Yes	Treatment > Comparison
Eohaustorius	Percent Mortality	ID-100	SB-REF-ID02	0.004	0.043	Rankit Unequal Var	0.706		Treatment <= Comparison
Eohaustorius	Percent Mortality	ID-101	SB-REF-ID02	0.002	0.395	Mann-Whitney	0.546		Treatment <= Comparison
Eohaustorius	Percent Mortality	ID-102	SB-REF-ID02	0.273	0.475	T-test Equal Var	0.155		Treatment <= Comparison
Eohaustorius	Percent Mortality	ID-108	SB-REF-ID02	0.007	0.030	Rankit Unequal Var	0.818		Treatment <= Comparison
Larval	Percent Normal Survival	SB-REF-ID01	Control	0.124	0.194	T-test Equal Var	0.018	Yes	Treatment < Comparison
Larval	Percent Normal Survival	SB-REF-ID02	Control	0.142	0.183	T-test Equal Var	0.053	Yes	Treatment < Comparison
Larval	Percent Normal Survival	ID-000-MIX	SB-REF-ID01	0.144	0.844	T-test Equal Var	0.002	Yes	Treatment < Comparison
Larval	Percent Normal Survival	ID-100	SB-REF-ID01	0.242	0.343	T-test Equal Var	0.988		Treatment >= Comparison
Larval	Percent Normal Survival	ID-101	SB-REF-ID01	0.533	0.098	T-test Unequal Var	0.000	Yes	Treatment < Comparison
Larval	Percent Normal Survival	ID-102	SB-REF-ID01	0.334	0.900	T-test Equal Var	0.079	Yes	Treatment < Comparison
Larval	Percent Normal Survival	ID-108	SB-REF-ID01	0.312	0.027	T-test Unequal Var	0.120		Treatment >= Comparison
Larval	Percent Normal Survival	ID-000-MIX	SB-REF-ID02	0.240	0.999	T-test Equal Var	0.001	Yes	Treatment < Comparison
Larval	Percent Normal Survival	ID-100	SB-REF-ID02	0.153	0.367	T-test Equal Var	0.962		Treatment >= Comparison
Larval	Percent Normal Survival	ID-101	SB-REF-ID02	0.793	0.020	T-test Unequal Var	0.000	Yes	Treatment < Comparison
Larval	Percent Normal Survival	ID-102	SB-REF-ID02	0.495	0.998	T-test Equal Var	0.025	Yes	Treatment < Comparison
Larval	Percent Normal Survival	ID-108	SB-REF-ID02	0.569	0.003	T-test Unequal Var	0.029	Yes	Treatment < Comparison
Neanthes	Individual Growth	SB-REF-ID01	Control	0.716	0.648	T-test Equal Var	0.957		Treatment >= Comparison
Neanthes	Individual Growth	SB-REF-ID02	Control	0.773	0.065	T-test Unequal Var	0.875		Treatment >= Comparison
Neanthes	Individual Growth	ID-000-MIX	SB-REF-ID01	0.609	0.267	T-test Equal Var	0.000	Yes	Treatment < Comparison
Neanthes	Individual Growth	ID-100	SB-REF-ID01	0.559	0.632	T-test Equal Var	0.004	Yes	Treatment < Comparison
Neanthes	Individual Growth	ID-101	SB-REF-ID01	0.941	0.083	T-test Unequal Var	0.003	Yes	Treatment < Comparison
Neanthes	Individual Growth	ID-102	SB-REF-ID01	0.973	0.666	T-test Equal Var	0.007	Yes	Treatment < Comparison
Neanthes	Individual Growth	ID-108	SB-REF-ID01	0.672	0.277	T-test Equal Var	0.002	Yes	Treatment < Comparison
Neanthes	Individual Growth	ID-000-MIX	SB-REF-ID02	0.949	0.021	T-test Unequal Var	0.004	Yes	Treatment < Comparison
Neanthes	Individual Growth	ID-100	SB-REF-ID02	0.774	0.166	T-test Equal Var	0.020	Yes	Treatment < Comparison
Neanthes	Individual Growth	ID-101	SB-REF-ID02	0.917	0.011	T-test Unequal Var	0.037	Yes	Treatment < Comparison
Neanthes	Individual Growth	ID-102	SB-REF-ID02	0.675	0.252	T-test Equal Var	0.028	Yes	Treatment < Comparison
Neanthes	Individual Growth	ID-108	SB-REF-ID02	0.959	0.024	T-test Unequal Var	0.029	Yes	Treatment < Comparison

```
                         Irondale Sediment Statistical Comparison                        1
                        T-test Results, This is a 2-tailed result
                            See Summary Page for 1-tail Result
                                                           15:42 Wednesday, March 25, 2009

-------------- Test=Larval Endpoint=Percent Normal Su Treatment=SB-REF-ID01 --------------

                                   The TTEST Procedure

                                    Variable:  result

       group          N        Mean     Std Dev     Std Err     Minimum     Maximum

       Control        5      1.3990      0.1613      0.0721      1.2233      1.5708
       Reference      5      1.1752      0.1155      0.0516      1.0494      1.3508
       Diff (1-2)            0.2238      0.1403      0.0887

 group        Method                 Mean      95% CL Mean        Std Dev      95% CL Std Dev

 Control                           1.3990     1.1987   1.5993     0.1613     0.0967   0.4636
 Reference                         1.1752     1.0318   1.3186     0.1155     0.0692   0.3318
 Diff (1-2)   Pooled               0.2238     0.0192   0.4284     0.1403     0.0948   0.2688
 Diff (1-2)   Satterthwaite        0.2238     0.0154   0.4322

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       2.52      0.0357
               Satterthwaite    Unequal      7.2468       2.52      0.0386

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.95    0.5332
```

```
-------------- Test=Larval Endpoint=Percent Normal Su Treatment=SB-REF-ID02 --------------

                                   The TTEST Procedure

                                    Variable:  result

       group          N        Mean     Std Dev     Std Err     Minimum     Maximum

       Control        5      1.3990      0.1613      0.0721      1.2233      1.5708
       Reference      5      1.2374      0.1144      0.0511      1.0993      1.3608
       Diff (1-2)            0.1616      0.1398      0.0884

 group        Method                 Mean      95% CL Mean        Std Dev      95% CL Std Dev

 Control                           1.3990     1.1987   1.5993      0.1613      0.0967   0.4636
 Reference                         1.2374     1.0954   1.3794      0.1144      0.0685   0.3286
 Diff (1-2)   Pooled               0.1616    -0.0423   0.3655      0.1398      0.0945   0.2679
 Diff (1-2)   Satterthwaite        0.1616    -0.0463   0.3695

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       1.83      0.1051
               Satterthwaite    Unequal      7.2098       1.83      0.1092

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.99    0.5216
```

```
------------- Test=Neanthes Endpoint=Individual Growth Treatment=SB-REF-ID01 -------------

                                   The TTEST Procedure

                                    Variable:  result

       group          N        Mean     Std Dev     Std Err     Minimum     Maximum

       Control        5      0.8580      0.1037      0.0464      0.7307      1.0187
       Reference      5      0.9861      0.1026      0.0459      0.8612      1.1070
       Diff (1-2)           -0.1281      0.1031      0.0652

 group        Method              Mean     95% CL Mean        Std Dev     95% CL Std Dev

 Control                        0.8580     0.7293   0.9867     0.1037     0.0621   0.2979
 Reference                      0.9861     0.8588   1.1135     0.1026     0.0615   0.2947
 Diff (1-2)   Pooled           -0.1281    -0.2785   0.0223     0.1031     0.0696   0.1975
 Diff (1-2)   Satterthwaite    -0.1281    -0.2785   0.0223

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8      -1.96      0.0850
               Satterthwaite    Unequal      7.9991      -1.96      0.0851

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.02    0.9841
```

```
------------- Test=Neanthes Endpoint=Individual Growth Treatment=SB-REF-ID02 -------------

                                   The TTEST Procedure

                                    Variable:  result

       group          N        Mean     Std Dev     Std Err     Minimum     Maximum

       Control        5      0.8580      0.1037      0.0464      0.7307      1.0187
       Reference      5      0.9918      0.2104      0.0941      0.7433      1.2580
       Diff (1-2)           -0.1338      0.1658      0.1049

 group        Method              Mean      95% CL Mean        Std Dev     95% CL Std Dev

 Control                        0.8580     0.7293   0.9867      0.1037     0.0621   0.2979
 Reference                      0.9918     0.7305   1.2530      0.2104     0.1261   0.6046
 Diff (1-2)   Pooled           -0.1338    -0.3756   0.1081      0.1658     0.1120   0.3177
 Diff (1-2)   Satterthwaite    -0.1338    -0.3922   0.1247

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8      -1.28      0.2380
               Satterthwaite    Unequal      5.8339      -1.28      0.2506

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       4.12    0.1991
```

```
----------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=SB-REF-ID01 -----------

                                   The TTEST Procedure

                      Variable:  rankit  (Rank for Variable result)

       group          N        Mean     Std Dev     Std Err     Minimum     Maximum

       Control        5     -0.5963           0           0     -0.5963     -0.5963
       Reference      5      0.5963      0.7970      0.3565     -0.5963      1.5466
       Diff (1-2)           -1.1927      0.5636      0.3565

 group        Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

 Control                       -0.5963    -0.5963  -0.5963          0           .        .
 Reference                      0.5963    -0.3933   1.5860     0.7970      0.4775   2.2904
 Diff (1-2)   Pooled           -1.1927    -2.0146  -0.3707     0.5636      0.3807   1.0797
 Diff (1-2)   Satterthwaite    -1.1927    -2.1823  -0.2030

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8      -3.35      0.0101
               Satterthwaite    Unequal           4      -3.35      0.0287

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4      Infty    <.0001
```

```
----------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=SB-REF-ID02 -----------

                                   The TTEST Procedure

                      Variable:  rankit  (Rank for Variable result)

       group          N        Mean     Std Dev     Std Err     Minimum     Maximum

       Control        5     -0.3184           0           0     -0.3184     -0.3184
       Reference      5      0.3184      0.8719      0.3899     -0.3184      1.2736
       Diff (1-2)           -0.6368      0.6166      0.3899

 group        Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

 Control                       -0.3184    -0.3184  -0.3184          0          .        .
 Reference                      0.3184    -0.7643   1.4011     0.8719     0.5224   2.5056
 Diff (1-2)   Pooled           -0.6368    -1.5360   0.2624     0.6166     0.4165   1.1812
 Diff (1-2)   Satterthwaite    -0.6368    -1.7194   0.4459

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8      -1.63      0.1411
               Satterthwaite    Unequal           4      -1.63      0.1778

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4      Infty    <.0001
```

```
----------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-000-MIX ------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID01     5      0.2817      0.1807      0.0808            0       0.4636
      Test            5      1.1956      0.1669      0.0747       0.9912       1.3453
      Diff (1-2)            -0.9139      0.1740      0.1100

group         Method              Mean      95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID01                     0.2817     0.0573   0.5061     0.1807     0.1083   0.5194
Test                            1.1956     0.9883   1.4029     0.1669     0.1000   0.4797
Diff (1-2)    Pooled           -0.9139    -1.1676  -0.6601     0.1740     0.1175   0.3333
Diff (1-2)    Satterthwaite    -0.9139    -1.1679  -0.6598

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8      -8.31      <.0001
               Satterthwaite    Unequal      7.9501      -8.31      <.0001

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.17    0.8814
```

```
------------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-100 --------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      0.2817      0.1807      0.0808           0      0.4636
      Test            5      0.0902      0.1235      0.0552           0      0.2255
      Diff (1-2)             0.1915      0.1548      0.0979

group         Method              Mean      95% CL Mean        Std Dev     95% CL Std Dev

SB-REF-ID01                     0.2817     0.0573   0.5061     0.1807     0.1083   0.5194
Test                            0.0902    -0.0632   0.2436     0.1235     0.0740   0.3549
Diff (1-2)    Pooled            0.1915    -0.0343   0.4173     0.1548     0.1046   0.2966
Diff (1-2)    Satterthwaite     0.1915    -0.0395   0.4226

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       1.96      0.0862
               Satterthwaite    Unequal      7.0671       1.96      0.0909

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       2.14    0.4790
```

```
------------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-101 --------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      0.2817      0.1807      0.0808           0      0.4636
      Test            5      0.1095      0.1537      0.0687           0      0.3218
      Diff (1-2)             0.1723      0.1678      0.1061

group         Method              Mean     95% CL Mean        Std Dev     95% CL Std Dev

SB-REF-ID01                     0.2817     0.0573   0.5061     0.1807     0.1083   0.5194
Test                            0.1095    -0.0814   0.3003     0.1537     0.0921   0.4416
Diff (1-2)    Pooled            0.1723    -0.0724   0.4169     0.1678     0.1133   0.3214
Diff (1-2)    Satterthwaite     0.1723    -0.0735   0.4180

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       1.62      0.1431
               Satterthwaite    Unequal      7.7985       1.62      0.1441

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.38    0.7609
```

```
------------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-102 --------------

                                     The TTEST Procedure

                                      Variable:  Result

      group            N         Mean      Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID01      5       0.2817       0.1807       0.0808            0       0.4636
      Test             5       0.2473       0.1692       0.0756            0       0.4636
      Diff (1-2)               0.0344       0.1750       0.1107

group         Method                Mean       95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID01                       0.2817      0.0573   0.5061      0.1807      0.1083   0.5194
Test                              0.2473      0.0372   0.4573      0.1692      0.1013   0.4861
Diff (1-2)    Pooled              0.0344     -0.2209   0.2897      0.1750      0.1182   0.3354
Diff (1-2)    Satterthwaite       0.0344     -0.2211   0.2899

               Method           Variances        DF     t Value     Pr > |t|

               Pooled           Equal             8        0.31       0.7637
               Satterthwaite    Unequal      7.9651        0.31       0.7637

                                    Equality of Variances

                    Method       Num DF     Den DF     F Value    Pr > F

                    Folded F          4          4        1.14    0.9009
```

```
------------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-108 --------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      0.2817      0.1807      0.0808           0      0.4636
      Test            5      0.0451      0.1009      0.0451           0      0.2255
      Diff (1-2)             0.2366      0.1464      0.0926

group         Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID01                     0.2817     0.0573   0.5061     0.1807     0.1083   0.5194
Test                            0.0451    -0.0801   0.1703     0.1009     0.0604   0.2898
Diff (1-2)    Pooled            0.2366     0.0232   0.4501     0.1464     0.0989   0.2804
Diff (1-2)    Satterthwaite     0.2366     0.0125   0.4608

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       2.56      0.0338
               Satterthwaite    Unequal      6.2706       2.56      0.0415

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       3.21    0.2847
```

```
-------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-000-MIX ---------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      1.1752      0.1155      0.0516      1.0494      1.3508
      Test            5      0.8921      0.1155      0.0517      0.7950      1.0640
      Diff (1-2)             0.2831      0.1155      0.0731

group         Method              Mean      95% CL Mean        Std Dev     95% CL Std Dev

SB-REF-ID01                     1.1752     1.0318   1.3186     0.1155     0.0692   0.3318
Test                            0.8921     0.7486   1.0356     0.1155     0.0692   0.3320
Diff (1-2)    Pooled            0.2831     0.1147   0.4516     0.1155     0.0780   0.2213
Diff (1-2)    Satterthwaite     0.2831     0.1147   0.4516

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       3.88      0.0047
               Satterthwaite    Unequal           8       3.88      0.0047

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.00    0.9992
```

```
---------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-100 -----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      1.1752      0.1155      0.0516      1.0494      1.3508
      Test            5      1.4125      0.1542      0.0690      1.2192      1.5708
      Diff (1-2)            -0.2372      0.1362      0.0862

group         Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID01                     1.1752     1.0318   1.3186     0.1155     0.0692   0.3318
Test                            1.4125     1.2210   1.6039     0.1542     0.0924   0.4431
Diff (1-2)    Pooled           -0.2372    -0.4359  -0.0386     0.1362     0.0920   0.2610
Diff (1-2)    Satterthwaite    -0.2372    -0.4387  -0.0358

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8      -2.75      0.0249
               Satterthwaite    Unequal      7.4134      -2.75      0.0268

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.78    0.5892
```

```
---------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-101 -----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      1.1752      0.1155      0.0516      1.0494      1.3508
      Test            5      0.3367      0.0424      0.0190      0.2778      0.3804
      Diff (1-2)             0.8385      0.0870      0.0550

group         Method              Mean      95% CL Mean       Std Dev      95% CL Std Dev

SB-REF-ID01                     1.1752     1.0318   1.3186     0.1155     0.0692   0.3318
Test                            0.3367     0.2840   0.3893     0.0424     0.0254   0.1218
Diff (1-2)    Pooled            0.8385     0.7117   0.9654     0.0870     0.0588   0.1667
Diff (1-2)    Satterthwaite     0.8385     0.6976   0.9795

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8      15.24      <.0001
               Satterthwaite    Unequal      5.0591      15.24      <.0001

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       7.42    0.0780
```

```
---------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-102 -----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean      Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID01     5      1.1752      0.1155       0.0516       1.0494       1.3508
      Test            5      1.0457      0.1457       0.0652       0.8876       1.2821
      Diff (1-2)             0.1295      0.1315       0.0832

group         Method                 Mean      95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID01                        1.1752     1.0318   1.3186     0.1155     0.0692   0.3318
Test                               1.0457     0.8648   1.2266     0.1457     0.0873   0.4188
Diff (1-2)    Pooled               0.1295    -0.0622   0.3213     0.1315     0.0888   0.2519
Diff (1-2)    Satterthwaite        0.1295    -0.0640   0.3230

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       1.56      0.1579
               Satterthwaite    Unequal      7.6031       1.56      0.1599

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.59    0.6632
```

```
---------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-108 -----------------

                                The TTEST Procedure

                                 Variable:  Result

      group            N         Mean      Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID01      5       1.1752       0.1155       0.0516       1.0494       1.3508
      Test             5       1.1036       0.0177      0.00792       1.0789       1.1202
      Diff (1-2)               0.0717       0.0826       0.0522

group         Method                Mean       95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID01                       1.1752      1.0318   1.3186      0.1155      0.0692   0.3318
Test                              1.1036      1.0816   1.1256      0.0177      0.0106   0.0509
Diff (1-2)    Pooled              0.0717     -0.0488   0.1921      0.0826      0.0558   0.1583
Diff (1-2)    Satterthwaite       0.0717     -0.0709   0.2142

               Method           Variances        DF     t Value     Pr > |t|

               Pooled           Equal             8        1.37       0.2075
               Satterthwaite    Unequal      4.1878        1.37       0.2392

                               Equality of Variances

                    Method       Num DF     Den DF     F Value     Pr > F

                    Folded F          4          4       42.57     0.0031
```

```
------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-000-MIX --------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      0.9861      0.1026      0.0459      0.8612      1.0170
      Test            5      0.5633      0.0723      0.0323      0.4770      0.6547
      Diff (1-2)             0.4229      0.0887      0.0561

group         Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID01                     0.9861     0.8588   1.1135     0.1026     0.0615   0.2947
Test                            0.5633     0.4735   0.6530     0.0723     0.0433   0.2077
Diff (1-2)    Pooled            0.4229     0.2935   0.5523     0.0887     0.0599   0.1700
Diff (1-2)    Satterthwaite     0.4229     0.2909   0.5548

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       7.54      <.0001
               Satterthwaite    Unequal      7.1861       7.54      0.0001

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       2.01    0.5143
```

```
--------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-100 ----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      0.9861      0.1026      0.0459      0.8612      1.1070
      Test            5      0.7210      0.1295      0.0579      0.5643      0.8805
      Diff (1-2)             0.2652      0.1168      0.0739

group         Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID01                     0.9861     0.8588   1.1135     0.1026     0.0615   0.2947
Test                            0.7210     0.5601   0.8818     0.1295     0.0776   0.3723
Diff (1-2)    Pooled            0.2652     0.0948   0.4356     0.1168     0.0789   0.2238
Diff (1-2)    Satterthwaite     0.2652     0.0932   0.4371

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       3.59      0.0071
               Satterthwaite    Unequal         7.6       3.59      0.0077

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.60    0.6619
```

```
--------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-101 ----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      0.9861      0.1026      0.0459      0.8612      1.1070
      Test            5      0.7669      0.0547      0.0244      0.7149      0.8454
      Diff (1-2)             0.2192      0.0822      0.0520

group         Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID01                     0.9861     0.8588   1.1135     0.1026     0.0615   0.2947
Test                            0.7669     0.6990   0.8348     0.0547     0.0328   0.1571
Diff (1-2)    Pooled            0.2192     0.0994   0.3391     0.0822     0.0555   0.1574
Diff (1-2)    Satterthwaite     0.2192     0.0926   0.3459

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       4.22      0.0029
               Satterthwaite    Unequal      6.1031       4.22      0.0054

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       3.52    0.2504
```

```
--------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-102 ----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID01     5      0.9861      0.1026      0.0459      0.8612      1.1070
      Test            5      0.7359      0.1479      0.0661      0.5557      0.9589
      Diff (1-2)             0.2502      0.1273      0.0805

group         Method                Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID01                     0.9861     0.8588   1.1135     0.1026     0.0615   0.2947
Test                            0.7359     0.5523   0.9196     0.1479     0.0886   0.4250
Diff (1-2)    Pooled            0.2502     0.0646   0.4358     0.1273     0.0860   0.2438
Diff (1-2)    Satterthwaite     0.2502     0.0605   0.4399

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       3.11      0.0145
               Satterthwaite    Unequal      7.1245       3.11      0.0167

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       2.08    0.4957
```

```
--------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-108 ----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean      Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID01     5      0.9861       0.1026       0.0459       0.8612       1.1070
      Test            5      0.7479       0.0756       0.0338       0.6467       0.8531
      Diff (1-2)             0.2382       0.0901       0.0570

group         Method              Mean       95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID01                     0.9861     0.8588   1.1135     0.1026     0.0615   0.2947
Test                            0.7479     0.6541   0.8418     0.0756     0.0453   0.2171
Diff (1-2)    Pooled            0.2382     0.1068   0.3696     0.0901     0.0608   0.1726
Diff (1-2)    Satterthwaite     0.2382     0.1048   0.3716

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       4.18      0.0031
               Satterthwaite    Unequal      7.3535       4.18      0.0037

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.84    0.5683
```

```
------------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-102 --------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean      Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID02     5      0.1287      0.1762      0.0788           0      0.3218
      Test            5      0.2473      0.1692      0.0756           0      0.4636
      Diff (1-2)            -0.1186      0.1727      0.1092

group        Method                Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID02                      0.1287    -0.0901   0.3475     0.1762     0.1056   0.5064
Test                             0.2473     0.0372   0.4573     0.1692     0.1013   0.4861
Diff (1-2)    Pooled            -0.1186    -0.3705   0.1333     0.1727     0.1167   0.3309
Diff (1-2)    Satterthwaite     -0.1186    -0.3706   0.1334

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8      -1.09      0.3093
               Satterthwaite    Unequal      7.9866      -1.09      0.3094

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.09    0.9386
```

```
-------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-000-MIX ---------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N       Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID02     5     1.2374      0.1144      0.0511      1.0993      1.3608
      Test            5     0.8921      0.1155      0.0517      0.7950      1.0640
      Diff (1-2)            0.3453      0.1150      0.0727

group         Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID02                     1.2374     1.0954   1.3794     0.1144     0.0685   0.3286
Test                            0.8921     0.7486   1.0356     0.1155     0.0692   0.3320
Diff (1-2)    Pooled            0.3453     0.1777   0.5130     0.1150     0.0776   0.2202
Diff (1-2)    Satterthwaite     0.3453     0.1777   0.5130

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       4.75      0.0014
               Satterthwaite    Unequal      7.9992       4.75      0.0014

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.02    0.9847
```

```
---------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-100 -----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID02     5      1.2374      0.1144      0.0511      1.0993      1.3608
      Test            5      1.4125      0.1542      0.0690      1.2192      1.5708
      Diff (1-2)            -0.1750      0.1358      0.0859

group         Method                Mean       95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID02                       1.2374     1.0954   1.3794     0.1144     0.0685   0.3286
Test                              1.4125     1.2210   1.6039     0.1542     0.0924   0.4431
Diff (1-2)    Pooled             -0.1750    -0.3730   0.0229     0.1358     0.0917   0.2601
Diff (1-2)    Satterthwaite      -0.1750    -0.3760   0.0259

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8      -2.04      0.0758
               Satterthwaite    Unequal      7.3786      -2.04      0.0788

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.82    0.5769
```

```
---------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-101 -----------------

                                        The TTEST Procedure

                                         Variable:  Result

      group            N         Mean      Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID02      5       1.2374       0.1144       0.0511       1.0993       1.3608
      Test             5       0.3367       0.0424       0.0190       0.2778       0.3804
      Diff (1-2)               0.9007       0.0862       0.0545

group          Method               Mean       95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID02                       1.2374     1.0954   1.3794     0.1144     0.0685   0.3286
Test                              0.3367     0.2840   0.3893     0.0424     0.0254   0.1218
Diff (1-2)     Pooled             0.9007     0.7750   1.0265     0.0862     0.0583   0.1652
Diff (1-2)     Satterthwaite      0.9007     0.7612   1.0403

                     Method            Variances        DF     t Value     Pr > |t|

                     Pooled            Equal             8       16.51       <.0001
                     Satterthwaite     Unequal      5.0791       16.51       <.0001

                                       Equality of Variances

                          Method       Num DF     Den DF     F Value     Pr > F

                          Folded F          4          4        7.28     0.0805
```

```
---------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-102 -----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID02     5      1.2374      0.1144      0.0511      1.0993      1.3608
      Test            5      1.0457      0.1457      0.0652      0.8876      1.2821
      Diff (1-2)             0.1917      0.1310      0.0828

group         Method              Mean      95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID02                     1.2374     1.0954   1.3794     0.1144     0.0685   0.3286
Test                            1.0457     0.8648   1.2266     0.1457     0.0873   0.4188
Diff (1-2)    Pooled            0.1917   0.000696   0.3828     0.1310     0.0885   0.2509
Diff (1-2)    Satterthwaite     0.1917   -0.00120   0.3847

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       2.31      0.0493
               Satterthwaite    Unequal      7.5723       2.31      0.0511

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       1.62    0.6502
```

```
---------------- Test=Larval Endpoint=Percent Normal Su Treatment=ID-108 -----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID02     5      1.2374      0.1144      0.0511      1.0993      1.3608
      Test            5      1.1036      0.0177     0.00792      1.0789      1.1202
      Diff (1-2)             0.1339      0.0818      0.0518

group         Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID02                     1.2374     1.0954   1.3794     0.1144     0.0685   0.3286
Test                            1.1036     1.0816   1.1256     0.0177     0.0106   0.0509
Diff (1-2)    Pooled            0.1339     0.0145   0.2532     0.0818     0.0553   0.1568
Diff (1-2)    Satterthwaite     0.1339   -0.00729   0.2750

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       2.59      0.0323
               Satterthwaite    Unequal      4.1915       2.59      0.0582

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4      41.75    0.0032
```

```
------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-000-MIX --------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID02     5      0.9918      0.2104      0.0941      0.7433      1.2580
      Test            5      0.5633      0.0723      0.0323      0.4770      0.6547
      Diff (1-2)             0.4285      0.1573      0.0995

group        Method              Mean      95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID02                    0.9918     0.7305   1.2530     0.2104     0.1261   0.6046
Test                           0.5633     0.4735   0.6530     0.0723     0.0433   0.2077
Diff (1-2)    Pooled           0.4285     0.1991   0.6579     0.1573     0.1062   0.3013
Diff (1-2)    Satterthwaite    0.4285     0.1717   0.6853

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       4.31      0.0026
               Satterthwaite    Unequal      4.9308       4.31      0.0079

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       8.48    0.0621
```

```
--------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-100 ----------------

                                The TTEST Procedure

                                 Variable:  Result

      group           N         Mean      Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID02     5       0.9918       0.2104       0.0941       0.7433       1.2580
      Test            5       0.7210       0.1295       0.0579       0.5643       0.8805
      Diff (1-2)              0.2708       0.1747       0.1105

group          Method                Mean       95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID02                        0.9918     0.7305   1.2530      0.2104      0.1261   0.6046
Test                               0.7210     0.5601   0.8818      0.1295      0.0776   0.3723
Diff (1-2)     Pooled              0.2708     0.0160   0.5256      0.1747      0.1180   0.3347
Diff (1-2)     Satterthwaite       0.2708    0.00672   0.5349

               Method           Variances        DF     t Value     Pr > |t|

               Pooled           Equal             8        2.45       0.0399
               Satterthwaite    Unequal      6.6521        2.45       0.0458

                               Equality of Variances

                  Method       Num DF     Den DF     F Value     Pr > F

                  Folded F          4          4        2.64     0.3704
```

```
--------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-101 ----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group            N         Mean      Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID02      5       0.9918       0.2104       0.0941       0.7433       1.2580
      Test             5       0.7669       0.0547       0.0244       0.7149       0.8454
      Diff (1-2)               0.2249       0.1537       0.0972

group         Method               Mean        95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID02                      0.9918     0.7305   1.2530     0.2104     0.1261   0.6046
Test                             0.7669     0.6990   0.8348     0.0547     0.0328   0.1571
Diff (1-2)    Pooled             0.2249   0.000706   0.4491     0.1537     0.1038   0.2945
Diff (1-2)    Satterthwaite      0.2249    -0.0329   0.4826

               Method           Variances        DF     t Value     Pr > |t|

               Pooled           Equal             8        2.31       0.0494
               Satterthwaite    Unequal      4.5377        2.31       0.0740

                                  Equality of Variances

                  Method       Num DF     Den DF     F Value     Pr > F

                  Folded F          4          4       14.81     0.0230
```

```
--------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-102 ----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID02     5      0.9918      0.2104      0.0941      0.7433      1.2580
      Test            5      0.7359      0.1479      0.0661      0.5557      0.9589
      Diff (1-2)             0.2558      0.1819      0.1150

group         Method              Mean     95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID02                     0.9918     0.7305   1.2530     0.2104     0.1261   0.6046
Test                            0.7359     0.5523   0.9196     0.1479     0.0886   0.4250
Diff (1-2)    Pooled            0.2558   -0.00937   0.5211     0.1819     0.1228   0.3484
Diff (1-2)    Satterthwaite     0.2558    -0.0148   0.5264

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       2.22      0.0568
               Satterthwaite    Unequal      7.1776       2.22      0.0605

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       2.02    0.5117
```

```
--------------- Test=Neanthes Endpoint=Individual Growth Treatment=ID-108 ----------------

                                   The TTEST Procedure

                                    Variable:  Result

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID02     5      0.9918      0.2104      0.0941      0.7433      1.2580
      Test            5      0.7479      0.0756      0.0338      0.6467      0.8531
      Diff (1-2)             0.2438      0.1581      0.1000

group         Method              Mean      95% CL Mean       Std Dev     95% CL Std Dev

SB-REF-ID02                     0.9918     0.7305   1.2530     0.2104     0.1261   0.6046
Test                            0.7479     0.6541   0.8418     0.0756     0.0453   0.2171
Diff (1-2)    Pooled            0.2438     0.0133   0.4744     0.1581     0.1068   0.3028
Diff (1-2)    Satterthwaite     0.2438    -0.0129   0.5006

               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       2.44      0.0406
               Satterthwaite    Unequal      5.0148       2.44      0.0586

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       7.75    0.0723
```

```
----------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-000-MIX ------------

                                  The NPAR1WAY Procedure

                     Wilcoxon Scores (Rank Sums) for Variable Result
                              Classified by Variable group

                                  Sum of      Expected       Std Dev          Mean
       group            N         Scores      Under H0      Under H0         Score
       ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
       SB-REF-ID02      5           15.0         27.50      4.699291           3.0
       Test             5           40.0         27.50      4.699291           8.0

                           Average scores were used for ties.


                                Wilcoxon Two-Sample Test

                              Statistic             15.0000

                              Normal Approximation
                              Z                     -2.5536
                              One-Sided Pr <  Z      0.0053
                              Two-Sided Pr > |Z|     0.0107

                              t Approximation
                              One-Sided Pr <  Z      0.0155
                              Two-Sided Pr > |Z|     0.0310

                        Z includes a continuity correction of 0.5.


                                   Kruskal-Wallis Test

                              Chi-Square             7.0755
                              DF                          1
                              Pr > Chi-Square        0.0078
```

```
------------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-101 --------------

                                  The NPAR1WAY Procedure

                     Wilcoxon Scores (Rank Sums) for Variable Result
                              Classified by Variable group

                                  Sum of      Expected       Std Dev          Mean
       group             N        Scores      Under H0      Under H0         Score
       ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
       SB-REF-ID02       5         28.50         27.50      4.183300          5.70
       Test              5         26.50         27.50      4.183300          5.30

                           Average scores were used for ties.


                                Wilcoxon Two-Sample Test

                              Statistic             28.5000

                              Normal Approximation
                              Z                      0.1195
                              One-Sided Pr >  Z      0.4524
                              Two-Sided Pr > |Z|     0.9049

                              t Approximation
                              One-Sided Pr >  Z      0.4537
                              Two-Sided Pr > |Z|     0.9075

                        Z includes a continuity correction of 0.5.


                                   Kruskal-Wallis Test

                              Chi-Square             0.0571
                              DF                          1
                              Pr > Chi-Square        0.8111
```

```
------------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-100 --------------

                                   The TTEST Procedure

                       Variable:  rankit  (Rank for Variable Result)

      group          N        Mean      Std Dev      Std Err      Minimum      Maximum

      SB-REF-ID02    5      0.1516       1.0242       0.4580      -0.5963       1.2736
      Test           5     -0.1516       0.6089       0.2723      -0.5963       0.5154
      Diff (1-2)            0.3032       0.8425       0.5329

group          Method               Mean       95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID02                       0.1516    -1.1201   1.4233     1.0242     0.6136   2.9431
Test                             -0.1516    -0.9077   0.6045     0.6089     0.3648   1.7498
Diff (1-2)     Pooled             0.3032    -0.9256   1.5321     0.8425     0.5691   1.6141
Diff (1-2)     Satterthwaite      0.3032    -0.9761   1.5826

               Method           Variances        DF     t Value     Pr > |t|

               Pooled           Equal             8        0.57       0.5849
               Satterthwaite    Unequal      6.5139        0.57       0.5884

                                  Equality of Variances

                    Method       Num DF     Den DF     F Value     Pr > F

                    Folded F          4          4        2.83     0.3380
```

```
------------- Test=Eohaustorius Endpoint=Percent Mortality Treatment=ID-108 --------------

                                   The TTEST Procedure

                      Variable:  rankit  (Rank for Variable Result)

      group           N        Mean     Std Dev     Std Err     Minimum     Maximum

      SB-REF-ID02     5      0.2349      0.9481      0.4240     -0.4575      1.2736
      Test            5     -0.2349      0.4977      0.2226     -0.4575      0.6554
      Diff (1-2)             0.4698      0.7572      0.4789

group         Method               Mean      95% CL Mean        Std Dev      95% CL Std Dev

SB-REF-ID02                     0.2349    -0.9424    1.4122     0.9481     0.5681   2.7246
Test                           -0.2349    -0.8529    0.3831     0.4977     0.2982   1.4302
Diff (1-2)    Pooled            0.4698    -0.6345    1.5742     0.7572     0.5115   1.4506
Diff (1-2)    Satterthwaite     0.4698    -0.6997    1.6394
               Method           Variances        DF    t Value    Pr > |t|

               Pooled           Equal             8       0.98      0.3553
               Satterthwaite    Unequal      6.0489       0.98      0.3641

                                  Equality of Variances

                    Method      Num DF    Den DF    F Value    Pr > F

                    Folded F         4         4       3.63    0.2397
```

Appendix D.

Chain of Custody (COCs)

SAIC®
From Science to Solutions

18912 North Creek Parkway, Suite 101
Bothell, Washington 98011
TEL: 425.485.5800 • FAX: 425.485.5566

CHAIN OF CUSTODY RECORD

Project No.:
Project Mgr: Tom Dube
Project Name: Irondale Intertidal Sediment Investigation
Project Location:
Sample Collectors: TH, JB, RB
Client Name: Ecology

Shipping Information

Number of Shipping Containers: 2
Date Shipped: 1/9/9
Carrier: SAIC
Waybill No.: n/a

Analyses / Tests

Sample ID	Depth	Matrix	Date	Time	# of Containers	Larval Development	Amphipod Mortality	Juvenile Polychaete Growth	Microtox							Comments
ID-101	8-14	SED	1.8.9	1705	1	A	A	A	A							11426 rcd @ 1°C
ID-102	9-15			1735	1	A	A	A	A							11433
ID-103	11-17			1805	1	A	A	A	A							11440
ID-104	13-19			1835	1	A	A	A	A							11452
ID-106	13-19			2000	1	A	A	A	A							11468
ID-100	15-21			1930	1	A	A	A	A							11461
ID-107	8-14			2020	1	A	A	A	A							11475
ID-108	12-18			2050	1	A	A	A	A							11482
																A: Archive

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature:	Signature:	Signature:	Signature:
Date/Time: 1/9/9 1200	Date/Time: 1/9/09 1200	Date/Time:	Date/Time:
Affiliation: SAIC	Affiliation: NewField	Affiliation:	Affiliation:

• White: Lab Returns to Originator Upon Receipt of Samples • Canary: Lab Retains • Pink: Lab Returns to Project Manager with Final Report • Goldenrod: Retained by Sampler

SAIC
From Science to Solutions

18912 North Creek Parkway, Suite 101
Bothell, Washington 98011
TEL: 425.485.5800 • FAX: 425.485.5566

CHAIN OF CUSTODY RECORD

Project No.:
Project Mgr: Tim Hammermeister
Project Name: Irondale Intertidal Sediment Characterization
Project Location: Irondale, WA
Sample Collectors: T. Hammermeister, J. Boas
Client Name: Ecology

Shipping Information

Number of Shipping Containers:
Date Shipped:
Carrier:
Waybill No.:

Sample ID	Depth	Matrix	Date	Time	# of Containers	Amphipod Mortality	Larval Development	Juvenile Polychaete Growth	Microtox Bioluminescence	Comments
SB-REF-ID01	0-5cm	SED	1/29/09	1030	1	X	X	X	X	11483
SB-REF-ID-02	↓	↓	↓	1100	1	X	X	X	X	11484
ID-000-MIX	8-17"	↓	1/8/09	1805	1	X	X	X	X	11485

RELINQUISHED BY:
Signature: Jenn Boas
Date/Time: 1/29/09 1:55
Affiliation: SAIC

RECEIVED BY:
Signature: Brian Hester
Date/Time: 1/29/09 1:55
Affiliation: NewFields

RELINQUISHED BY:
Signature:
Date/Time:
Affiliation:

RECEIVED BY:
Signature:
Date/Time:
Affiliation:

- White: Lab Returns to Originator Upon Receipt of Samples
- Canary: Lab Retains
- Pink: Lab Returns to Project Manager with Final Report
- Goldenrod: Retained by Sampler

APPENDIX E

NEWFIELDS UPLAND BIOASSAY REPORT

BIOLOGICAL TESTING OF SOILS FROM THE IRONDALE IRON AND STEEL PLANT SITE IRONDALE, WA

FEBRUARY 2009

(REVISED MARCH 2009)

PREPARED FOR:
GEOENGINEERS, INC.
600 Stewart Street, Suite 1700
Seattle, WA 98101

PREPARED BY:
NEWFIELDS
PO Box 216
4729 View Drive
Port Gamble, Washington 98364

1.0 INTRODUCTION

GeoEngineers, Inc. requested NewFields Northwest, L.L.C., in Port Gamble, Washington to evaluate soil from the former Irondale Iron and Steel Plant in Irondale, Washington. As part of this Remedial Investigation/Feasibility Study (RI/FS), NewFields Northwest (NewFields) was requested to perform a suite of soil toxicity tests to aid developing soil cleanup levels for the Irondale site.

2.0 METHODS

This section summarizes the test methods that were followed for this biological characterization. Test methods followed guidance provided by the Washington State Department of Ecology and the Puget Sound Estuary Program (PSEP 1995), and the various updates presented during the Annual Sediment Management Review meetings (SMARM). Soil toxicity was evaluated using three standard bioassays, the Microtox™ Bioassay, the 14-day earthworm test and the 14-day early seedling growth test.

2.1 SAMPLE AND TEST BIOTA RECEIPT

The test soil was collected by GeoEngineers personnel on June 5 – 6, 2008. The soil samples were hand delivered by GeoEngineers personnel to the NewFields laboratory on June 6, 2008.

The earthworms *Eisinia foetida* were supplied by Aquatic Research Organisms in Hampton, New Hampshire and held in moist peat moss at 20°C prior to test initiation. Butter crunch lettuce *Lactuca sativa* seeds were obtained from Territorial Seed Company in Cottage Grove, Oregon. The plant seeds were stored dry at 4°C Celsius prior to testing.

2.2 MICROTOX® BIOASSAY

The Microtox® test was performed by Nautilus Environmental LLC. The Microtox test exposed the luminescent marine bacterium *Vibrio fischeri* to a liquid extract of the test soils. Bacterial light output was measured using the Microtox Model 500 Analyzer at 5 and 15 minutes of exposure. Light output from the test porewater was compared to that of the reference treatments at both time intervals. A complete description of the Microtox test methods is presented in Appendix A.

2.3 EARTHWORM BIOASSAY

Two 14-day earthworm bioassays were performed on soils from the Irondale site. For the first bioassay test, a soil dilution series of sample TP11 was prepared to determine a dose-response relationship between Total Petroleum Hydrocarbon (TPH) concentrations in sample TP11 and worm survival. A clean background site sample (TP23) was mixed with sample TP11 to prepare a dilution series of 100, 50, 25, 12, 6, and 3 percent. This test was initiated on June 19, 2008. A second bioassay was performed on undiluted soil samples to assess potential effects from metals detected in the soils. This test was initiated on June 23, 2008.

Test exposures were prepared with approximately 200g of soil placed in clean, acid and solvent-rinsed 300-mL glass jars. Three replicate chambers were prepared for each test treatment and the artificial control soil. All soils were hydrated with deionized laboratory water to approximately 35-45 percent moisture prior to organism addition.

Test chambers were placed in randomly assigned positions in a temperature controlled environmental space at 23°C under continuous lighting. The soil pH was measured on each treatment prior to test initiation and at test termination. Soil pH was measured by combining 25mL of soil and 25mL of deionized laboratory water and mixing thoroughly. Measurements were taken immediately upon mixing and again after approximately 30 minutes. Temperature of the environmental space was monitored daily until test termination.

The tests were initiated by randomly allocating 10 *E. foetida* into each test chamber, ensuring that each of the worms successfully buried into the soil. Worms that did not bury within approximately one hour were replaced with healthy animals. The 14-day bioassays were conducted as static tests with no feeding during the exposure period. At test termination, soil from each test chamber was wet-sieved through a 0.5-mm screen and all recovered animals transferred into a Petri dish. The number of surviving and dead worms was then determined.

2.4 PLANT BIOASSAY

Two 14-day early seedling growth bioassays were performed on soils from the Irondale site. The initial test was initiated on June 23, 2008. Due to low germination of the artificial soil control in the initial test, the soils were retested on August 8, 2008.

Test exposures were prepared with approximately 300g of soil placed in clean, 500-mL plastic cups. Three replicate chambers were prepared for each test treatment and the artificial control soil.

Test chambers were placed in randomly assigned positions in a temperature controlled environmental space at 23°C. Light was provided on a 16 hour light / 8 hour dark cycle. The targeted light quality was 100 micro-Einsteins ($\mu Em^{-2}s^{-1}$) and was measured with an Apogee™ Quantum Meter. The soil pH was measured on each treatment prior to test initiation and at test termination. Soil pH was measured by combining 25mL of soil and 25mL of deionized laboratory water and mixing thoroughly. Measurements were taken immediately upon mixing and again after approximately 30 minutes. Temperature of the environmental space was monitored daily until test termination.

The tests were initiated by allocating 20 *L. sativa seeds* into each test chamber utilizing a position template. Seeds were buried approximately 2-3 mm deep and covered with soil by gently tapping the test chamber or brushing soil over the seeds. All chambers were gently hydrated to field capacity using a spray bottle with deionized laboratory water. Hydration was maintained throughout the course of the test through twice daily application of water.

At test termination, the number of germinated seeds in each replicate was recorded. The cumulative growth (excluding roots) of all germinated plants in each replicate was then transferred to pre-weighed, aluminum foil weigh-boats. A wet weight was determined on each replicate prior to being dried a drying oven at 60°C for approximately 24 hours. Each weigh-boat was removed, cooled in a dessicator, and then weighed again for dry-weight determination. Weights were performed on an analytical microbalance to 0.01 mg.

3.0 RESULTS AND DISCUSSION

3.1 MICROTOX BIOASSAY

Results of the Microtox bioassay are shown in Table 1. Only sample TP18 exhibited a significant decrease in light transmission compared to the Control sample, however this is likely an artifact of the very dark color of the sample. The laboratory ran additional tests and determined that the dark color of the soil decreased light transmission even at the start of the test and with diluted sample (see Appendix A for complete discussion). All other samples showed light transmission between 93 and 100% of Control.

Table 1. Results of Microtox Bioassay.

Sample ID	5 Minute Results				15 Minute Results			
	P < 0.05	% of Control	SQS Hit	CSL Hit	P < 0.05	% of Control	SQS Hit	CSL Hit
TP38	No	97	No	No	Yes	95	No	No
TP06	No	99	No	No	Yes	96	No	No
TP08	No	98	No	No	Yes	94	No	No
DP01	No	100	No	No	No	99	No	No
TP42	Yes	96	No	No	Yes	93	No	No
TP40	No	100	No	No	No	101	No	No
TP22	Yes	95	No	No	No	99	No	No
TP10	No	101	No	No	No	110	No	No
TP32	No	102	No	No	No	106	No	No
TP12	No	101	No	No	No	103	No	No
TP18*	Yes	66	**Yes**	**Yes**	Yes	64	**Yes**	**Yes**
TP41	No	101	No	No	No	103	No	No
GEI SSI	No	102	No	No	No	96	No	No
TP03	No	104	No	No	No	103	No	No
TP02	No	103	No	No	No	101	No	No

*Sample had very dark color, result may be test artifact

3.2 EARTHWORM BIOASSAY

Table 2 presents the survival results of the dilution series test on Treatment TP11 compared to Control survival and survival in a background sample TP23. Reduced survival was observed in the 50% and 100% concentrations of TP11; however, due to the variability in the three replicates the reduced survival is not statistically significant.

Table 2. Earthworm TPH Dilution Series Survival Results.

Treatment	Rep	Initial #	Final #	% Survival	Mean % Survival	Total TPH (mg/kg)
Control	1	10	9	90%	97%	17
	2	10	10	100%		
	3	10	10	100%		
TP-23 Background	1	10	8	80%	93%	11U
	2	10	10	100%		
	3	10	10	100%		
TP11 3%	1	10	10	100%	100%	215
	2	10	10	100%		
	3	10	10	100%		
TP11 6%	1	10	10	100%	100%	390
	2	10	10	100%		
	3	10	10	100%		
TP11 12%	1	10	10	100%	100%	640
	2	10	10	100%		
	3	10	10	100%		
TP11 25%	1	10	10	100%	100%	1,140
	2	10	10	100%		
	3	11	11	100%		
TP11 50%	1	10	10	100%	87%	3,900
	2	10	10	100%		
	3	10	6	60%		
TP11 100%	1	10	10	100%	77%	5,200
	2	10	3	30%		
	3	10	10	100%		

Results for the earthworm survival test on *Eisinia foetida* are provided in Table 3. Survival in the Control sample was 100%; test treatments ranged between 96.7 and 100% mean survival. Table 4 summarizes the earthworm survival compared to metal concentrations measured in the test soils.

Table 3. Earthworm Metals Survival Results.

Treatment	Replicate	Initial #	Final #	Survival %	Mean Survival %
Control	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
GEI-SS1	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP03	1	10	9	90	96.7
	2	11	11	100	
	3	10	10	100	
DP01	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP22	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP40	1	10	10	100	96.7
	2	10	9	90	
	3	10	10	100	
TP08	1	10	10	100	96.7
	2	10	9	90	
	3	10	10	100	
TP32	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP06	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP02	1	10	9	90	96.7
	2	10	10	100	
	3	10	10	100	
TP38	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP18	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP41	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	

Table 4. Earthworm Survival Results and Measured Metal Concentrations.

Treatment	Mean Survival %	Metal Concentrations (mg/kg)					
		Arsenic	Copper	Iron	Lead	Nickel	Zinc
Control	100	NA	NA	NA	NA	NA	NA
GEI-SS1	100	4.8	74	37,800	20	6	55
TP03	96.7	29.1	260	130,000	280	54	1,460
DP01	100	4.8	97.1	31,700	8	33	86
TP22	100	2.0	9.5	15,300	3	28	32
TP40	96.7	43.6	876	202,000	110	70	90
TP08	96.7	8.4	298	26,700	8	31	45
TP32	100	38.5	883	106,000	50	13	84
DP06	100	6.2	127	24,800	91	31	106
TP02	96.7	1.9	14.4	16,100	10	36	42
TP38	100	3.0	23.8	18,400	147	36	79
TP18	100	3.1	16.3	14,200	20	22	39
TP41	100	2.5	32.0	17,400	7	33	48

3.3 PLANT BIOASSAY

Results of the *Lactuca sativa* bioassay are provided in Table 5. A summary of the associated metal concentrations is provided in Table 4 above. Germination of seeds in the Control sample was 96.7%. Germination of seeds in the test treatments ranged from 53.3% to 98.3%. Growth was highest in Treatment TP18 and lowest in Treatment TP06.

Table 5. Germination and Growth of *Lactuca sativa*.

Treatment	Mean Germination (%)	Mean Wet wt. Germinated Seed (mg)	Mean Dry wt. Germinated Seed (mg)	Mean Wet wt. Initial Seed (mg)	Mean Dry wt. Initial Seed (mg)
Control	96.7	29.30	1.41	28.23	1.36
GEI-SS1	96.7	35.51	2.15	34.32	2.08
TP03	66.7	47.15	2.13	32.75	1.49
DP01	86.7	17.80	1.28	14.87	1.08
TP22	71.7	14.22	1.41	10.12	1.00
TP40	73.3	33.12	1.64	24.59	1.20
TP08	93.3	20.05	1.90	18.85	1.77
TP32	81.7	38.77	1.69	31.58	1.38
TP06	53.3	21.69	1.12	11.83	0.62
TP02	98.3	26.80	2.05	26.40	2.02
TP38	70.0	43.17	1.97	30.56	1.39
TP18	98.3	55.53	2.68	54.36	2.62
TP41	68.3	19.72	1.26	13.56	0.88

Germination and growth results for each test treatment of the *L. sativa* bioassay were compared with an ANOVA followed by a Dunnett's one-way comparison (Table 6). Prior to the ANOVA the data were tested for the assumptions of normal distribution and homogeneity of variance. Germination data were normally distributed with homogeneous variance; the ANOVA was performed on arcsine-square root transformed data. Growth data did not meet the assumptions and the ANOVA was performed on rankits data.

Treatments with germination below 72% were determined to be significantly lower than Control germination but no treatments had significantly less growth than the Control sample. Because of the difference in growth in the Control sample and several of the test treatments, a second ANOVA was run with comparisons to Treatment TP18, the treatment with the highest growth. Results of this comparison showed all treatments except TP02 and GEI-SS1 had significantly ($p \leq 0.05$) less growth than TP18.

Table 6. ANOVA Results for Germination and Growth of *Lactuca sativa*.

Treatment	Germination (%)		Statistical Comparison*		Dry Weight per Initial Seed (mg)		Statistical Comparison*	
	Mean	Std Dev	Sig < Control	Sig < TP18	Mean	Std Dev	Sig < Control	Sig < TP18
Control	96.7	2.9	--	N	1.36	0.23	--	Y
TP18	98.3	2.9	N	--	2.62	0.45	N	--
TP02	98.3	2.9	N	N	2.02	0.21	N	N
GEI-SS1	96.7	2.9	N	N	2.08	0.19	N	N
TP08	93.3	7.6	N	N	1.77	0.14	N	Y
DP01	86.7	12.6	N	N	1.08	0.19	N	Y
TP32	81.7	2.9	N	Y	1.38	0.16	N	Y
TP40	73.3	22.5	N	Y	1.20	0.36	N	Y
TP22	71.7	14.4	Y	Y	1.00	0.15	N	Y
TP38	70.0	10.0	Y	Y	1.39	0.35	N	Y
TP41	68.3	16.1	Y	Y	0.88	0.30	N	Y
TP03	66.7	15.3	Y	Y	1.49	0.97	N	Y
TP06	53.3	15.3	Y	Y	0.62	0.27	N	Y

* Germination data are normally distributed with homogeneous variance: ANOVA performed on arcsine transformed data ($p \leq 0.05$). Growth data are not normally distributed and variance is not homogeneous: ANOVA performed on rankits ($p \leq 0.05$).

Germination and growth data were compared to concentrations of six metals measured in the test samples to determine whether the metal concentrations were likely related to either germination or growth of *L. sativa*. Figure 1 shows the germination results compared to the metal concentrations. No obvious relationship between decreased germination and higher metal concentration are apparent. Growth data are compared to metal concentrations in Figure 2. There are no strong relationships among all of the test treatments; however, there is a cluster of six treatments (including the Control sample) that may be influenced by some other factor. These six (circled) have the lowest growth but also low concentrations of these metals, indicating that some unmeasured factor may be influencing the growth. Possible explanations are extremely coarse or fine size of soil, lack of nutrients, low organic carbon content.

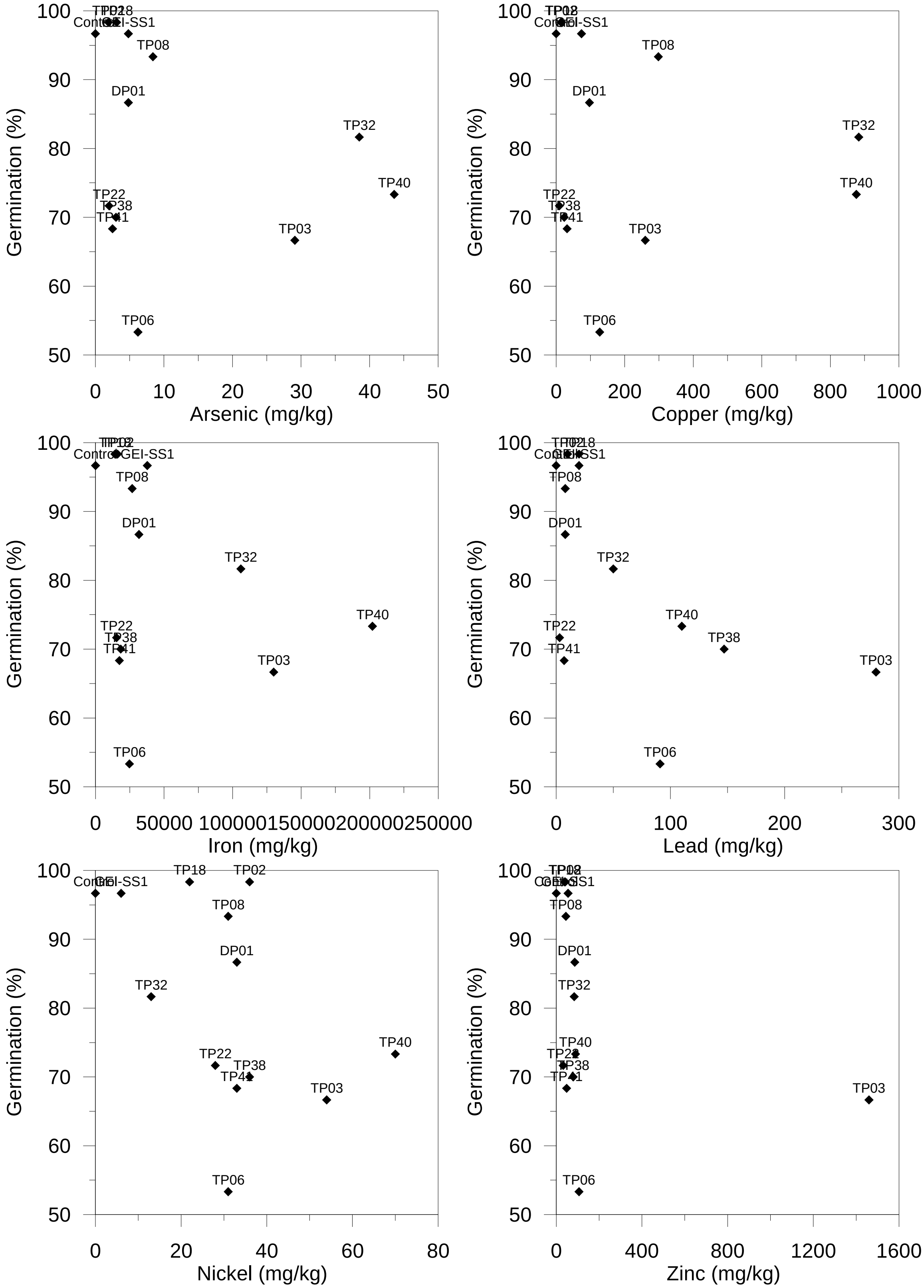


Figure 1. Relationship of *Lactuca sativa* Germination to Metal Concentrations.

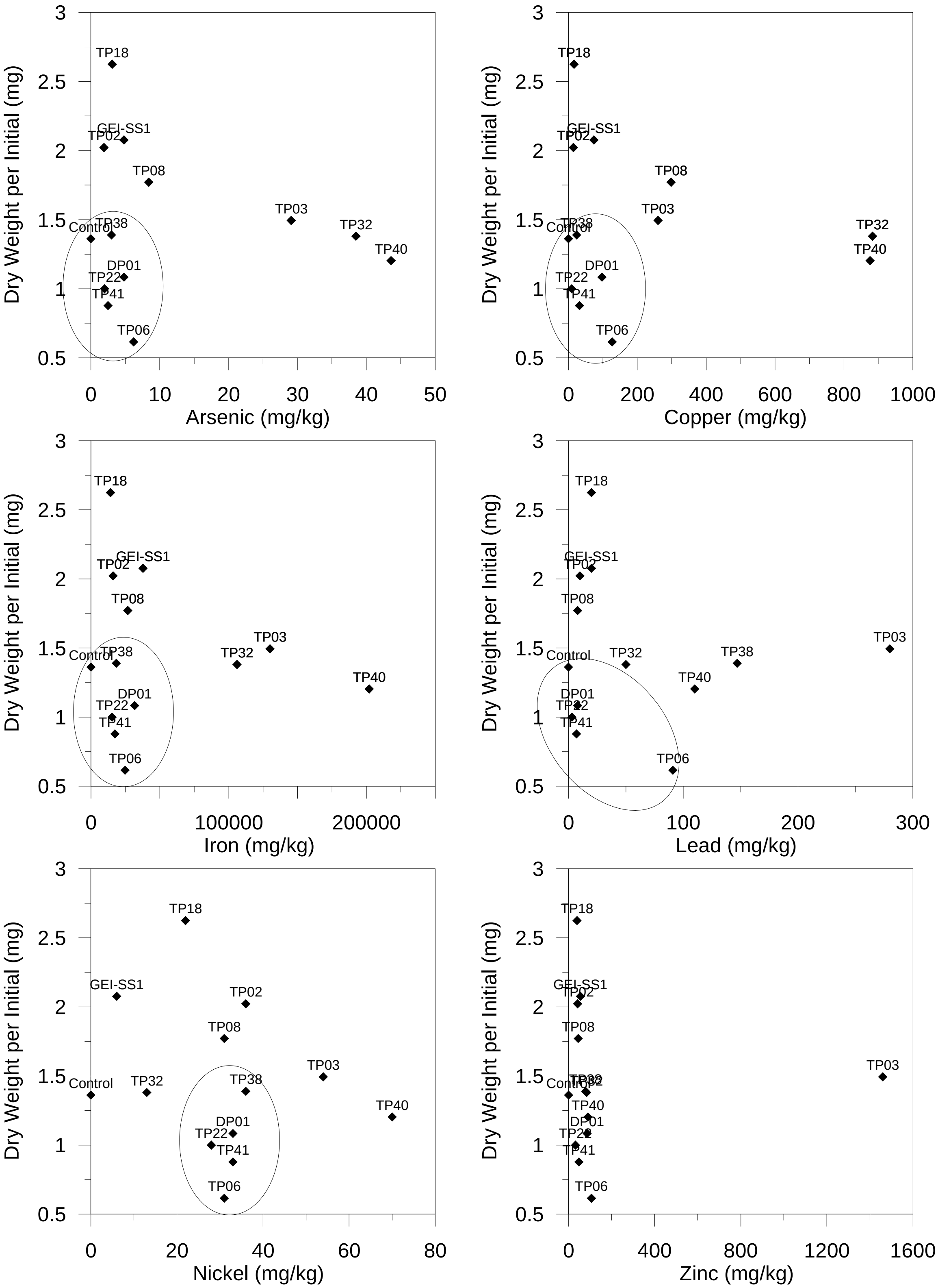


Figure 2. Relationship of *Lactuca sativa* Growth to Metal Concentrations.

4.0 CONCLUSION

The Microtox® bioassay performed on Irondale soil extracts resulted in one sample (TP18) with decreased light transmission. Further investigation by the analytical laboratory determined that this was a result of the dark coloration of the soil extract and possibly not due to a toxic effect on the luminescent bacteria. This is supported by the fact that sample TP18 exhibited high earthworm survival and the highest seed germination and growth in the plant bioassay.

No positive correlations were made between the earthworm bioassay results and TPH concentrations. While a statistically significant difference was not detected between the undiluted TPH sample TP11 (5,200 mg/kg total TPH) and the background sample, there was a slight reduction in survival from the other concentrations. Anecdotally, this may indicate the beginning of the dose-response curve at this TPH concentration. This data set indicates that 5,200 mg/kg Total TPH is the No Observed Effect Concentration (NOEC).

Earthworm survival in the soils where metals concentrations were measured ranged from 96.7 to 100 percent. These results indicate that the metal concentrations measured in the soil did not express a toxic effect on the survival of earthworms exposed for 14 days.

Only the plant bioassay exhibited any significant effects from several treatments. Statistical analyses of the plant responses and associated metal concentrations did not result in any definitive relationships. Reduced growth in several of the samples with low metal concentrations may be due to unmeasured factors, possibly particle size, lack of nutrients, low organic carbon, or unmeasured chemical constituents.

5.0 REFERENCES

Washington State Department of Ecology (WDOE). 1996. Earthworm Bioassay Protocol for Soil Toxicity Screening. WDOE Environmental Investigation and Laboratory Services Program Publication No. 96-327.

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PSEP. 1995. Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments. Puget Sound Estuary Program. Puget Sound Water Quality Action Team, Olympia, Washington.

APPENDIX A

MICROTOX® REPORT

Nautilus Environmental

Toxicological Evaluation of Soil

Microtox

Report date: July 15, 2008

Submitted to:

NEWFIELDS NORTHWEST
Port Gamble, WA

Washington Laboratory
5009 Pacific Hwy East
Suite 2
Tacoma, WA 98424

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SIGNATURE PAGE

Eric Tollefson
Project Manager

Mary Ann Rempel-Hester
Laboratory Manager

1.0 INTRODUCTION

Soil samples were collected and evaluated for toxicity as part of a project being conducted by NewFields Northwest. Soil samples were tested for toxicity using Microtox tests.

2.0 METHODS

2.1 Samples

Fifteen soil subsamples were collected by NewFields personnel on June 5 and 6, 2008 and were delivered on June 10 to the Nautilus Environmental laboratory in Tacoma, WA. The condition of the sample containers were inspected upon receipt and the identities compared with the information provided on the chain-of-custody forms. The samples were stored at 4±2°C in the dark prior to test initiation.

2.2 Test Procedures

The luminescent marine bacterium *Vibrio fischeri* was used as the test organism for the Microtox test. The bacteria were exposed to deionized water that was added to and extracted from soil samples and light readings were measured after 5 minutes and 15 minutes of exposure. Test equipment included the Microtox Model 500 Analyzer, which measures light output and is equipped with a 15°C chamber to maintain test temperature in the samples and a 4°C chamber to keep the rehydrated bacteria chilled.

Vials of freeze-dried bacteria (Microtox® Acute Reagent Lot # 7k1002, Expiration date 10/09) were obtained from Strategic Diagnostics, Inc. and stored at -20°C until use. On the day of the test, a vial was rehydrated with 1.0 ml of Microtox Reconstitution Solution, mixed thoroughly, and allowed to equilibrate for 30 minutes at 4°C. The bacteria were used within 2 hours of rehydration.

The tests were conducted in accordance with WDOE (2008) test protocol with some modifications; these methods are summarized in Table 1. 90 grams of each sample was weighed and placed in a 300ml beaker. 30ml of deionized water were then added to each beaker creating a soil slurry. The soil slurry was then mixed for 24 hours in the dark at 4°C by gentle agitation (100 rpm) on a rotary shaker table. The slurry for each sample was transferred into 50-ml centrifuge tubes and spun for 30 minutes at 4500 G. Each slurry extract was adjusted to a salinity of 20 parts per thousand (ppt) with Forty Fathoms artificial seasalt. The DO in each sample was between 50 and 100 percent saturation and, as a result, the samples did not require aeration. The pH was adjusted to 7.8 to 8.2 using NaOH or HCl, if necessary. The control was deionized water adjusted to 20 ppt with artificial seasalt. Each slurry extract was tested within 3 hours of extraction.

Tests were conducted using five replicates. Disposable glass cuvettes were placed in the Microtox test wells and 1 ml of salinity adjusted slurry extract was added. The rehydrated bacteria (reagent) were thoroughly mixed and 10 µl was added to each test cuvette. After an initial incubation period of 5 minutes, the control cuvette was placed in the read chamber of the Microtox Analyzer to set the instrument. Initial light readings (I_0) were then taken by placing each cuvette in the read chamber of the Microtox Analyzer and measurements were recorded on a data sheet. Light output was measured in each cuvette after an additional 5 minutes (I_5) and 15 minutes (I_{15}) of exposure.

Test acceptability criterion was final mean control light output greater than or equal to 72% of initial control mean output, and test mean output not greater than 110% of control mean output. The data were evaluated statistically by conducting one-tailed t-tests on the change in output over time for soil extracts compared to the control. Comparison to the control is preferred, according to WDOE (2008).

A reference toxicant test using phenol was conducted in conjunction with the soil tests to ensure that the sensitivity of the test was within the acceptable range of historical values determined in this laboratory.

Table 1. Summary of methods for the Microtox test.

Test date	June 12, 2008
Test organism source	Strategic Diagnostics
Batch number and expiration date	Lot#7k1002, Expiry 10/09
Control	Saltwater (20 ppt) prepared with Forty Fathoms Sea Salts
Sample preparation	24-hour extraction with deionized water; centrifugation at 4500 G for 30 minutes; salinity adjustment to 20 ppt using Forty Fathoms Sea Salts; pH adjustment to 7.8-8.2 ppt
Test chamber	Glass cuvette
Test volume	1 mL
Volume of inoculum/replicate	10 μL
Number of replicates/sample	5
Test temperature	15 ± 1°C
Aeration	None
Reference toxicant	Phenol

3.0 RESULTS

The results of toxicity tests conducted using Microtox are provided in Tables 2 and 3.

Table 2. Results of Microtox tests showing change in light output of samples as a percentage of change in light output of control after 5 and 15 minute of exposure.

Sample	Change in light output as a % of Control (5 minutes)	Change in light output as a % of Control (15 minutes)
TP38	97	95
TP06	99	96
TP08	98	94
DP01	100	99
TP42	96	93
TP40	100	101
TP22	95	99
TP10	101	110
TP32	102	106
TP12	101	103
TP18	66	64
TP41	101	103
GEI SS1	102	96
TP03	104	103
TP02	103	101

Table 3. **Statistical analyses of Microtox results. Shaded data indicates > 10% difference and statistically significant difference ($p<0.05$) relative to the control**

Sample	5-minute reading Mean % change in light output	p-values	15 minute reading Mean % change in light output	p-values
Test1				
Control	93 ± 2	---	87 ± 1	---
TP38	91 ± 2	0.07	82 ± 2	<0.01
TP06	92 ± 2	0.19	83 ± 2	0.01
TP08	91 ± 2	0.11	82 ± 3	0.01
DP01	93 ± 3	0.42	86 ± 1	0.07
TP42	90 ± 2	0.03	81 ± 3	0.01
Test 2				
Control	94 ± 3	---	85 ± 2	---
TP40	94 ± 2	0.49	87 ± 3	NA
TP22	90 ± 2	0.01	84 ± 5	0.37
TP10	95 ± 2	NA	94 ± 2	NA
TP32	96 ± 5	NA	90 ± 8	NA
TP12	95 ± 3	NA	88 ± 5	NA
Test 3				
Control	96 ± 3	---	88 ± 5	---
TP18[1]	63 ± 5	<0.01	56 ± 4	<0.01
TP41	97 ± 3	NA	91 ± 4	NA
GEI SS1	98 ± 3	NA	85 ± 2	0.09
TP03	101 ± 2	NA	91 ± 2	NA
TP02	99 ± 4	NA	89 ± 4	NA

NA - Not applicable, test results greater than control results. [1]See discussion

3.1 QA/QC

The Microtox tests met control acceptance criteria and there were no deviations from protocol.

Results of reference toxicant test conducted in conjunction with this testing program are provided in Table 4. The results of this test fell within the range of mean ± two standard deviations of historical results for *Vibrio fischeri*, indicating that the sensitivity of the test organisms was appropriate.

Table 4. **Reference toxicant test results.**

Exposure Duration	Test date	Toxicant	EC50	Acceptable Range	CV (%)
5 Minutes	June 12, 2008	Phenol	28.2 mg/L	23.2-39.8	13.1
15 Minutes			38.0 mg/L	26.1-45.9	13.7

4.0 DISCUSSION

The only sample that showed an effect was TP18. TP18 was also the only sample that had an initial light output (I_0) less than 80% of the control initial light output. WDOE (2008) guidelines for microtox analysis state that samples with I_0 values less than 80% of control should be compared against control I_0 values for determination of decrease in light output at five (I_5) and 15 (I_{15}) minutes. Otherwise the sample I_0 value is used instead of the control I_0 value. In compliance with this guideline only TP18 used the control I_0 value for determination of light output decrease, all other samples used the sample I_0 value.

The initial light output (I_0) is taken after the bacteria has been exposed to the sample for five minutes. The guideline stated above is believed to have been established to catch any toxicity that may have occurred during the first five minutes of exposure, which could have led to a decrease in light output by time zero. However interferences such as dark coloration of sample may also lead to a decrease in I_0 not related to toxicity. TP18 was much darker than any of the other extracts, even after all of the suspended particulates were removed by centrifugation. To determine if the dark coloration caused an interference, TP18 was rerun at four concentrations (100%, 75%, 50%, and 25%) along with all of the other samples (100% only) and the control. Instead of taking the initial reading (I_0) five minutes after the bacteria was added the initial readings were taken immediately after the bacteria was added. The exercise should demonstrate if the sample had a toxic effect in the first five minutes or if it was really the color of the sample that caused the lower light levels. The results are in Table 5 below. The lowest light readings were from the TP18 samples, with light output increasing with a decrease in the percentage of TP18. This appears to demonstrate that the coloration of the sample caused the lower light output.

Table 5. **Light output immediately after adding bacteria.**

Sample	Light Reading
Control	91
TP18 100%	38
TP18 75%	41
TP18 50%	44
TP18 25%	56
TP41	65
TP02	80
TP22	82
GEI SS1	85
DP01	75
TP06	70
TP10	85
TP40	66
TP32	86
TP03	81
TP42	76
TP08	87
TP38	81
TP12	77

If the I_5 and I_{15} values for sample TP18 are compared against the sample I_0 and not the control I_0, the results are not significantly different from control, nor are they greater than 10 percent lower than the control (Table 6). The laboratory believes that the decrease in light output for sample TP18 is due to interference, and not toxicity. Therefore sample TP18 should not be designated as above sediment quality standards.

Table 6. **Statistical analysis of sample TP18 normalized to sample I_0.**

	5-minute reading		15 minute reading	
Sample	Mean % change in light output	p-values	Mean % change in light output	p-values
Control	96 ± 3	---	88 ± 5	---
TP18	97 ± 3	0.30	87 ± 3	0.27

5.0 REFERENCES

American Society of Testing and Materials (ASTM). 2000. Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates. ASTM Designation E 1706-00.

U.S. Environmental Protection Agency (USEPA). 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-99/064.

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Appendix Table A. Microtox 100 Percent Sediment Porewater Test
Sites TP38, TP06, TP08, DP01, TP42
NewFields Northwest
Test Date: June 12, 2008

Site		Light Reading								Quality Control Steps	
		Replicate								Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.	$T_{(mean)}/C_{(mean)}$	$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
Control	$I_{(0)}$	**91**	**82**	**85**	**83**	**85**	85				
	$I_{(5)}$	**86**	**74**	**82**	**78**	**78**	80			0.93	
	$I_{(15)}$	**78**	**73**	**74**	**72**	**74**	74			0.87	
	$C_{(5)}$	0.95	0.90	0.96	0.94	0.92	0.93	0.02			
	$C_{(15)}$	0.86	0.89	0.87	0.87	0.87	0.87	0.01			
TP38	$I_{(0)}$	**78**	**89**	**82**	**80**	**83**	82				0.97
	$I_{(5)}$	**73**	**81**	**72**	**73**	**76**	75				
	$I_{(15)}$	**67**	**72**	**67**	**66**	**67**	68				
	$T_{(5)}$	0.94	0.91	0.88	0.91	0.92	0.91	0.02	0.97		
	$T_{(15)}$	0.86	0.81	0.82	0.83	0.81	0.82	0.02	0.95		
TP06	$I_{(0)}$	**82**	**81**	**77**	**83**	**81**	81				0.95
	$I_{(5)}$	**76**	**73**	**73**	**75**	**75**	74				
	$I_{(15)}$	**70**	**68**	**65**	**66**	**68**	67				
	$T_{(5)}$	0.93	0.90	0.95	0.90	0.93	0.92	0.02	0.99		
	$T_{(15)}$	0.85	0.84	0.84	0.80	0.84	0.83	0.02	0.96		
TP08	$I_{(0)}$	**69**	**78**	**71**	**74**	**77**	74				0.87
	$I_{(5)}$	**62**	**70**	**66**	**66**	**73**	67				
	$I_{(15)}$	**58**	**60**	**59**	**60**	**66**	61				
	$T_{(5)}$	0.90	0.90	0.93	0.89	0.95	0.91	0.02	0.98		
	$T_{(15)}$	0.84	0.77	0.83	0.81	0.86	0.82	0.03	0.94		
DP01	$I_{(0)}$	**82**	**85**	**80**	**85**	**89**	84				0.99
	$I_{(5)}$	**78**	**78**	**73**	**77**	**86**	78				
	$I_{(15)}$	**71**	**74**	**69**	**72**	**76**	72				
	$T_{(5)}$	0.95	0.92	0.91	0.91	0.97	0.93	0.03	1.00		
	$T_{(15)}$	0.87	0.87	0.86	0.85	0.85	0.86	0.01	0.99		
TP42	$I_{(0)}$	**80**	**82**	**84**	**80**	**78**	81				0.95
	$I_{(5)}$	**71**	**76**	**73**	**73**	**71**	73				
	$I_{(15)}$	**64**	**67**	**64**	**65**	**67**	65				
	$T_{(5)}$	0.89	0.93	0.87	0.91	0.91	0.90	0.02	0.96		
	$T_{(15)}$	0.80	0.82	0.76	0.81	0.86	0.81	0.03	0.93		

$I_{(0)}$ is the light reading after the initial five minute incubation period
$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	93%	YES
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	87%	YES

YES: Control results are acceptable and can be used for statistical analyses.
NO: Control results are unacceptable (retest required because there is no reference sediment to use instead of control).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	97%	YES
S2	$I_{T(mean)}/I_{C(mean)}$:	95%	YES
S3	$I_{T(mean)}/I_{C(mean)}$:	87%	YES
S4	$I_{T(mean)}/I_{C(mean)}$:	99%	YES
S5	$I_{T(mean)}/I_{C(mean)}$:	95%	YES

YES: Use initial site values to calculate change in final light readings
NO: Use control initial mean value to calculate change in final light readings for each site.

Appendix Table B. Microtox 100 Percent Sediment Porewater Test
Sites TP40, TP22, TP10, TP32, TP12
NewFields Northwest
Test Date: June 12, 2008

Site	Light Reading								$T_{(mean)}/C_{(mean)}$	Quality Control Steps	
		Replicate								Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.		$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
Control	$I_{(0)}$	**92**	**78**	**88**	**97**	**94**	90				
	$I_{(5)}$	**88**	**74**	**80**	**94**	**86**	84			0.94	
	$I_{(15)}$	**78**	**67**	**74**	**85**	**79**	77			0.85	
	$C_{(5)}$	0.96	0.95	0.91	0.97	0.91	0.94	0.03			
	$C_{(15)}$	0.85	0.86	0.84	0.88	0.84	0.85	0.02			
TP40	$I_{(0)}$	**95**	**89**	**88**	**85**	**90**	89				1.00
	$I_{(5)}$	**88**	**83**	**86**	**80**	**83**	84				
	$I_{(15)}$	**83**	**76**	**80**	**72**	**76**	77				
	$T_{(5)}$	0.93	0.93	0.98	0.94	0.92	0.94	0.02	1.00		
	$T_{(15)}$	0.87	0.85	0.91	0.85	0.84	0.87	0.03	1.01		
TP22	$I_{(0)}$	**91**	**90**	**88**	**84**	**92**	89				0.99
	$I_{(5)}$	**81**	**82**	**76**	**78**	**82**	80				
	$I_{(15)}$	**78**	**80**	**67**	**72**	**79**	75				
	$T_{(5)}$	0.89	0.91	0.86	0.93	0.89	0.90	0.02	0.95		
	$T_{(15)}$	0.86	0.89	0.76	0.86	0.86	0.84	0.05	0.99		
TP10	$I_{(0)}$	**86**	**98**	**96**	**95**	**92**	93				1.04
	$I_{(5)}$	**84**	**90**	**92**	**91**	**87**	89				
	$I_{(15)}$	**81**	**95**	**89**	**89**	**84**	88				
	$T_{(5)}$	0.98	0.92	0.96	0.96	0.95	0.95	0.02	1.01		
	$T_{(15)}$	0.94	0.97	0.93	0.94	0.91	0.94	0.02	1.10		
TP32	$I_{(0)}$	**84**	**86**	**92**	**86**	**87**	87				0.97
	$I_{(5)}$	**84**	**87**	**81**	**82**	**81**	83				
	$I_{(15)}$	**81**	**86**	**76**	**75**	**74**	78				
	$T_{(5)}$	1.00	1.01	0.88	0.95	0.93	0.96	0.05	1.02		
	$T_{(15)}$	0.96	1.00	0.83	0.87	0.85	0.90	0.08	1.06		
TP12	$I_{(0)}$	**84**	**86**	**82**	**81**	**87**	84				0.94
	$I_{(5)}$	**76**	**81**	**82**	**77**	**81**	79				
	$I_{(15)}$	**71**	**77**	**78**	**69**	**73**	74				
	$T_{(5)}$	0.90	0.94	1.00	0.95	0.93	0.95	0.03	1.01		
	$T_{(15)}$	0.85	0.90	0.95	0.85	0.84	0.88	0.05	1.03		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	**94%**	**YES**
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	**85%**	**YES**

YES: Control results are acceptable and can be used for statistical analyses.
NO: Control results are unacceptable (retest required because there is no reference sediment to use instead of control).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	**100%**	**YES**
S2	$I_{T(mean)}/I_{C(mean)}$:	**99%**	**YES**
S3	$I_{T(mean)}/I_{C(mean)}$:	**104%**	**YES**
S4	$I_{T(mean)}/I_{C(mean)}$:	**97%**	**YES**
S5	$I_{T(mean)}/I_{C(mean)}$:	**94%**	**YES**

YES: Use initial site values to calculate change in final light readings
NO: Use control initial mean value to calculate change in final light readings for each site.

Appendix Table C. Microtox 100 Percent Sediment Porewater Test
Sites TP18, TP41, GEI SSI, TP03, TP02
NewFields Northwest
Test Date: June 12, 2008

Site	Light Reading								$T_{(mean)}/C_{(mean)}$	Quality Control Steps: Change in control light readings compared to initial control	Quality Control Steps: Evaluation of initial light output in site sediments
	Reading	Replicate 1	2	3	4	5	Mean	St.Dev.		$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
Control	$I_{(0)}$	**92**	**86**	**90**	**87**	**101**	91				
	$I_{(5)}$	**90**	**85**	**85**	**86**	**92**	88			0.96	
	$I_{(15)}$	**83**	**75**	**85**	**75**	**83**	80			0.88	
	$C_{(5)}$	0.98	0.99	0.94	0.99	0.91	0.96	0.03			
	$C_{(15)}$	0.90	0.87	0.94	0.86	0.82	0.88	0.05			
TP18	$I_{(0)}$	**60**	**53**	**59**	**66**	**58**	59				0.65
	$I_{(5)}$	**56**	**53**	**56**	**64**	**59**	58				
	$I_{(15)}$	**52**	**48**	**49**	**58**	**49**	51				
	$T_{(5)}$	0.61	0.58	0.61	0.70	0.65	0.63	0.05	0.66		
	$T_{(15)}$	0.57	0.53	0.54	0.64	0.54	0.56	0.04	0.64		
TP41	$I_{(0)}$	**81**	**73**	**76**	**72**	**81**	77				0.84
	$I_{(5)}$	**80**	**73**	**72**	**72**	**76**	75				
	$I_{(15)}$	**72**	**70**	**71**	**65**	**70**	70				
	$T_{(5)}$	0.99	1.00	0.95	1.00	0.94	0.97	0.03	1.01		
	$T_{(15)}$	0.89	0.96	0.93	0.90	0.86	0.91	0.04	1.03		
GEI SSI	$I_{(0)}$	**84**	**87**	**82**	**88**	**85**	85				0.93
	$I_{(5)}$	**80**	**87**	**83**	**85**	**82**	83				
	$I_{(15)}$	**72**	**74**	**72**	**72**	**70**	72				
	$T_{(5)}$	0.95	1.00	1.01	0.97	0.96	0.98	0.03	1.02		
	$T_{(15)}$	0.86	0.85	0.88	0.82	0.82	0.85	0.02	0.96		
TP03	$I_{(0)}$	**81**	**80**	**81**	**82**	**80**	81				0.89
	$I_{(5)}$	**80**	**81**	**82**	**81**	**82**	81				
	$I_{(15)}$	**74**	**74**	**75**	**71**	**73**	73				
	$T_{(5)}$	0.99	1.01	1.01	0.99	1.03	1.01	0.02	1.04		
	$T_{(15)}$	0.91	0.93	0.93	0.87	0.91	0.91	0.02	1.03		
TP02	$I_{(0)}$	**85**	**82**	**88**	**85**	**82**	84				0.93
	$I_{(5)}$	**85**	**85**	**82**	**84**	**81**	83				
	$I_{(15)}$	**76**	**74**	**72**	**79**	**75**	75				
	$T_{(5)}$	1.00	1.04	0.93	0.99	0.99	0.99	0.04	1.03		
	$T_{(15)}$	0.89	0.90	0.82	0.93	0.91	0.89	0.04	1.01		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

$I_{(5)}$: $F_{c(mean)}/I_{c(mean)}$:	**96%**	**YES**
$I_{(15)}$: $F_{c(mean)}/I_{c(mean)}$:	**88%**	**YES**

YES: Control results are acceptable and can be used for statistical analyses.

NO: Control results are unacceptable (retest required because there is no reference sediment to use instead of control).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	**65%**	**NO**
S2	$I_{T(mean)}/I_{C(mean)}$:	**84%**	**YES**
S3	$I_{T(mean)}/I_{C(mean)}$:	**93%**	**YES**
S4	$I_{T(mean)}/I_{C(mean)}$:	**89%**	**YES**
S5	$I_{T(mean)}/I_{C(mean)}$:	**93%**	**YES**

YES: Use initial site values to calculate change in final light readings

NO: Use control initial mean value to calculate change in final light readings for each site.

Nautilus Environmental
Washington Laboratory
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Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields

Test Date: 6/12/08

Sample ID: TP38, TP06, TP08, DP01, TP42

Test No.: 0806-T082, T075, T076, T071, T085

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	$I_{(0)}$	5 min	91	82	85	83	85
	$I_{(5)}$	10min	86	74	82	78	78
	$I_{(15)}$	20 min	78	73	74	72	74
TP 38	$I_{(0)}$	5 min	78	89	82	80	83
	$I_{(5)}$	10min	73	81	72	73	76
	$I_{(15)}$	20 min	67	72	67	66	67
TP06	$I_{(0)}$	5 min	82	81	77	83	81
	$I_{(5)}$	10min	76	73	73	75	75
	$I_{(15)}$	20 min	70	68	65	66	68
TP08	$I_{(0)}$	5 min	69	78	71	74	77
	$I_{(5)}$	10min	62	70	66	66	73
	$I_{(15)}$	20 min	58	60	59	60	66
DP01	$I_{(0)}$	5 min	82	85	80	85	89
	$I_{(5)}$	10min	78	78	73	77	86
	$I_{(15)}$	20 min	71	74	69	72	76
TP42	$I_{(0)}$	5 min	80	82	84	80	78
	$I_{(5)}$	10min	71	76	73	73	71
	$I_{(15)}$	20 min	64	67	64	65	67

Comments:

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Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields **Test Date:** 6/12/08

Sample ID: TP40, TP22, TP10, TP32, TP12 **Test No.:** 0806-T083, T080, T077, T081, T078

Site	Light Reading	Time	Replicate 1	2	3	4	5
CON	$I_{(0)}$	5 min	92	78	88	97	94
	$I_{(5)}$	10min	88	74	80	94	86
	$I_{(15)}$	20 min	78	67	74	85	79
TP40	$I_{(0)}$	5 min	95	89	88	85	90
	$I_{(5)}$	10min	88	83	86	80	83
	$I_{(15)}$	20 min	83	76	80	72	76
TP22	$I_{(0)}$	5 min	91	90	88	84	92
	$I_{(5)}$	10min	81	82	76	78	82
	$I_{(15)}$	20 min	78	80	67	72	79
TP10	$I_{(0)}$	5 min	86	98	96	95	92
	$I_{(5)}$	10min	84	90	92	91	87
	$I_{(15)}$	20 min	81	95	89	89	84
TP32	$I_{(0)}$	5 min	84	86	92	86	87
	$I_{(5)}$	10min	84	87	81	82	81
	$I_{(15)}$	20 min	81	86	76	75	74
TP12	$I_{(0)}$	5 min	84	86	82	81	87
	$I_{(5)}$	10min	76	81	82	77	81
	$I_{(15)}$	20 min	71	77	78	69	73

Comments:

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields **Test Date:** 6/12/08

Sample ID: TP18, TP41, GEISS1, TP03, TP02 **Test No.:** 0806-T079, T084, T072, T074, T073

Site	Light Reading	Time	Replicate 1	2	3	4	5
CON	$I_{(0)}$	5 min	92	86	90	87	101
	$I_{(5)}$	10min	90	85	85	86	92
	$I_{(15)}$	20 min	83	75	85	75	83
TP18	$I_{(0)}$	5 min	60	53	59	66	58
	$I_{(5)}$	10min	56	53	56	64	59
	$I_{(15)}$	20 min	52	48	49	58	49
TP41	$I_{(0)}$	5 min	81	73	76	72	81
	$I_{(5)}$	10min	80	73	72	72	76
	$I_{(15)}$	20 min	72	70	71	65	70
GEI SS1	$I_{(0)}$	5 min	84	87	82	88	85
	$I_{(5)}$	10min	80	87	83	85	82
	$I_{(15)}$	20 min	72	74	72	72	70
TP03	$I_{(0)}$	5 min	81	80	81	82	80
	$I_{(5)}$	10min	80	81	82	81	82
	$I_{(15)}$	20 min	74	74	75	71	73
TP02	$I_{(0)}$	5 min	85	82	88	85	82
	$I_{(5)}$	10min	85	85	82	84	81
	$I_{(15)}$	20 min	76	74	72	79	75

Comments:

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5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields **Test Date:** 6/30/08

Sample ID: TP18, TP41, TP02, TP22, GEISS1, DP01, TP06, TP10, TP40, TP32, TP03, TP42, TP08, TP38, TP12 **Test No.:** N/A

Measurement of light readings at inoculation time to determine interference

Site	Light Reading	Time	Replicate				
			CON ~~1~~	TP18 100% ~~2~~	TP18 75% ~~3~~	TP18 50% ~~4~~	TP18 25% ~~5~~
	$I_{(0)}$	0 ~~5~~ min	91	38	41	44	56
	$I_{(5)}$	5 ~~10~~min	180	78	88	90	119
	$I_{(15)}$	20 min					
			TP41	TP02	TP22	GEISS1	DP01
	$I_{(0)}$	0 ~~5~~ min	65	80	82	85	75
	$I_{(5)}$	5 ~~10~~min	145	152	165	161	143
	$I_{(15)}$	20 min					
			TP06	TP10	TP40	TP32	TP03
	$I_{(0)}$	0 ~~5~~ min	70	85	66	86	81
	$I_{(5)}$	5 ~~10~~min	161	162	140	158	150
	$I_{(15)}$	20 min					
			TP42	TP08	TP38	TP12	
	$I_{(0)}$	0 ~~5~~ min	76	87	81	77	
	$I_{(5)}$	5 ~~10~~min	151	145	138	135	
	$I_{(15)}$	20 min					
	$I_{(0)}$	0 ~~5~~ min					
	$I_{(5)}$	5 ~~10~~min					
	$I_{(15)}$	20 min					
	$I_{(0)}$	5 min					
	$I_{(5)}$	10min					
	$I_{(15)}$	20 min					

Comments:

APPENDIX C – Water Quality Results

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: et

Client : Newfields

Test Date: 6/12/08

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 0806-T072, T071, T074, T073, T078, T075

Test Species: *Vibrio fischeri*

	Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
25.0ML clear	CON	0.0	20.1	6.8	6.8	8.14				<1.0
10.0ML clear	GEI SS1	0.0	19.6	7.0	7.0	8.10				<1.0
19.3ML Clear	DP01	0.0	19.5	7.1	7.1	7.59	8.06	50µL 0.1N NaOH		<1.0
13.2ML Some color	TP03	0.0	19.7	6.7	6.7	8.09				<1.0
13.9ML Some color	TP02	0.0	20.8	6.9	6.9	7.99				<1.0
16.8ML Some color	TP12	0.0	20.3	7.1	7.1	8.10				<1.0
14.8ML Color	TP06	0.0	19.6	7.0	7.0	8.10				<1.0

Sample Description: ____________________

Comments: ____________________

QA Check: ____________________

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Washington Laboratory
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Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: Et

Client : Newfields

Test Date: 6/12/09

Test Type: **Microtox 100% Porewater Toxicity Test**

Test No: 0806-T076, T081, T084, T079, T082, T083

Test Species: ***Vibrio fischeri***

	Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
20ML color	TP08	0.0	19.1	6.5	6.5	8.19				<1.0
15.4ML color	TP42	0.0	20.1	6.9	6.9	8.00				<1.0
18.7ML color	TP32	0.0	20.8	7.1	7.1	8.00				<1.0
13.9ML color	TP41	0.0	20.8	6.8	6.8	8.02				<1.0
8.3ML Dark color	TP18	0.0	20.7	6.8	6.8	7.81	8.04	10µL 0.1N NaOH		<1.0
21.4ML cloudy	TP38	0.0	20.1	7.0	7.0	7.48	8.20	50µL 0.1N NaOH		<1.0
21.8ML cloudy	TP40	0.0	20.5	6.4	6.4	8.12				<1.0

Sample Description: ______________________

Comments: ______________________

QA Check: ______________________

Nautilus Environmental
Washington Laboratory
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Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: gt

Client : Newfields

Test Date: 6/12/08

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 0806-T080, T077

Test Species: *Vibrio fischeri*

220ML cloudy
19.2ML cloudy

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
TP22	0.0	19.8	6.7	6.7	8.01				<1.0
TP10	0.0	20.9	6.5	6.5	7.90				<1.0

Sample Description: ______________________

Comments: ______________________

QA Check: ______________

Water Quality Results - Total Ammonia
Nautilus Environmental Northwest Laboratory

Client/Site ID: Newfields

Test Type: Soil Microtox

DI Blank: 0.0 **Seawater Blank:**

N x 1.22

Sample ID	Sample Date	Test Day	pH (units)	Salinity (ppt)	Analysis Date	Nitrogen (mg/L)	Ammonia (mg/L)
Blank Spike (10 mg/L NH₃)	NA	NA	NA	NA			11.9
TP06							<1.0
TP42							<1.0
TP10							<1.0
DP01							<1.0
TP12							<1.0
TP08							<1.0
TP32							<1.0
TP03							<1.0
TP38							<1.0 (0.4)
TP38 DUP							<1.0 (0.3)
TP38 Spike							~~9.4~~ 12.1
TP02							<1.0
Spike Check (10 mg/L NH₃)	NA	NA	NA	NA			11.8
TP22							<1.0
TP40							<1.0
TP41							<1.0
GEI SS1							<1.0 ~~(0.6)~~
TP18							<1.0 (0.9)
TP18 DUP							<1.0 (0.9)
TP18 Spike							13.5
CON							<1.0
Spike Check (10 mg/L NH₃)	NA	NA	NA	NA			

Relative Percent Difference (RPD) = Sample (mg/L) - sample duplicate (mg/L) x 100
average (mg/L)

% Recovery = Spiked sample (mg/L) - sample (mg/L) x 100
spike conc'n (mg/L)

Sample I.D.	NH_3 (mg/L)	Sample Dup	Spike (mg/L)	RPD	% Recovery
Blank	0.0	NA	11.9	NA	97.5
TP38	0.4	0.3	12.1	28.5	96.7
TP18	0.9	0.9	13.5	0.0	103.3

Nautilus Northwest Laboratory - 5009 Pacific Hwy. E., Suite 2 Tacoma, WA 98424

Comments:

QA Review/Date:

APPENDIX E

NEWFIELDS UPLAND BIOASSAY REPORT

BIOLOGICAL TESTING OF SOILS FROM THE IRONDALE IRON AND STEEL PLANT SITE IRONDALE, WA

FEBRUARY 2009

(REVISED MARCH 2009)

PREPARED FOR:
GEOENGINEERS, INC.
600 Stewart Street, Suite 1700
Seattle, WA 98101

PREPARED BY:
NEWFIELDS
PO Box 216
4729 View Drive
Port Gamble, Washington 98364

1.0 INTRODUCTION

GeoEngineers, Inc. requested NewFields Northwest, L.L.C., in Port Gamble, Washington to evaluate soil from the former Irondale Iron and Steel Plant in Irondale, Washington. As part of this Remedial Investigation/Feasibility Study (RI/FS), NewFields Northwest (NewFields) was requested to perform a suite of soil toxicity tests to aid developing soil cleanup levels for the Irondale site.

2.0 METHODS

This section summarizes the test methods that were followed for this biological characterization. Test methods followed guidance provided by the Washington State Department of Ecology and the Puget Sound Estuary Program (PSEP 1995), and the various updates presented during the Annual Sediment Management Review meetings (SMARM). Soil toxicity was evaluated using three standard bioassays, the Microtox™ Bioassay, the 14-day earthworm test and the 14-day early seedling growth test.

2.1 SAMPLE AND TEST BIOTA RECEIPT

The test soil was collected by GeoEngineers personnel on June 5 – 6, 2008. The soil samples were hand delivered by GeoEngineers personnel to the NewFields laboratory on June 6, 2008.

The earthworms *Eisinia foetida* were supplied by Aquatic Research Organisms in Hampton, New Hampshire and held in moist peat moss at 20°C prior to test initiation. Butter crunch lettuce *Lactuca sativa* seeds were obtained from Territorial Seed Company in Cottage Grove, Oregon. The plant seeds were stored dry at 4°C Celsius prior to testing.

2.2 MICROTOX® BIOASSAY

The Microtox® test was performed by Nautilus Environmental LLC. The Microtox test exposed the luminescent marine bacterium *Vibrio fischeri* to a liquid extract of the test soils. Bacterial light output was measured using the Microtox Model 500 Analyzer at 5 and 15 minutes of exposure. Light output from the test porewater was compared to that of the reference treatments at both time intervals. A complete description of the Microtox test methods is presented in Appendix A.

2.3 EARTHWORM BIOASSAY

Two 14-day earthworm bioassays were performed on soils from the Irondale site. For the first bioassay test, a soil dilution series of sample TP11 was prepared to determine a dose-response relationship between Total Petroleum Hydrocarbon (TPH) concentrations in sample TP11 and worm survival. A clean background site sample (TP23) was mixed with sample TP11 to prepare a dilution series of 100, 50, 25, 12, 6, and 3 percent. This test was initiated on June 19, 2008. A second bioassay was performed on undiluted soil samples to assess potential effects from metals detected in the soils. This test was initiated on June 23, 2008.

Test exposures were prepared with approximately 200g of soil placed in clean, acid and solvent-rinsed 300-mL glass jars. Three replicate chambers were prepared for each test treatment and the artificial control soil. All soils were hydrated with deionized laboratory water to approximately 35-45 percent moisture prior to organism addition.

Test chambers were placed in randomly assigned positions in a temperature controlled environmental space at 23°C under continuous lighting. The soil pH was measured on each treatment prior to test initiation and at test termination. Soil pH was measured by combining 25mL of soil and 25mL of deionized laboratory water and mixing thoroughly. Measurements were taken immediately upon mixing and again after approximately 30 minutes. Temperature of the environmental space was monitored daily until test termination.

The tests were initiated by randomly allocating 10 *E. foetida* into each test chamber, ensuring that each of the worms successfully buried into the soil. Worms that did not bury within approximately one hour were replaced with healthy animals. The 14-day bioassays were conducted as static tests with no feeding during the exposure period. At test termination, soil from each test chamber was wet-sieved through a 0.5-mm screen and all recovered animals transferred into a Petri dish. The number of surviving and dead worms was then determined.

2.4 PLANT BIOASSAY

Two 14-day early seedling growth bioassays were performed on soils from the Irondale site. The initial test was initiated on June 23, 2008. Due to low germination of the artificial soil control in the initial test, the soils were retested on August 8, 2008.

Test exposures were prepared with approximately 300g of soil placed in clean, 500-mL plastic cups. Three replicate chambers were prepared for each test treatment and the artificial control soil.

Test chambers were placed in randomly assigned positions in a temperature controlled environmental space at 23°C. Light was provided on a 16 hour light / 8 hour dark cycle. The targeted light quality was 100 micro-Einsteins ($\mu Em^{-2}s^{-1}$) and was measured with an Apogee™ Quantum Meter. The soil pH was measured on each treatment prior to test initiation and at test termination. Soil pH was measured by combining 25mL of soil and 25mL of deionized laboratory water and mixing thoroughly. Measurements were taken immediately upon mixing and again after approximately 30 minutes. Temperature of the environmental space was monitored daily until test termination.

The tests were initiated by allocating 20 *L. sativa seeds* into each test chamber utilizing a position template. Seeds were buried approximately 2-3 mm deep and covered with soil by gently tapping the test chamber or brushing soil over the seeds. All chambers were gently hydrated to field capacity using a spray bottle with deionized laboratory water. Hydration was maintained throughout the course of the test through twice daily application of water.

At test termination, the number of germinated seeds in each replicate was recorded. The cumulative growth (excluding roots) of all germinated plants in each replicate was then transferred to pre-weighed, aluminum foil weigh-boats. A wet weight was determined on each replicate prior to being dried a drying oven at 60°C for approximately 24 hours. Each weigh-boat was removed, cooled in a dessicator, and then weighed again for dry-weight determination. Weights were performed on an analytical microbalance to 0.01 mg.

3.0 RESULTS AND DISCUSSION

3.1 MICROTOX BIOASSAY

Results of the Microtox bioassay are shown in Table 1. Only sample TP18 exhibited a significant decrease in light transmission compared to the Control sample, however this is likely an artifact of the very dark color of the sample. The laboratory ran additional tests and determined that the dark color of the soil decreased light transmission even at the start of the test and with diluted sample (see Appendix A for complete discussion). All other samples showed light transmission between 93 and 100% of Control.

Table 1. Results of Microtox Bioassay.

Sample ID	5 Minute Results				15 Minute Results			
	P < 0.05	% of Control	SQS Hit	CSL Hit	P < 0.05	% of Control	SQS Hit	CSL Hit
TP38	No	97	No	No	Yes	95	No	No
TP06	No	99	No	No	Yes	96	No	No
TP08	No	98	No	No	Yes	94	No	No
DP01	No	100	No	No	No	99	No	No
TP42	Yes	96	No	No	Yes	93	No	No
TP40	No	100	No	No	No	101	No	No
TP22	Yes	95	No	No	No	99	No	No
TP10	No	101	No	No	No	110	No	No
TP32	No	102	No	No	No	106	No	No
TP12	No	101	No	No	No	103	No	No
TP18*	Yes	66	**Yes**	**Yes**	Yes	64	**Yes**	**Yes**
TP41	No	101	No	No	No	103	No	No
GEI SSI	No	102	No	No	No	96	No	No
TP03	No	104	No	No	No	103	No	No
TP02	No	103	No	No	No	101	No	No
*Sample had very dark color, result may be test artifact								

3.2 EARTHWORM BIOASSAY

Table 2 presents the survival results of the dilution series test on Treatment TP11 compared to Control survival and survival in a background sample TP23. Reduced survival was observed in the 50% and 100% concentrations of TP11; however, due to the variability in the three replicates the reduced survival is not statistically significant.

Table 2. Earthworm TPH Dilution Series Survival Results.

Treatment	Rep	Initial #	Final #	% Survival	Mean % Survival	Total TPH (mg/kg)
Control	1	10	9	90%	97%	17
	2	10	10	100%		
	3	10	10	100%		
TP-23 Background	1	10	8	80%	93%	11U
	2	10	10	100%		
	3	10	10	100%		
TP11 3%	1	10	10	100%	100%	215
	2	10	10	100%		
	3	10	10	100%		
TP11 6%	1	10	10	100%	100%	390
	2	10	10	100%		
	3	10	10	100%		
TP11 12%	1	10	10	100%	100%	640
	2	10	10	100%		
	3	10	10	100%		
TP11 25%	1	10	10	100%	100%	1,140
	2	10	10	100%		
	3	11	11	100%		
TP11 50%	1	10	10	100%	87%	3,900
	2	10	10	100%		
	3	10	6	60%		
TP11 100%	1	10	10	100%	77%	5,200
	2	10	3	30%		
	3	10	10	100%		

Results for the earthworm survival test on *Eisinia foetida* are provided in Table 3. Survival in the Control sample was 100%; test treatments ranged between 96.7 and 100% mean survival. Table 4 summarizes the earthworm survival compared to metal concentrations measured in the test soils.

Table 3. Earthworm Metals Survival Results.

Treatment	Replicate	Initial #	Final #	Survival %	Mean Survival %
Control	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
GEI-SS1	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP03	1	10	9	90	96.7
	2	11	11	100	
	3	10	10	100	
DP01	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP22	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP40	1	10	10	100	96.7
	2	10	9	90	
	3	10	10	100	
TP08	1	10	10	100	96.7
	2	10	9	90	
	3	10	10	100	
TP32	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP06	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP02	1	10	9	90	96.7
	2	10	10	100	
	3	10	10	100	
TP38	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP18	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	
TP41	1	10	10	100	100.0
	2	10	10	100	
	3	10	10	100	

Table 4. Earthworm Survival Results and Measured Metal Concentrations.

Treatment	Mean Survival %	Metal Concentrations (mg/kg)					
		Arsenic	Copper	Iron	Lead	Nickel	Zinc
Control	100	NA	NA	NA	NA	NA	NA
GEI-SS1	100	4.8	74	37,800	20	6	55
TP03	96.7	29.1	260	130,000	280	54	1,460
DP01	100	4.8	97.1	31,700	8	33	86
TP22	100	2.0	9.5	15,300	3	28	32
TP40	96.7	43.6	876	202,000	110	70	90
TP08	96.7	8.4	298	26,700	8	31	45
TP32	100	38.5	883	106,000	50	13	84
DP06	100	6.2	127	24,800	91	31	106
TP02	96.7	1.9	14.4	16,100	10	36	42
TP38	100	3.0	23.8	18,400	147	36	79
TP18	100	3.1	16.3	14,200	20	22	39
TP41	100	2.5	32.0	17,400	7	33	48

3.3 PLANT BIOASSAY

Results of the *Lactuca sativa* bioassay are provided in Table 5. A summary of the associated metal concentrations is provided in Table 4 above. Germination of seeds in the Control sample was 96.7%. Germination of seeds in the test treatments ranged from 53.3% to 98.3%. Growth was highest in Treatment TP18 and lowest in Treatment TP06.

Table 5. Germination and Growth of *Lactuca sativa*.

Treatment	Mean Germination (%)	Mean Wet wt. Germinated Seed (mg)	Mean Dry wt. Germinated Seed (mg)	Mean Wet wt. Initial Seed (mg)	Mean Dry wt. Initial Seed (mg)
Control	96.7	29.30	1.41	28.23	1.36
GEI-SS1	96.7	35.51	2.15	34.32	2.08
TP03	66.7	47.15	2.13	32.75	1.49
DP01	86.7	17.80	1.28	14.87	1.08
TP22	71.7	14.22	1.41	10.12	1.00
TP40	73.3	33.12	1.64	24.59	1.20
TP08	93.3	20.05	1.90	18.85	1.77
TP32	81.7	38.77	1.69	31.58	1.38
TP06	53.3	21.69	1.12	11.83	0.62
TP02	98.3	26.80	2.05	26.40	2.02
TP38	70.0	43.17	1.97	30.56	1.39
TP18	98.3	55.53	2.68	54.36	2.62
TP41	68.3	19.72	1.26	13.56	0.88

Germination and growth results for each test treatment of the *L. sativa* bioassay were compared with an ANOVA followed by a Dunnett's one-way comparison (Table 6). Prior to the ANOVA the data were tested for the assumptions of normal distribution and homogeneity of variance. Germination data were normally distributed with homogeneous variance; the ANOVA was performed on arcsine-square root transformed data. Growth data did not meet the assumptions and the ANOVA was performed on rankits data.

Treatments with germination below 72% were determined to be significantly lower than Control germination but no treatments had significantly less growth than the Control sample. Because of the difference in growth in the Control sample and several of the test treatments, a second ANOVA was run with comparisons to Treatment TP18, the treatment with the highest growth. Results of this comparison showed all treatments except TP02 and GEI-SS1 had significantly ($p \leq 0.05$) less growth than TP18.

Table 6. ANOVA Results for Germination and Growth of *Lactuca sativa*.

Treatment	Germination (%)		Statistical Comparison*		Dry Weight per Initial Seed (mg)		Statistical Comparison*	
	Mean	Std Dev	Sig < Control	Sig < TP18	Mean	Std Dev	Sig < Control	Sig < TP18
Control	96.7	2.9	--	N	1.36	0.23	--	Y
TP18	98.3	2.9	N	--	2.62	0.45	N	--
TP02	98.3	2.9	N	N	2.02	0.21	N	N
GEI-SS1	96.7	2.9	N	N	2.08	0.19	N	N
TP08	93.3	7.6	N	N	1.77	0.14	N	Y
DP01	86.7	12.6	N	N	1.08	0.19	N	Y
TP32	81.7	2.9	N	Y	1.38	0.16	N	Y
TP40	73.3	22.5	N	Y	1.20	0.36	N	Y
TP22	71.7	14.4	Y	Y	1.00	0.15	N	Y
TP38	70.0	10.0	Y	Y	1.39	0.35	N	Y
TP41	68.3	16.1	Y	Y	0.88	0.30	N	Y
TP03	66.7	15.3	Y	Y	1.49	0.97	N	Y
TP06	53.3	15.3	Y	Y	0.62	0.27	N	Y

* Germination data are normally distributed with homogeneous variance: ANOVA performed on arcsine transformed data ($p \leq 0.05$). Growth data are not normally distributed and variance is not homogeneous: ANOVA performed on rankits ($p \leq 0.05$).

Germination and growth data were compared to concentrations of six metals measured in the test samples to determine whether the metal concentrations were likely related to either germination or growth of *L. sativa*. Figure 1 shows the germination results compared to the metal concentrations. No obvious relationship between decreased germination and higher metal concentration are apparent. Growth data are compared to metal concentrations in Figure 2. There are no strong relationships among all of the test treatments; however, there is a cluster of six treatments (including the Control sample) that may be influenced by some other factor. These six (circled) have the lowest growth but also low concentrations of these metals, indicating that some unmeasured factor may be influencing the growth. Possible explanations are extremely coarse or fine size of soil, lack of nutrients, low organic carbon content.

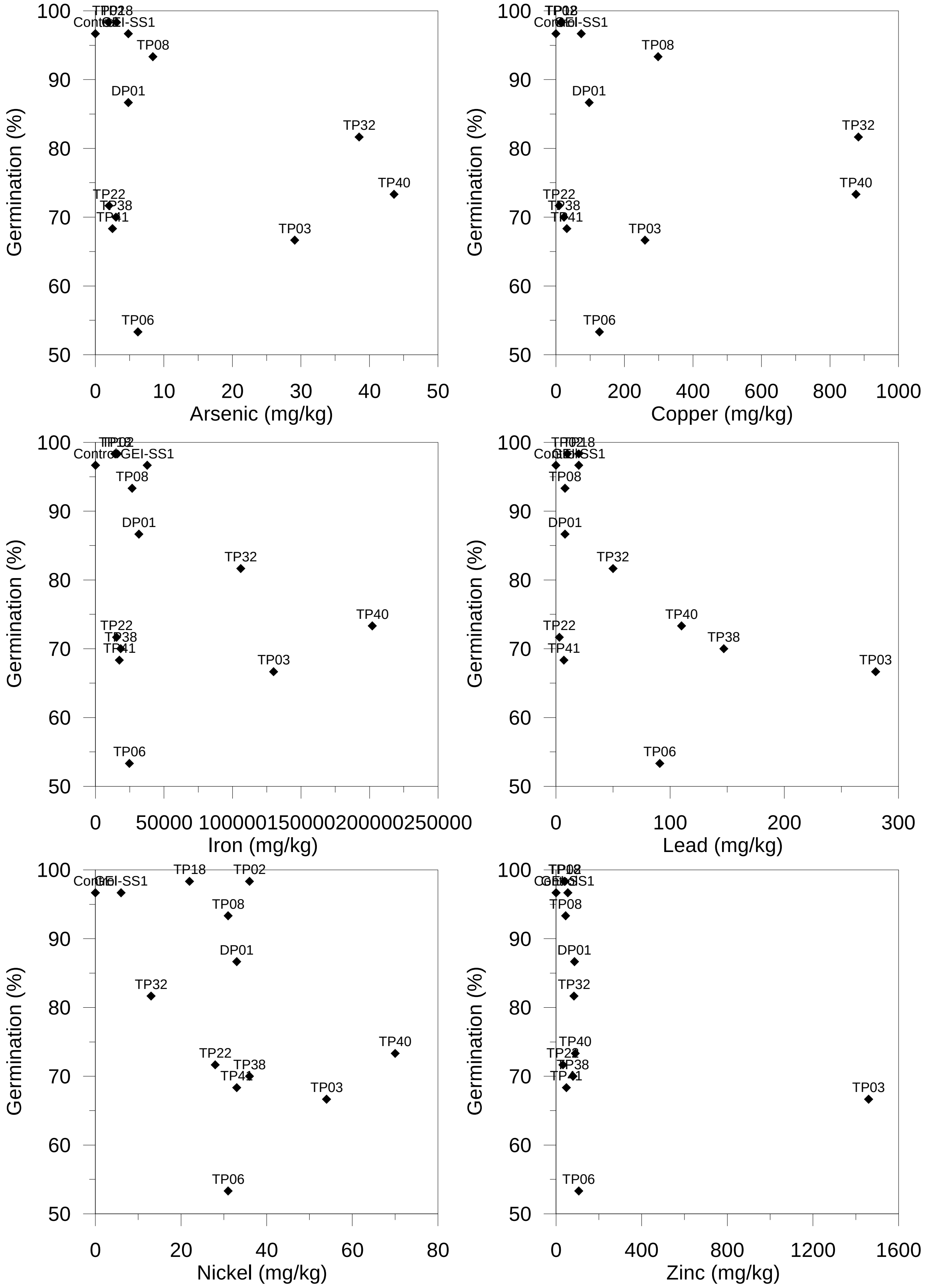

Figure 1. Relationship of *Lactuca sativa* Germination to Metal Concentrations.

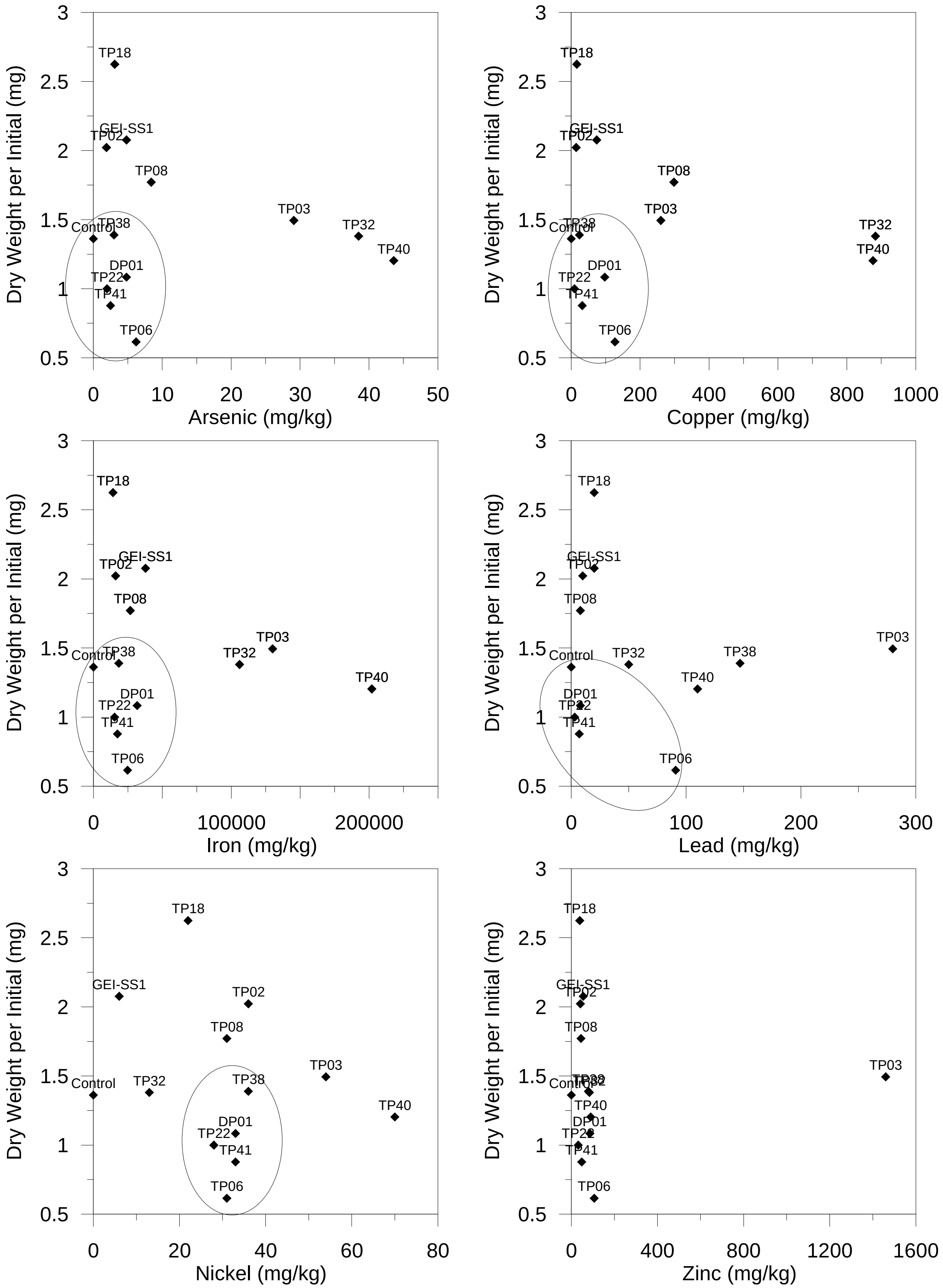

Figure 2. Relationship of *Lactuca sativa* Growth to Metal Concentrations.

4.0 CONCLUSION

The Microtox® bioassay performed on Irondale soil extracts resulted in one sample (TP18) with decreased light transmission. Further investigation by the analytical laboratory determined that this was a result of the dark coloration of the soil extract and possibly not due to a toxic effect on the luminescent bacteria. This is supported by the fact that sample TP18 exhibited high earthworm survival and the highest seed germination and growth in the plant bioassay.

No positive correlations were made between the earthworm bioassay results and TPH concentrations. While a statistically significant difference was not detected between the undiluted TPH sample TP11 (5,200 mg/kg total TPH) and the background sample, there was a slight reduction in survival from the other concentrations. Anecdotally, this may indicate the beginning of the dose-response curve at this TPH concentration. This data set indicates that 5,200 mg/kg Total TPH is the No Observed Effect Concentration (NOEC).

Earthworm survival in the soils where metals concentrations were measured ranged from 96.7 to 100 percent. These results indicate that the metal concentrations measured in the soil did not express a toxic effect on the survival of earthworms exposed for 14 days.

Only the plant bioassay exhibited any significant effects from several treatments. Statistical analyses of the plant responses and associated metal concentrations did not result in any definitive relationships. Reduced growth in several of the samples with low metal concentrations may be due to unmeasured factors, possibly particle size, lack of nutrients, low organic carbon, or unmeasured chemical constituents.

5.0 REFERENCES

Washington State Department of Ecology (WDOE). 1996. Earthworm Bioassay Protocol for Soil Toxicity Screening. WDOE Environmental Investigation and Laboratory Services Program Publication No. 96-327.

Washington State Department of Ecology (WDOE). 1996. Early Seedling Growth Protocol for Soil Toxicity Screening. WDOE Environmental Investigation and Laboratory Services Program Publication No. 96-327.

PSEP. 1995. Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments. Puget Sound Estuary Program. Puget Sound Water Quality Action Team, Olympia, Washington.

APPENDIX A

MICROTOX® REPORT

Nautilus Environmental

Toxicological Evaluation of Soil

Microtox

Report date: July 15, 2008

Submitted to:

NEWFIELDS NORTHWEST
Port Gamble, WA

Washington Laboratory
5009 Pacific Hwy East
Suite 2
Tacoma, WA 98424

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SIGNATURE PAGE

Eric Tollefson
Project Manager

Mary Ann Rempel-Hester
Laboratory Manager

This report has been prepared based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party.

1.0 INTRODUCTION

Soil samples were collected and evaluated for toxicity as part of a project being conducted by NewFields Northwest. Soil samples were tested for toxicity using Microtox tests.

2.0 METHODS

2.1 Samples

Fifteen soil subsamples were collected by NewFields personnel on June 5 and 6, 2008 and were delivered on June 10 to the Nautilus Environmental laboratory in Tacoma, WA. The condition of the sample containers were inspected upon receipt and the identities compared with the information provided on the chain-of-custody forms. The samples were stored at 4±2°C in the dark prior to test initiation.

2.2 Test Procedures

The luminescent marine bacterium *Vibrio fischeri* was used as the test organism for the Microtox test. The bacteria were exposed to deionized water that was added to and extracted from soil samples and light readings were measured after 5 minutes and 15 minutes of exposure. Test equipment included the Microtox Model 500 Analyzer, which measures light output and is equipped with a 15°C chamber to maintain test temperature in the samples and a 4°C chamber to keep the rehydrated bacteria chilled.

Vials of freeze-dried bacteria (Microtox® Acute Reagent Lot # 7k1002, Expiration date 10/09) were obtained from Strategic Diagnostics, Inc. and stored at -20°C until use. On the day of the test, a vial was rehydrated with 1.0 ml of Microtox Reconstitution Solution, mixed thoroughly, and allowed to equilibrate for 30 minutes at 4°C. The bacteria were used within 2 hours of rehydration.

The tests were conducted in accordance with WDOE (2008) test protocol with some modifications; these methods are summarized in Table 1. 90 grams of each sample was weighed and placed in a 300ml beaker. 30ml of deionized water were then added to each beaker creating a soil slurry. The soil slurry was then mixed for 24 hours in the dark at 4°C by gentle agitation (100 rpm) on a rotary shaker table. The slurry for each sample was transferred into 50-ml centrifuge tubes and spun for 30 minutes at 4500 G. Each slurry extract was adjusted to a salinity of 20 parts per thousand (ppt) with Forty Fathoms artificial seasalt. The DO in each sample was between 50 and 100 percent saturation and, as a result, the samples did not require aeration. The pH was adjusted to 7.8 to 8.2 using NaOH or HCl, if necessary. The control was deionized water adjusted to 20 ppt with artificial seasalt. Each slurry extract was tested within 3 hours of extraction.

Tests were conducted using five replicates. Disposable glass cuvettes were placed in the Microtox test wells and 1 ml of salinity adjusted slurry extract was added. The rehydrated bacteria (reagent) were thoroughly mixed and 10 µl was added to each test cuvette. After an initial incubation period of 5 minutes, the control cuvette was placed in the read chamber of the Microtox Analyzer to set the instrument. Initial light readings (I_0) were then taken by placing each cuvette in the read chamber of the Microtox Analyzer and measurements were recorded on a data sheet. Light output was measured in each cuvette after an additional 5 minutes (I_5) and 15 minutes (I_{15}) of exposure.

Test acceptability criterion was final mean control light output greater than or equal to 72% of initial control mean output, and test mean output not greater than 110% of control mean output. The data were evaluated statistically by conducting one-tailed t-tests on the change in output over time for soil extracts compared to the control. Comparison to the control is preferred, according to WDOE (2008).

A reference toxicant test using phenol was conducted in conjunction with the soil tests to ensure that the sensitivity of the test was within the acceptable range of historical values determined in this laboratory.

Table 1. Summary of methods for the Microtox test.

Test date	June 12, 2008
Test organism source	Strategic Diagnostics
Batch number and expiration date	Lot#7k1002, Expiry 10/09
Control	Saltwater (20 ppt) prepared with Forty Fathoms Sea Salts
Sample preparation	24-hour extraction with deionized water; centrifugation at 4500 G for 30 minutes; salinity adjustment to 20 ppt using Forty Fathoms Sea Salts; pH adjustment to 7.8-8.2 ppt
Test chamber	Glass cuvette
Test volume	1 mL
Volume of inoculum/replicate	10 µL
Number of replicates/sample	5
Test temperature	15 ± 1°C
Aeration	None
Reference toxicant	Phenol

3.0 RESULTS

The results of toxicity tests conducted using Microtox are provided in Tables 2 and 3.

Table 2. Results of Microtox tests showing change in light output of samples as a percentage of change in light output of control after 5 and 15 minute of exposure.

Sample	Change in light output as a % of Control (5 minutes)	Change in light output as a % of Control (15 minutes)
TP38	97	95
TP06	99	96
TP08	98	94
DP01	100	99
TP42	96	93
TP40	100	101
TP22	95	99
TP10	101	110
TP32	102	106
TP12	101	103
TP18	66	64
TP41	101	103
GEI SS1	102	96
TP03	104	103
TP02	103	101

Table 3. Statistical analyses of Microtox results. Shaded data indicates > 10% difference and statistically significant difference ($p<0.05$) relative to the control

Sample	5-minute reading		15 minute reading	
	Mean % change in light output	p-values	Mean % change in light output	p-values
Test1				
Control	93 ± 2	---	87 ± 1	---
TP38	91 ± 2	0.07	82 ± 2	<0.01
TP06	92 ± 2	0.19	83 ± 2	0.01
TP08	91 ± 2	0.11	82 ± 3	0.01
DP01	93 ± 3	0.42	86 ± 1	0.07
TP42	90 ± 2	0.03	81 ± 3	0.01
Test 2				
Control	94 ± 3	---	85 ± 2	---
TP40	94 ± 2	0.49	87 ± 3	NA
TP22	90 ± 2	0.01	84 ± 5	0.37
TP10	95 ± 2	NA	94 ± 2	NA
TP32	96 ± 5	NA	90 ± 8	NA
TP12	95 ± 3	NA	88 ± 5	NA
Test 3				
Control	96 ± 3	---	88 ± 5	---
TP18[1]	63 ± 5	<0.01	56 ± 4	<0.01
TP41	97 ± 3	NA	91 ± 4	NA
GEI SS1	98 ± 3	NA	85 ± 2	0.09
TP03	101 ± 2	NA	91 ± 2	NA
TP02	99 ± 4	NA	89 ± 4	NA

NA - Not applicable, test results greater than control results. [1]See discussion

3.1 QA/QC

The Microtox tests met control acceptance criteria and there were no deviations from protocol.

Results of reference toxicant test conducted in conjunction with this testing program are provided in Table 4. The results of this test fell within the range of mean ± two standard deviations of historical results for *Vibrio fischeri*, indicating that the sensitivity of the test organisms was appropriate.

Table 4. Reference toxicant test results.

Exposure Duration	Test date	Toxicant	EC50	Acceptable Range	CV (%)
5 Minutes	June 12, 2008	Phenol	28.2 mg/L	23.2-39.8	13.1
15 Minutes			38.0 mg/L	26.1-45.9	13.7

4.0 DISCUSSION

The only sample that showed an effect was TP18. TP18 was also the only sample that had an initial light output (I_0) less than 80% of the control initial light output. WDOE (2008) guidelines for microtox analysis state that samples with I_0 values less than 80% of control should be compared against control I_0 values for determination of decrease in light output at five (I_5) and 15 (I_{15}) minutes. Otherwise the sample I_0 value is used instead of the control I_0 value. In compliance with this guideline only TP18 used the control I_0 value for determination of light output decrease, all other samples used the sample I_0 value.

The initial light output (I_0) is taken after the bacteria has been exposed to the sample for five minutes. The guideline stated above is believed to have been established to catch any toxicity that may have occurred during the first five minutes of exposure, which could have led to a decrease in light output by time zero. However interferences such as dark coloration of sample may also lead to a decrease in I_0 not related to toxicity. TP18 was much darker than any of the other extracts, even after all of the suspended particulates were removed by centrifugation. To determine if the dark coloration caused an interference, TP18 was rerun at four concentrations (100%, 75%, 50%, and 25%) along with all of the other samples (100% only) and the control. Instead of taking the initial reading (I_0) five minutes after the bacteria was added the initial readings were taken immediately after the bacteria was added. The exercise should demonstrate if the sample had a toxic effect in the first five minutes or if it was really the color of the sample that caused the lower light levels. The results are in Table 5 below. The lowest light readings were from the TP18 samples, with light output increasing with a decrease in the percentage of TP18. This appears to demonstrate that the coloration of the sample caused the lower light output.

Table 5. **Light output immediately after adding bacteria.**

Sample	Light Reading
Control	91
TP18 100%	38
TP18 75%	41
TP18 50%	44
TP18 25%	56
TP41	65
TP02	80
TP22	82
GEI SS1	85
DP01	75
TP06	70
TP10	85
TP40	66
TP32	86
TP03	81
TP42	76
TP08	87
TP38	81
TP12	77

If the I_5 and I_{15} values for sample TP18 are compared against the sample I_0 and not the control I_0, the results are not significantly different from control, nor are they greater than 10 percent lower than the control (Table 6). The laboratory believes that the decrease in light output for sample TP18 is due to interference, and not toxicity. Therefore sample TP18 should not be designated as above sediment quality standards.

Table 6. **Statistical analysis of sample TP18 normalized to sample I_0.**

	5-minute reading		15 minute reading	
Sample	Mean % change in light output	p-values	Mean % change in light output	p-values
Control	96 ± 3	---	88 ± 5	---
TP18	97 ± 3	0.30	87 ± 3	0.27

5.0 REFERENCES

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U.S. Environmental Protection Agency (USEPA). 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-99/064.

Washington Department of Ecology (WDOE). 2008. Sediment Sampling and Analysis Plan Appendix: Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards Publication No. 03-09-043. Revised February 2008.

Appendix Table A. Microtox 100 Percent Sediment Porewater Test
Sites TP38, TP06, TP08, DP01, TP42
NewFields Northwest
Test Date: June 12, 2008

Site	Light Reading									Quality Control Steps	
	Replicate								$T_{(mean)}$/ $C_{(mean)}$	Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.		$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
Control	$I_{(0)}$	91	82	85	83	85	85				
	$I_{(5)}$	86	74	82	78	78	80			0.93	
	$I_{(15)}$	78	73	74	72	74	74			0.87	
	$C_{(5)}$	0.95	0.90	0.96	0.94	0.92	0.93	0.02			
	$C_{(15)}$	0.86	0.89	0.87	0.87	0.87	0.87	0.01			
TP38	$I_{(0)}$	78	89	82	80	83	82				0.97
	$I_{(5)}$	73	81	72	73	76	75				
	$I_{(15)}$	67	72	67	66	67	68				
	$T_{(5)}$	0.94	0.91	0.88	0.91	0.92	0.91	0.02	0.97		
	$T_{(15)}$	0.86	0.81	0.82	0.83	0.81	0.82	0.02	0.95		
TP06	$I_{(0)}$	82	81	77	83	81	81				0.95
	$I_{(5)}$	76	73	73	75	75	74				
	$I_{(15)}$	70	68	65	66	68	67				
	$T_{(5)}$	0.93	0.90	0.95	0.90	0.93	0.92	0.02	0.99		
	$T_{(15)}$	0.85	0.84	0.84	0.80	0.84	0.83	0.02	0.96		
TP08	$I_{(0)}$	69	78	71	74	77	74				0.87
	$I_{(5)}$	62	70	66	66	73	67				
	$I_{(15)}$	58	60	59	60	66	61				
	$T_{(5)}$	0.90	0.90	0.93	0.89	0.95	0.91	0.02	0.98		
	$T_{(15)}$	0.84	0.77	0.83	0.81	0.86	0.82	0.03	0.94		
DP01	$I_{(0)}$	82	85	80	85	89	84				0.99
	$I_{(5)}$	78	78	73	77	86	78				
	$I_{(15)}$	71	74	69	72	76	72				
	$T_{(5)}$	0.95	0.92	0.91	0.91	0.97	0.93	0.03	1.00		
	$T_{(15)}$	0.87	0.87	0.86	0.85	0.85	0.86	0.01	0.99		
TP42	$I_{(0)}$	80	82	84	80	78	81				0.95
	$I_{(5)}$	71	76	73	73	71	73				
	$I_{(15)}$	64	67	64	65	67	65				
	$T_{(5)}$	0.89	0.93	0.87	0.91	0.91	0.90	0.02	0.96		
	$T_{(15)}$	0.80	0.82	0.76	0.81	0.86	0.81	0.03	0.93		

$I_{(0)}$ is the light reading after the initial five minute incubation period
$I_{(5)}$ is the light reading five minutes after $I_{(0)}$
$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$
$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	93%	YES
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	87%	YES

YES: Control results are acceptable and can be used for statistical analyses.
NO: Control results are unacceptable (retest required because there is no reference sediment to use instead of control).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	97%	YES
S2	$I_{T(mean)}/I_{C(mean)}$:	95%	YES
S3	$I_{T(mean)}/I_{C(mean)}$:	87%	YES
S4	$I_{T(mean)}/I_{C(mean)}$:	99%	YES
S5	$I_{T(mean)}/I_{C(mean)}$:	95%	YES

YES: Use initial site values to calculate change in final light readings
NO: Use control initial mean value to calculate change in final light readings for each site.

Appendix Table B. Microtox 100 Percent Sediment Porewater Test
Sites TP40, TP22, TP10, TP32, TP12
NewFields Northwest
Test Date: June 12, 2008

Site	Light Reading								$T_{(mean)}/C_{(mean)}$	Quality Control Steps	
	Reading	Replicate 1	2	3	4	5	Mean	St.Dev.		Change in control light readings compared to initial control $F_{c(mean)}/I_{c(mean)}$	Evaluation of initial light output in site sediments $I_{(0)T(mean)}/I_{(0)C(mean)}$
Control	$I_{(0)}$	**92**	**78**	**88**	**97**	**94**	90				
	$I_{(5)}$	**88**	**74**	**80**	**94**	**86**	84			0.94	
	$I_{(15)}$	**78**	**67**	**74**	**85**	**79**	77			0.85	
	$C_{(5)}$	0.96	0.95	0.91	0.97	0.91	0.94	0.03			
	$C_{(15)}$	0.85	0.86	0.84	0.88	0.84	0.85	0.02			
TP40	$I_{(0)}$	**95**	**89**	**88**	**85**	**90**	89				1.00
	$I_{(5)}$	**88**	**83**	**86**	**80**	**83**	84				
	$I_{(15)}$	**83**	**76**	**80**	**72**	**76**	77				
	$T_{(5)}$	0.93	0.93	0.98	0.94	0.92	0.94	0.02	1.00		
	$T_{(15)}$	0.87	0.85	0.91	0.85	0.84	0.87	0.03	1.01		
TP22	$I_{(0)}$	**91**	**90**	**88**	**84**	**92**	89				0.99
	$I_{(5)}$	**81**	**82**	**76**	**78**	**82**	80				
	$I_{(15)}$	**78**	**80**	**67**	**72**	**79**	75				
	$T_{(5)}$	0.89	0.91	0.86	0.93	0.89	0.90	0.02	0.95		
	$T_{(15)}$	0.86	0.89	0.76	0.86	0.86	0.84	0.05	0.99		
TP10	$I_{(0)}$	**86**	**98**	**96**	**95**	**92**	93				1.04
	$I_{(5)}$	**84**	**90**	**92**	**91**	**87**	89				
	$I_{(15)}$	**81**	**95**	**89**	**89**	**84**	88				
	$T_{(5)}$	0.98	0.92	0.96	0.96	0.95	0.95	0.02	1.01		
	$T_{(15)}$	0.94	0.97	0.93	0.94	0.91	0.94	0.02	1.10		
TP32	$I_{(0)}$	**84**	**86**	**92**	**86**	**87**	87				0.97
	$I_{(5)}$	**84**	**87**	**81**	**82**	**81**	83				
	$I_{(15)}$	**81**	**86**	**76**	**75**	**74**	78				
	$T_{(5)}$	1.00	1.01	0.88	0.95	0.93	0.96	0.05	1.02		
	$T_{(15)}$	0.96	1.00	0.83	0.87	0.85	0.90	0.08	1.06		
TP12	$I_{(0)}$	**84**	**86**	**82**	**81**	**87**	84				0.94
	$I_{(5)}$	**76**	**81**	**82**	**77**	**81**	79				
	$I_{(15)}$	**71**	**77**	**78**	**69**	**73**	74				
	$T_{(5)}$	0.90	0.94	1.00	0.95	0.93	0.95	0.03	1.01		
	$T_{(15)}$	0.85	0.90	0.95	0.85	0.84	0.88	0.05	1.03		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	**94%**	**YES**
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	**85%**	**YES**

YES: Control results are acceptable and can be used for statistical analyses.
NO: Control results are unacceptable (retest required because there is no reference sediment to use instead of control).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	**100%**	**YES**
S2	$I_{T(mean)}/I_{C(mean)}$:	**99%**	**YES**
S3	$I_{T(mean)}/I_{C(mean)}$:	**104%**	**YES**
S4	$I_{T(mean)}/I_{C(mean)}$:	**97%**	**YES**
S5	$I_{T(mean)}/I_{C(mean)}$:	**94%**	**YES**

YES: Use initial site values to calculate change in final light readings
NO: Use control initial mean value to calculate change in final light readings for each site.

Appendix Table C. Microtox 100 Percent Sediment Porewater Test
Sites TP18, TP41, GEI SSI, TP03, TP02
NewFields Northwest
Test Date: June 12, 2008

Site	Light Reading								$T_{(mean)}/C_{(mean)}$	Quality Control Steps	
		Replicate								Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.		$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
Control	$I_{(0)}$	92	86	90	87	101	91				
	$I_{(5)}$	90	85	85	86	92	88			0.96	
	$I_{(15)}$	83	75	85	75	83	80			0.88	
	$C_{(5)}$	0.98	0.99	0.94	0.99	0.91	0.96	0.03			
	$C_{(15)}$	0.90	0.87	0.94	0.86	0.82	0.88	0.05			
TP18	$I_{(0)}$	60	53	59	66	58	59				0.65
	$I_{(5)}$	56	53	56	64	59	58				
	$I_{(15)}$	52	48	49	58	49	51				
	$T_{(5)}$	0.61	0.58	0.61	0.70	0.65	0.63	0.05	0.66		
	$T_{(15)}$	0.57	0.53	0.54	0.64	0.54	0.56	0.04	0.64		
TP41	$I_{(0)}$	81	73	76	72	81	77				0.84
	$I_{(5)}$	80	73	72	72	76	75				
	$I_{(15)}$	72	70	71	65	70	70				
	$T_{(5)}$	0.99	1.00	0.95	1.00	0.94	0.97	0.03	1.01		
	$T_{(15)}$	0.89	0.96	0.93	0.90	0.86	0.91	0.04	1.03		
GEI SSI	$I_{(0)}$	84	87	82	88	85	85				0.93
	$I_{(5)}$	80	87	83	85	82	83				
	$I_{(15)}$	72	74	72	72	70	72				
	$T_{(5)}$	0.95	1.00	1.01	0.97	0.96	0.98	0.03	1.02		
	$T_{(15)}$	0.86	0.85	0.88	0.82	0.82	0.85	0.02	0.96		
TP03	$I_{(0)}$	81	80	81	82	80	81				0.89
	$I_{(5)}$	80	81	82	81	82	81				
	$I_{(15)}$	74	74	75	71	73	73				
	$T_{(5)}$	0.99	1.01	1.01	0.99	1.03	1.01	0.02	1.04		
	$T_{(15)}$	0.91	0.93	0.93	0.87	0.91	0.91	0.02	1.03		
TP02	$I_{(0)}$	85	82	88	85	82	84				0.93
	$I_{(5)}$	85	85	82	84	81	83				
	$I_{(15)}$	76	74	72	79	75	75				
	$T_{(5)}$	1.00	1.04	0.93	0.99	0.99	0.99	0.04	1.03		
	$T_{(15)}$	0.89	0.90	0.82	0.93	0.91	0.89	0.04	1.01		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	96%	YES
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	88%	YES

YES: Control results are acceptable and can be used for statistical analyses.
NO: Control results are unacceptable (retest required because there is no reference sediment to use instead of control).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	65%	NO
S2	$I_{T(mean)}/I_{C(mean)}$:	84%	YES
S3	$I_{T(mean)}/I_{C(mean)}$:	93%	YES
S4	$I_{T(mean)}/I_{C(mean)}$:	89%	YES
S5	$I_{T(mean)}/I_{C(mean)}$:	93%	YES

YES: Use initial site values to calculate change in final light readings
NO: Use control initial mean value to calculate change in final light readings for each site.

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields **Test Date:** 6/12/08

Sample ID: TP38, TP06, TP08, DP01, TP42 **Test No.:** 0806-T082, T075, T076, T071, T08

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	$I_{(0)}$	5 min	91	82	85	83	85
	$I_{(5)}$	10min	86	74	82	78	78
	$I_{(15)}$	20 min	78	73	74	72	74
TP 38	$I_{(0)}$	5 min	78	89	82	80	83
	$I_{(5)}$	10min	73	81	72	73	76
	$I_{(15)}$	20 min	67	72	67	66	67
TP06	$I_{(0)}$	5 min	82	81	77	83	81
	$I_{(5)}$	10min	76	73	73	75	75
	$I_{(15)}$	20 min	70	68	65	66	68
TP08	$I_{(0)}$	5 min	69	78	71	74	77
	$I_{(5)}$	10min	62	70	66	66	73
	$I_{(15)}$	20 min	58	60	59	60	66
DP01	$I_{(0)}$	5 min	82	85	80	85	89
	$I_{(5)}$	10min	78	78	73	77	86
	$I_{(15)}$	20 min	71	74	69	72	76
TP42	$I_{(0)}$	5 min	80	82	84	80	78
	$I_{(5)}$	10min	71	76	73	73	71
	$I_{(15)}$	20 min	64	67	64	65	67

Comments:

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Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields **Test Date:** 6/12/08

Sample ID: TP40, TP22, TP10, TP32, TP12 **Test No.:** 0806-T083, T080, T077, T081, T078

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	$I_{(0)}$	5 min	92	78	88	97	94
	$I_{(5)}$	10min	88	74	80	94	86
	$I_{(15)}$	20 min	78	67	74	85	79
TP40	$I_{(0)}$	5 min	95	89	88	85	90
	$I_{(5)}$	10min	88	83	86	80	83
	$I_{(15)}$	20 min	83	76	80	72	76
TP22	$I_{(0)}$	5 min	91	90	88	84	92
	$I_{(5)}$	10min	81	82	76	78	82
	$I_{(15)}$	20 min	78	80	67	72	79
TP10	$I_{(0)}$	5 min	86	98	96	95	92
	$I_{(5)}$	10min	84	90	92	91	87
	$I_{(15)}$	20 min	81	95	89	89	84
TP32	$I_{(0)}$	5 min	84	86	92	86	87
	$I_{(5)}$	10min	84	87	81	82	81
	$I_{(15)}$	20 min	81	86	76	75	74
TP12	$I_{(0)}$	5 min	84	86	82	81	87
	$I_{(5)}$	10min	76	81	82	77	81
	$I_{(15)}$	20 min	71	77	78	69	73

Comments:

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Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields **Test Date:** 6/12/08

Sample ID: TP18, TP41, GEISSI, TP03, TP02 **Test No.:** 0806-T079, T084, T072, T074, T073

Site	Light Reading	Time	Replicate 1	2	3	4	5
CON	$I_{(0)}$	5 min	92	86	90	87	101
	$I_{(5)}$	10min	90	85	85	86	92
	$I_{(15)}$	20 min	83	75	85	75	83
TP18	$I_{(0)}$	5 min	60	53	59	66	58
	$I_{(5)}$	10min	56	53	56	64	59
	$I_{(15)}$	20 min	52	48	49	58	49
TP41	$I_{(0)}$	5 min	81	73	76	72	81
	$I_{(5)}$	10min	80	73	72	72	76
	$I_{(15)}$	20 min	72	70	71	65	70
GEI SS1	$I_{(0)}$	5 min	84	87	82	88	85
	$I_{(5)}$	10min	80	87	83	85	82
	$I_{(15)}$	20 min	72	74	72	72	70
TP03	$I_{(0)}$	5 min	81	80	81	82	80
	$I_{(5)}$	10min	80	81	82	81	82
	$I_{(15)}$	20 min	74	74	75	71	73
TP02	$I_{(0)}$	5 min	85	82	88	85	82
	$I_{(5)}$	10min	85	85	82	84	81
	$I_{(15)}$	20 min	76	74	72	79	75

Comments:

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Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields **Test Date:** 6/30/08

Sample ID: TP18, TP41, TP02, TP22, GEISSI, DP01, TP06, TP10, TP40, TP32, TP03, TP42, TP08, TP38, TP12 **Test No.:** N/A

Measurement of light readings at inoculation time to determine interference

Site	Light Reading	Time	Replicate				
			CON ~~1~~	TP18 100% ~~2~~	TP18 75% ~~3~~	TP18 50% ~~4~~	TP18 25% ~~5~~
	$I_{(0)}$	0 ~~5~~ min	91	38	41	44	56
	$I_{(5)}$	5 ~~10~~min	180	78	88	90	119
	$I_{(15)}$	20 min					
			TP41	TP02	TP22	GEISSI	DP01
	$I_{(0)}$	0 ~~5~~ min	65	80	82	85	75
	$I_{(5)}$	5 ~~10~~min	145	152	165	161	143
	$I_{(15)}$	20 min					
			TP06	TP10	TP40	TP32	TP03
	$I_{(0)}$	0 ~~5~~ min	70	85	66	86	81
	$I_{(5)}$	5 ~~10~~min	161	162	140	158	150
	$I_{(15)}$	20 min					
			TP42	TP08	TP38	TP12	
	$I_{(0)}$	0 ~~5~~ min	76	87	81	77	
	$I_{(5)}$	5 ~~10~~min	151	145	138	135	
	$I_{(15)}$	20 min					
	$I_{(0)}$	0 ~~5~~ min					
	$I_{(5)}$	5 ~~10~~min					
	$I_{(15)}$	20 min					
	$I_{(0)}$	5 min					
	$I_{(5)}$	10min					
	$I_{(15)}$	20 min					

Comments: ____________________

APPENDIX C – Water Quality Results

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: et

Client : Newfields

Test Date: 6/12/08

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 0806-T072, T071, T074, T073, T078, T075

Test Species: *Vibrio fischeri*

	Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
25.0ML clear	CON	0.0	20.1	6.8	6.8	8.14				<1.0
10.0ML clear	GEI SS1	0.0	19.6	7.0	7.0	8.10				<1.0
19.3ML clear	DP01	0.0	19.5	7.1	7.1	7.59	8.06	50µL 0.1N NaOH		<1.0
13.2ML some color	TP03	0.0	19.7	6.7	6.7	8.09				<1.0
13.9ML some color	TP02	0.0	20.8	6.9	6.9	7.99				<1.0
16.8ML some color	TP12	0.0	20.3	7.1	7.1	8.10				<1.0
14.8ML color	TP06	0.0	19.6	7.0	7.0	8.10				<1.0

Sample Description: ______________________

Comments: ______________________

QA Check: ______________________

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Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: Et

Client : Newfields

Test Date: 6/12/09

Test Type: **Microtox 100% Porewater Toxicity Test**

Test No: 0806-T076, T081, T084, T079, T082, T083

Test Species: ***Vibrio fischeri***

	Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
20ML color	TP08	0.0	19.1	6.5	6.5	8.19				<1.0
15.4ML color	TP42	0.0	20.1	6.9	6.9	8.00				<1.0
18.7ML color	TP32	0.0	20.8	7.1	7.1	8.00				<1.0
13.9ML color	TP41	0.0	20.8	6.8	6.8	8.02				<1.0
8.3ML Dark color	TP18	0.0	20.7	6.8	6.8	7.81	8.04	10µL 0.1N NaOH		<1.0
21.4ML cloudy	TP38	0.0	20.1	7.0	7.0	7.48	8.20	50µL 0.1N NaOH		<1.0
21.8ML cloudy	TP40	0.0	20.5	6.4	6.4	8.12				<1.0

Sample Description: ______________________

Comments: ______________________

QA Check: ______________________

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: gt

Client : Newfields

Test Date: 6/12/08

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 0806-T080, T077

Test Species: *Vibrio fischeri*

220ML cloudy
19.2ML cloudy

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
TP22	0.0	19.8	6.7	6.7	8.01				<1.0
TP10	0.0	20.9	6.5	6.5	7.90				<1.0

Sample Description: ______

Comments: ______

QA Check: ______

Water Quality Results - Total Ammonia
Nautilus Environmental Northwest Laboratory

Client/Site ID: Newfields
Test Type: Soil Microtox

DI Blank: 0.0 **Seawater Blank:** ______

Sample ID	Sample Date	Test Day	pH (units)	Salinity (ppt)	Analysis Date	Nitrogen (mg/L)	N x 1.22 Ammonia (mg/L)
Blank Spike (10 mg/L NH3)	NA	NA	NA	NA			11.9
TP06							<1.0
TP42							<1.0
TP10							<1.0
DP01							<1.0
TP12							<1.0
TP08							<1.0
TP32							<1.0
TP03							<1.0
TP38							<1.0 (0.4)
TP38 DUP							<1.0 (0.3)
TP38 Spike							~~[illegible]~~ 12.1
TP02							<1.0
Spike Check (10 mg/L NH3)	NA	NA	NA	NA			11.8
TP22							<1.0
TP40							<1.0
TP41							<1.0
GEI SS1							<1.0 ~~(0.6)~~
TP18							<1.0 (0.9)
TP18 DUP							<1.0 (0.9)
TP18 Spike							13.5
CON							<1.0
Spike Check (10 mg/L NH3)	NA	NA	NA	NA			

Relative Percent Difference (RPD) = Sample (mg/L) - sample duplicate (mg/L) x 100
average (mg/L)

% Recovery = Spiked sample (mg/L) - sample (mg/L) x 100
spike conc'n (mg/L)

Sample I.D.	NH_3 (mg/L)	Sample Dup	Spike (mg/L)	RPD	% Recovery
Blank	0.0	NA	11.9	NA	97.5
TP38	0.4	0.3	12.1	28.5	96.7
TP18	0.9	0.9	13.5	0.0	103.3

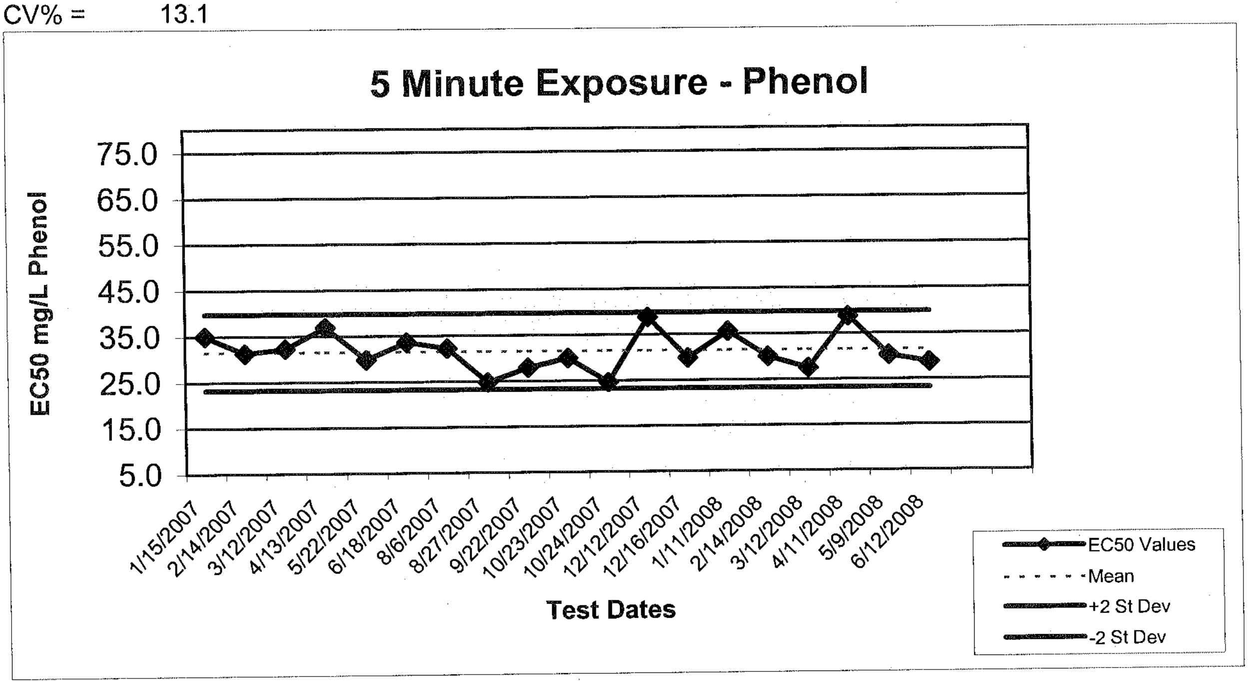
Nautilus Northwest Laboratory - 5009 Pacific Hwy. E., Suite 2 Tacoma, WA 98424

Comments: ______
QA Review/Date:

APPENDIX D – Reference Toxicant Tests

Reference Toxicant Control Chart
Microtox 5-Minute Exposure

CV% = 13.1

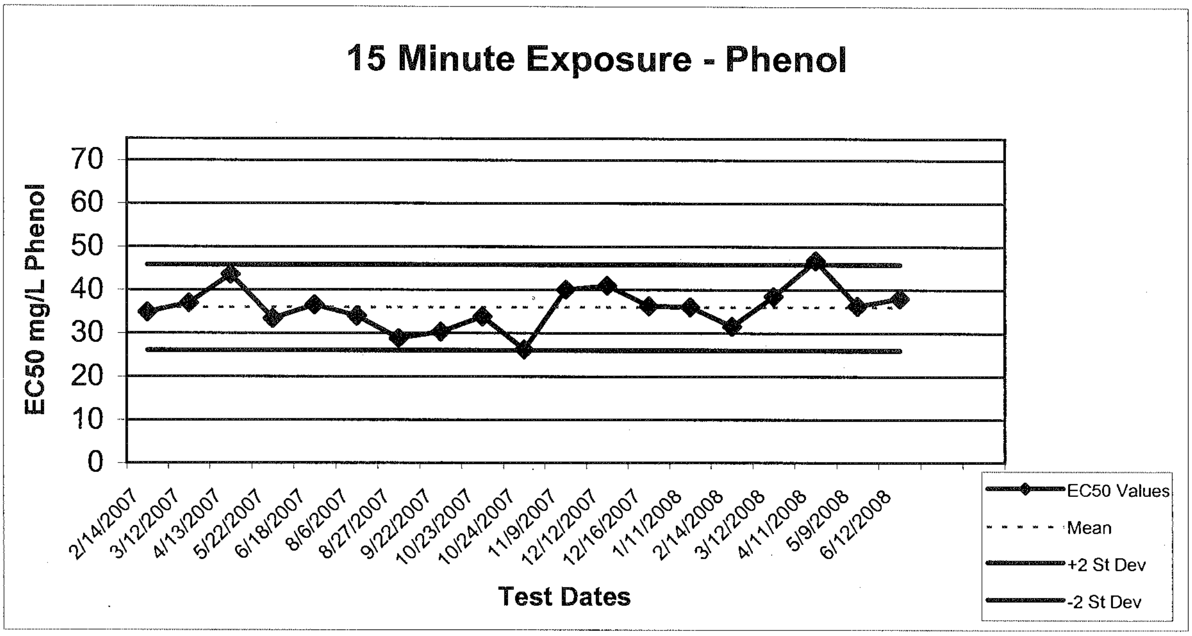


Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
1/15/2007	1322	34.3	35.0	31.5	4.1	23.2	39.8
2/14/2007	930	30.7	31.3	31.5	4.1	23.2	39.8
3/12/2007	952	31.7	32.3	31.5	4.1	23.2	39.8
4/13/2007	1329	36.2	36.9	31.5	4.1	23.2	39.8
5/22/2007	1053	29.3	29.9	31.5	4.1	23.2	39.8
6/18/2007	1338	33.0	33.7	31.5	4.1	23.2	39.8
8/6/2007	1252	31.6	32.2	31.5	4.1	23.2	39.8
8/27/2007	1257	24.3	24.8	31.5	4.1	23.2	39.8
9/22/2007	1044	27.4	27.9	31.5	4.1	23.2	39.8
10/23/2007	830	29.4	30.0	31.5	4.1	23.2	39.8
10/24/2007	1114	24.2	24.7	31.5	4.1	23.2	39.8
12/12/2007	1316	38.0	38.8	31.5	4.1	23.2	39.8
12/16/2007	1140	29.3	29.9	31.5	4.1	23.2	39.8
1/11/2008	1015	34.9	35.6	31.5	4.1	23.2	39.8
2/14/2008	1239	29.5	30.1	31.5	4.1	23.2	39.8
3/12/2008	1245	27.0	27.6	31.5	4.1	23.2	39.8
4/11/2008	928	38.0	38.8	31.5	4.1	23.2	39.8
5/9/2008	1002	29.7	30.3	31.5	4.1	23.2	39.8
6/12/2008	1314	28.2	28.8	31.5	4.1	23.2	39.8

a - Highest concentration of Phenol is 102 mg/L

Reference Toxicant Control Chart
Microtox 15-Minute Exposure

CV% = 13.7



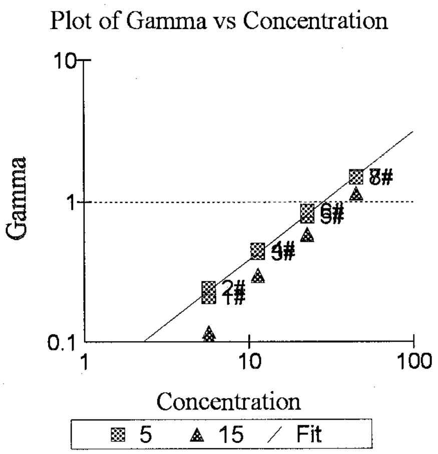
Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
2/14/2007	930	34.2	34.9	36.0	4.9	26.1	45.9
3/12/2007	952	36.3	37.0	36.0	4.9	26.1	45.9
4/13/2007	1329	42.8	43.7	36.0	4.9	26.1	45.9
5/22/2007	1053	32.8	33.5	36.0	4.9	26.1	45.9
6/18/2007	1338	35.9	36.6	36.0	4.9	26.1	45.9
8/6/2007	1252	33.4	34.1	36.0	4.9	26.1	45.9
8/27/2007	1257	28.3	28.9	36.0	4.9	26.1	45.9
9/22/2007	1044	29.8	30.4	36.0	4.9	26.1	45.9
10/23/2007	830	33.2	33.9	36.0	4.9	26.1	45.9
10/24/2007	1114	25.8	26.3	36.0	4.9	26.1	45.9
11/9/2007	1337	39.3	40.1	36.0	4.9	26.1	45.9
12/12/2007	1316	40.2	41.0	36.0	4.9	26.1	45.9
12/16/2007	1140	35.6	36.3	36.0	4.9	26.1	45.9
1/11/2008	1015	35.4	36.1	36.0	4.9	26.1	45.9
2/14/2008	1239	31.0	31.6	36.0	4.9	26.1	45.9
3/12/2008	1245	37.7	38.5	36.0	4.9	26.1	45.9
4/11/2008	928	45.9	46.8	36.0	4.9	26.1	45.9
5/9/2008	1002	35.6	36.3	36.0	4.9	26.1	45.9
6/12/2008	1314	37.3	38.0	36.0	4.9	26.1	45.9

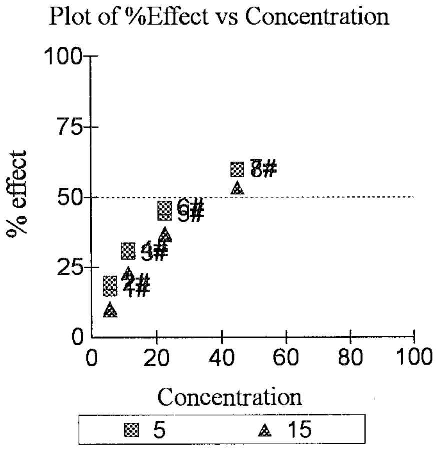
a - Highest concentration of Phenol is 102 mg/L

MicrotoxOmni Test Report

Date: 06/12/2008 01:14 PM

Test Protocol: Basic Test
Sample: 102mg/L Penol
Toxicant: 102mg/L Phenol
Reagent Lot no.: 7k1002
Test description: Reference Toxicant
Test name: RT061208VF
Database file: \\Fif-ws3\alldata\Karen\Microtox\MicrotoxOmni\Edge Analytical.mdb


Plot of Gamma vs Concentration


Plot of %Effect vs Concentration

			5 Mins Data:			15 Mins Data:		
Sample	Conc	Io	It	Gamma	% effect	It	Gamma	% effect
Control	0.000	98.62	116.34	1.180 #		96.89	0.9825 #	
Control	0.000	83.41	99.73	1.196 #		82.13	0.9847 #	
1	5.625	88.53	86.99	0.2087 #	17.27%	77.87	0.1182 #	10.57%
2	5.625	95.84	91.60	0.2426 #	19.53%	85.05	0.1083 #	9.775%
3	11.25	95.81	79.41	0.4330 #	30.21%	72.81	0.2943 #	22.74%
4	11.25	86.50	70.40	0.4593 #	31.47%	65.32	0.3025 #	23.22%
5	22.50	89.23	59.21	0.7898 #	44.13%	55.65	0.5770 #	36.59%
6	22.50	87.71	56.01	0.8599 #	46.23%	54.10	0.5946 #	37.29%
7	45.00	91.22	43.15	1.511 #	60.17%	41.89	1.142 #	53.31%
8	45.00	93.11	44.47	1.487 #	59.79%	42.63	1.148 #	53.45%

- used in calculation; * - invalid data; D - deleted from calcs.

Calculations on 5 Mins data:
EC50 Concentration:28.16% (95% confidence range: 26.27 to 30.19)
95% Confidence Factor: 1.072
Estimating Equation:LOG C =1.094 x LOG G +1.450
Coeff. of Determination (R^2):0.9948
Slope: 0.9093
Correction Factor: 1.188

Calculations on 15 Mins data:
EC50 Concentration:37.34% (95% confidence range: 33.30 to 41.88)
95% Confidence Factor: 1.122
Estimating Equation:LOG C =0.9009 x LOG G +1.572
Coeff. of Determination (R^2):0.9901
Slope: 1.099
Correction Factor: 0.9836

APPENDIX E – Chain-of Custody Forms

NEWFIELDS

NewFields Northwest, LLC.
Shipping: 4729 NE View Dr.
Mailing: P.O. Box 216
Port Gamble, WA. 98364
Tel: (360) 297-6040, Fax: (360)297-7268

CHAIN OF CUSTODY

13277

Destination Lab: Nautilus
Destination Contact: Eric Tollefson
Date: 6/10/08
Turn-Around-Time: Results by 6/13/08
Project Name: Irondale
Contract/PO:

Sample Originator: NewFields
Contact Name: Brian Hester
Address: Above
Phone: ↓
Fax:
E-mail: bhester@newfields.com

Report Results To: Same
Contact Name: Same
Address: /
Phone: /
Fax:
Email:

Invoicing To: NewFields
Comments or Special Instructions: please provide draft results ASAP

No.	Sample ID	Matrix	No. & Type of Container	Date & Time	microtox						Preservation	Sample Temp Upon Receipt	LAB ID
1	DP01	SS	1G	6/5/08 1330	X						4°C	1.0°C	S08-016
2	GEI-SS1	↓	↓	6/5/08 1135	↓						↓	5.6	S08-017
3	TP02			6/5/08 1530								6.4	S08-018
4	TP03			6/6/08 1015								4.5	S08-019
5	TP06			6/5/08 1500								7.4	S08-020
6	TP08			6/6/08 1245								3.9	S08-021
7	TP10			6/5/08 1210								6.7	S08-022
8	TP12			6/5/08 0915								5.8	S08-023
9	TP18			6/5/08 1010								2.6	S08-024
10	TP22			6/6/08 0830								4.7	S08-025
11	TP32			6/6/08 1130								4.5	S08-026
12	TP38			6/5/08 1600								6.7	S08-027
13	TP40			6/5/08 1645								5.9	S08-028
14	TP41			6/5/08 1256								3.2	S08-029
15	TP42			6/5/08 1350								5.7	S08-030
16													
17													
18													
19													
20													

Relinquished by:	Recieved by:	Relinquished by:	Recieved by:
Print Name: Brian Hester	Print Name: MaryAnn Rempel-Hester	Print Name:	Print Name:
Signature:	Signature:	Signature:	Signature:
Affiliation: NewFields	Affiliation: Nautilus	Affiliation:	Affiliation:
Date/Time: 6/10/08 0700	Date/Time: 6/11/08 0700	Date/Time:	Date/Time:

Matrix Codes
FW = Fresh Water
WW = Waste Water
SB = Salt & Brackish Water
SS = Soil & Sediment
TS = plant & Animal Tissue
OT = Other

WHITE – return to originator • YELLOW – lab • PINK – retained by originator

APPENDIX B

LABORATORY DOCUMENTS

BIOLOGICAL TESTING OF SOILS FROM
THE IRONDALE IRON AND STEEL PLANT SITE
IRONDALE, WA

EARTHWORM BIOASSAY

TPH DILUTION SERIES

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 19-Jun-2008	TEST END DATE 3-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	22±2

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
Control	0	1	6.6	6.6	#2	23.0	BH	6/19/08	
Control	1				#2	23.2	MMB	6/20/08	
Control	2				#2	23.0	MMB	6/21/08	
Control	3				#2	23.0	MMB	6/22/08	
Control	4				#2	22.8	BH	6/23/08	
Control	5				#2	23.0	BH	6/24/08	
Control	6				#2	23.5	BH	6/25/08	
Control	7				#2	23.2	CR	6/26/08	
Control	8				#2	23.1	CR	6/27/08	
Control	9				#2	24.0	TS	6/28/08	
Control	10				#2	24.5	TS	6/29/08	
Control	11				#2	25.5 ①	MMB	6/30/08	
Control	12				#2	24.5	TS	7/1/08	
Control	13				#2	24.5	CR	7/2/08	
Control	14	1	7.4	7.3	#2	24.5	TS	7/3/08	

worm weigh 10 worms = 4.18g (3-6g target)

① Test room temp lowered in AM, MMB 6/30/08.

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 19-Jun-2008	TEST END DATE 3-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	22±2

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP23 Background	0	2	7.4	7.5			BH	6/19/08	
TP23 Background	1								
TP23 Background	2								
TP23 Background	3								
TP23 Background	4								
TP23 Background	5								
TP23 Background	6								
TP23 Background	7								
TP23 Background	8								
TP23 Background	9								
TP23 Background	10								
TP23 Background	11								
TP23 Background	12								
TP23 Background	13								
TP23 Background	14	2	6.9	6.9			TS	7/3/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 19-Jun-2008	TEST END DATE 3-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP11 3%	0	2	7.2	7.3			BH	6/19/08	
TP11 3%	1								
TP11 3%	2								
TP11 3%	3								
TP11 3%	4								
TP11 3%	5								
TP11 3%	6								
TP11 3%	7								
TP11 3%	8								
TP11 3%	9								
TP11 3%	10								
TP11 3%	11								
TP11 3%	12								
TP11 3%	13								
TP11 3%	14	2	7.4	7.4			TS	7/3/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 19-Jun-2008	TEST END DATE 3-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	22±2

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP11 6%	0	2	7.1	7.1			BH	6/19/08	
TP11 6%	1								
TP11 6%	2								
TP11 6%	3								
TP11 6%	4								
TP11 6%	5								
TP11 6%	6								
TP11 6%	7								
TP11 6%	8								
TP11 6%	9								
TP11 6%	10								
TP11 6%	11								
TP11 6%	12								
TP11 6%	13								
TP11 6%	14	2	7.2	7.3			TS	7/3/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 19-Jun-2008	TEST END DATE 3-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	22±2

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP11 12%	0	2	7.1	7.2			BH	6/19/08	
TP11 12%	1								
TP11 12%	2								
TP11 12%	3								
TP11 12%	4								
TP11 12%	5								
TP11 12%	6								
TP11 12%	7								
TP11 12%	8								
TP11 12%	9								
TP11 12%	10								
TP11 12%	11								
TP11 12%	12								
TP11 12%	13								
TP11 12%	14	2	7.3	7.2			TS	7/3/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 19-Jun-2008	TEST END DATE 3-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP11 25%	0	2	7.1	7.1			BH	6/19/08	
TP11 25%	1								
TP11 25%	2								
TP11 25%	3								
TP11 25%	4								
TP11 25%	5								
TP11 25%	6								
TP11 25%	7								
TP11 25%	8								
TP11 25%	9								
TP11 25%	10								
TP11 25%	11								
TP11 25%	12								
TP11 25%	13								
TP11 25%	14	2	7.2	7.0			TS	7/3/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 19-Jun-2008	TEST END DATE 3-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	22±2

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP11 50%	0	2	6.9	7.0			BH	6/19/08	
TP11 50%	1								
TP11 50%	2								
TP11 50%	3								
TP11 50%	4								
TP11 50%	5								
TP11 50%	6								
TP11 50%	7								
TP11 50%	8								
TP11 50%	9								
TP11 50%	10								
TP11 50%	11								
TP11 50%	12								
TP11 50%	13								
TP11 50%	14	2	7.0	7.0			TS	7/3/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 19-Jun-2008	TEST END DATE 3-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)	
	5 - 9	22±2	

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP11 100%	0	2	6.8	6.9			BH	6/19/08	
TP11 100%	1								
TP11 100%	2								
TP11 100%	3								
TP11 100%	4								
TP11 100%	5								
TP11 100%	6								
TP11 100%	7								
TP11 100%	8								
TP11 100%	9								
TP11 100%	10								
TP11 100%	11								
TP11 100%	12								
TP11 100%	13								
TP11 100%	14	2	6.9	6.8			TS	7/3/08	

NEWFIELDS

14-DAY SOIL TOXICITY TEST OBSERVATION DATA SHEET 3

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
Geoengineers	Irondale	1374-001-860-3	B. Hester	Bath 3	WDOE 96-327	*Eisinia foetida*

Observation Key

#S= Number on the Surface (surface of soil)
#M= Number of Mortality (Dead on surface)
#A = Avoidance (Avoiding soil, on sides or chamber)
N=Normal

INITIAL # OF ORGANISMS: 10

ENDPOINT DATA & OBSERVATIONS

CLIENT / NEWFIELDS ID	REP	INITIAL # IF DIFF	Jar #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Number Remaining
DATE / TECHN.				MMB 6/20/08	MMB 6/21/08	MMB 6/22/08	BH 6/23/08	BH 6/24/08	BH 6/25/08	CR 6/26/08	CR 6/27/08	TS 6/28/08	TS 6/29/08	MMB 6/30/08	TS 7/1/08	CR 7/2/08	TS 7/3/08	
Control	1		17	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9
Control	2		7	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
Control	3		24	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP23 Background	1		3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	8
TP23 Background	2		15	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP23 Background	3		5	1A	↓	↓	↓	↓	↓	1A	↓	↓	↓	↓	↓	↓	↓	10
TP11 3%	1		4	N	↓	↓	↓	↓	↓	N	↓	↓	↓	↓	↓	↓	↓	10
TP11 3%	2		12	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP11 3%	3		14	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP11 6%	1		8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP11 6%	2		21	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP11 6%	3		22	↓	↓	↓	↓	↓	↓	1A	↓	↓	↓	↓	↓	↓	↓	10
TP11 12%	1		9	↓	↓	↓	↓	↓	↓	N	↓	↓	↓	↓	↓	↓	↓	10
TP11 12%	2		23	↓	↓	↓	↓	↓	↓	N	↓	↓	↓	↓	↓	↓	↓	10
TP11 12%	3		1	↓	↓	↓	↓	↓	↓	N	↓	↓	↓	↓	↓	↓	↓	10

NEWFIELDS

14-DAY SOIL TOXICITY TEST OBSERVATION DATA SHEET 3

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
Geoengineers	Irondale	1374-001-860-3	B. Hester	Bath 3	WDOE 96-327	*Eisinia foetida*

Observation Key

#S= Number on the Surface (surface of soil)
#M= Number of Mortality (Dead on surface)
#A = Avoidance (Avoiding soil, on sides or chamber)
N=Normal

INITIAL # OF ORGANISMS: 10

ENDPOINT DATA & OBSERVATIONS

CLIENT / NEWFIELDS ID	REP	INITIAL # IF DIFF	Jar #	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Number Remaining
				DATE / TECHN.	MMB 6/20/08	MMB 6/21/08	MMB 6/22/08	BH 6/23/08	BH 6/24/08	BH 6/25/08	CR 6/26/08	CR 6/27/08	TS 6/28/08	TS 6/29/08	MMB 6/30/08	TS 7/1/08	CR 7/2/08	TS 7/3/08	
TP11 25%	1		13		N	N	N	N	N	N	N	N	N	N	N	N	N	N	10
TP11 25%	2		11		↓	↓	↓	↓	↓	↓	1A	↓	↓	↓	↓	↓	2S	↓	11
TP11 25%	3		20								N						N		10
TP11 50%	1		6								↓				2S	1S	4S	2S	10
TP11 50%	2		18												2S	2S	3S	3S	10
TP11 50%	3		10												N	N	1S	N	6
TP11 100%	1		19		1A	N									3S	2S	3S	3S	10
TP11 100%	2		2		2A	1A					1A	1A			4S	N	1S	N	3[φ]
TP11 100%	3		16		N	N					N	N			3S	3S	3S	3S	10

[φ] Possible dead body on lid - not counted CR 7/3/08

CETIS Analysis Detail

Eisenia 14-d Survival Soil Test	**NewFields**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	02-1253-8731	02-1253-8731	03 Sep-08 8:29 AM	CETISv1.1.2

Method	Alt H	Data Transform	Zeta
Dunnett's Multiple Comparison	C > T	Angular (Corrected)	

NOEL	LOEL	Toxic Units	ChV	PMSD
5200	>5200	0.01923	N/A	40.02%

Group Comparisons

Control	vs	Conc-mg/kg	Statistic	Critical	P-Value	MSD	Decision(0.05)
17		215	-0.5533	2.53222	0.9568	0.46505	Non-Significant Effect
17		390	-0.5533	2.53222	0.9568	0.46505	Non-Significant Effect
17		640	-0.5533	2.53222	0.9568	0.46505	Non-Significant Effect
17		1140	-0.5669	2.53222	0.9582	0.46505	Non-Significant Effect
17		3900	0.40125	2.53222	0.7223	0.46505	Non-Significant Effect
17		5200	0.95743	2.53222	0.4762	0.46505	Non-Significant Effect

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	0.2236083	0.0372681	6	0.74	0.62884	Non-Significant Effect
Error	0.7083079	0.0505934	14			
Total	0.93191621	0.0878615	20			

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Modified Levene	1.74957	4.45582	0.18199	Equal Variances
Distribution	Shapiro-Wilk W	0.80648		0.00083	Non-normal Distribution

Data Summary

			Original Data				Transformed Data			
Conc-mg/kg	Control Type	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
17	Control Sed	3	0.93333	0.80000	1.00000	0.11547	1.31039	1.10715	1.41202	0.17602
215		3	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00029
390		3	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00029
640		3	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00029
1140		3	1.00000	1.00000	1.00000	0.00000	1.41450	1.41202	1.41946	0.00431
3900		3	0.86667	0.60000	1.00000	0.23094	1.23670	0.88608	1.41202	0.30365
5200		3	0.76667	0.30000	1.00000	0.40415	1.13456	0.57964	1.41202	0.48057

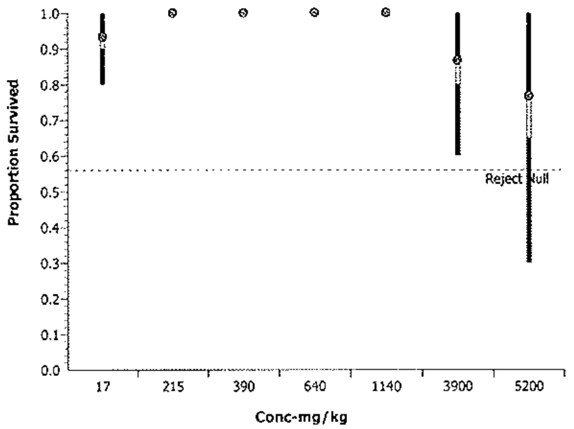
Analyst:________ Approval:________

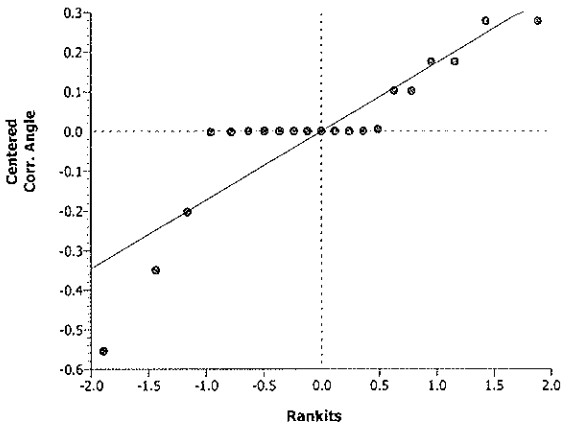
CETIS Analysis Detail

Data Detail

Conc-mg/kg	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
17	Control Sed	0.80000	1.00000	1.00000							
215		1.00000	1.00000	1.00000							
390		1.00000	1.00000	1.00000							
640		1.00000	1.00000	1.00000							
1140		1.00000	1.00000	1.00000							
3900		1.00000	1.00000	0.60000							
5200		1.00000	0.30000	1.00000							

Graphics





CETIS Analysis Detail

Report Date: 03 Sep-08 8:25 AM
Analysis: 15-3588-7146

Eisenia 14-d Survival Soil Test	NewFields

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	02-1253-8731	02-1253-8731	03 Sep-08 8:25 AM	CETISv1.1.2

Method	Alt H	Data Transform	Zeta	NOEL	LOEL	Toxic Units	ChV	PMSD
Dunnett's Multiple Comparison	C > T	Angular (Corrected)		5200	>5200	0.01923	N/A	35.78%

Group Comparisons

Control	vs	Conc-mg/kg	Statistic	Critical	P-Value	MSD	Decision(0.05)
11		215	-0.3055	2.53222	0.9234	0.45029	Non-Significant Effect
11		390	-0.3055	2.53222	0.9234	0.45029	Non-Significant Effect
11		640	-0.3055	2.53222	0.9234	0.45029	Non-Significant Effect
11		1140	-0.3194	2.53222	0.9257	0.45029	Non-Significant Effect
11		3900	0.68039	2.53222	0.6027	0.45029	Non-Significant Effect
11		5200	1.25481	2.53222	0.3475	0.45029	Non-Significant Effect

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	0.2228968	0.0371495	6	0.78	0.59701	Non-Significant Effect
Error	0.6640514	0.0474322	14			
Total	0.88694818	0.0845817	20			

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Modified Levene	1.81195	4.45582	0.16847	Equal Variances
Distribution	Shapiro-Wilk W	0.77389		0.00027	Non-normal Distribution

Data Summary

			Original Data				Transformed Data			
Conc-mg/kg	Control Type	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
11	Reference Sed	3	0.96667	0.90000	1.00000	0.05773	1.35769	1.24905	1.41202	0.09409
215		3	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00029
390		3	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00029
640		3	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00029
1140		3	1.00000	1.00000	1.00000	0.00000	1.41450	1.41202	1.41946	0.00431
3900		3	0.86667	0.60000	1.00000	0.23094	1.23670	0.88608	1.41202	0.30365
5200		3	0.76667	0.30000	1.00000	0.40415	1.13456	0.57964	1.41202	0.48057

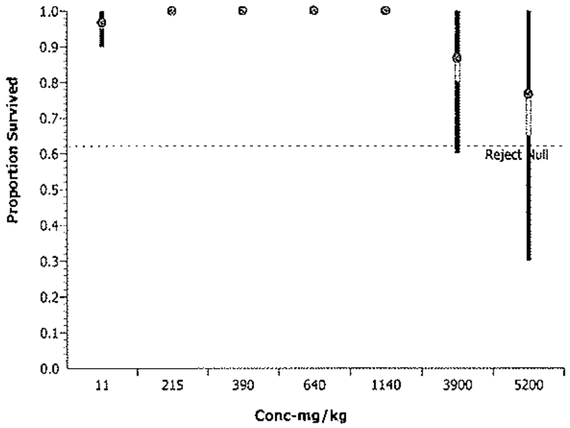
Analyst:________ Approval:________

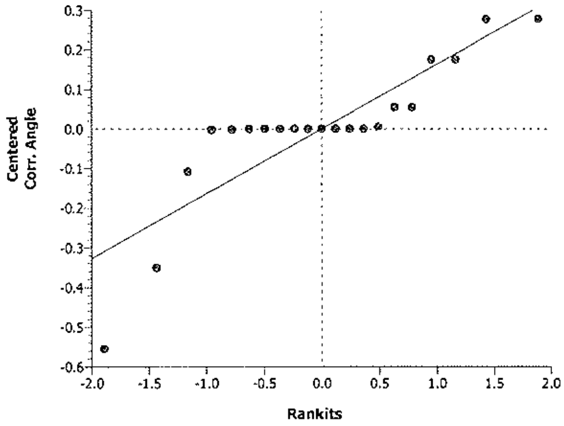
CETIS Analysis Detail

Data Detail

Conc-mg/kg	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
11	Reference Sed	1.00000	1.00000	0.90000							
215		1.00000	1.00000	1.00000							
390		1.00000	1.00000	1.00000							
640		1.00000	1.00000	1.00000							
1140		1.00000	1.00000	1.00000							
3900		1.00000	1.00000	0.60000							
5200		1.00000	0.30000	1.00000							

Graphics





```
                                    Means by treatment

 species      endpoint     Treatment                         mean      notrans

Earthworm     Survival     Control                          1.42045     96.667
Earthworm     Survival     TP-23 Background                 1.35630     93.333
Earthworm     Survival     TP11 100%                        1.14876     76.667
Earthworm     Survival     TP11 12%                         1.57080    100.000
Earthworm     Survival     TP11 25%                         1.57080    100.000
Earthworm     Survival     TP11 3%                          1.57080    100.000
Earthworm     Survival     TP11 50%                         1.26170     86.667
Earthworm     Survival     TP11 6%                          1.57080    100.000
```

```
                 Results of Assumption Checks

                                 Prob        Prob
 species     endpoint          Normal    Homogeneous

Earthworm    Survival    .001647290     .000069201
```

```
                                              ANOVA Results

------------------------------------------ species=Earthworm endpoint=Survival -------------------------------------------

                                              The GLM Procedure

                                           Class Level Information

           Class          Levels    Values

           Treatment           8    Control TP-23 Background TP11 100% TP11 12% TP11 25% TP11 3% TP11 50% TP11 6%


                                  Number of Observations Read          24
                                  Number of Observations Used          24
```

```
                                                ANOVA Results

------------------------------------------ species=Earthworm endpoint=Survival -------------------------------------------

                                                 The GLM Procedure

Dependent Variable: result

                                                      Sum of
                    Source                      DF          Squares     Mean Square    F Value    Pr > F

                    Model                        7       0.57636865      0.08233838       0.64    0.7161

                    Error                       16       2.05360920      0.12835057

                    Corrected Total             23       2.62997785


                                  R-Square     Coeff Var      Root MSE    result Mean

                                  0.219153      24.98679      0.358260       1.433799


                    Source                      DF        Type I SS     Mean Square    F Value    Pr > F

                    Treatment                    7       0.57636865      0.08233838       0.64    0.7161


                    Source                      DF      Type III SS     Mean Square    F Value    Pr > F

                    Treatment                    7       0.57636865      0.08233838       0.64    0.7161
```

```
-------------------------------------------- species=Earthworm endpoint=Survival ---------------------------------------------

                                                     The GLM Procedure

                                          Dunnett's One-tailed t Tests for result

        NOTE: This test controls the Type I experimentwise error for comparisons of all treatments against a control.


                                           Alpha                              0.05
                                           Error Degrees of Freedom             16
                                           Error Mean Square              0.128351
                                           Critical Value of Dunnett's t   2.55786
                                           Minimum Significant Difference   0.7482


                               Comparisons significant at the 0.05 level are indicated by ***.


                                                               Difference
                                     Treatment                    Between     Simultaneous 95%
                                    Comparison                      Means    Confidence Limits

                        TP11 25%         - Control                 0.1503    -Infinity  0.8986
                        TP11 3%          - Control                 0.1503    -Infinity  0.8986
                        TP11 12%         - Control                 0.1503    -Infinity  0.8986
                        TP11 6%          - Control                 0.1503    -Infinity  0.8986
                        TP-23 Background - Control                -0.0642    -Infinity  0.6841
                        TP11 50%         - Control                -0.1588    -Infinity  0.5895
                        TP11 100%        - Control                -0.2717    -Infinity  0.4765
```

```
-------------------------------------------- species=Earthworm endpoint=Survival ---------------------------------------------

                                                    The NPAR1WAY Procedure

                                       Wilcoxon Scores (Rank Sums) for Variable result
                                               Classified by Variable Treatment

                                                       Sum of      Expected       Std Dev          Mean
                       Treatment              N        Scores      Under H0      Under H0         Score
                       --------------------------------------------------------------------------------
                       Control                3         33.00         37.50      7.439977     11.000000
                       TP-23 Background       3         32.00         37.50      7.439977     10.666667
                       TP11 100%              3         30.00         37.50      7.439977     10.000000
                       TP11 12%               3         43.50         37.50      7.439977     14.500000
                       TP11 25%               3         43.50         37.50      7.439977     14.500000
                       TP11 3%                3         43.50         37.50      7.439977     14.500000
                       TP11 50%               3         31.00         37.50      7.439977     10.333333
                       TP11 6%                3         43.50         37.50      7.439977     14.500000

                                              Average scores were used for ties.


                                                     Kruskal-Wallis Test

                                                  Chi-Square         4.6316
                                                  DF                      7
                                                  Pr > Chi-Square    0.7048
```

BIOLOGICAL TESTING OF SOILS FROM
THE IRONDALE IRON AND STEEL PLANT SITE
IRONDALE, WA

EARTHWORM BIOASSAY

STANDARD TEST – METAL SAMPLES

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
Control	0	1	7.2	7.2	#2	22.8	BH	6/23/08	
Control	1				#2	23.0	BH	6/24/08	
Control	2				#2	23.5	BH	6/25/08	
Control	3				#2	23.2	CR	6/26/08	
Control	4				#2	23.1	CR	6/27/08	
Control	5				#2	24.0	TS	6/28/08	
Control	6				#2	24.5	TS	6/29/08	
Control	7				#2	26.0 ①	MMB	6/30/08	
Control	8				#2	24.5	TS	7/1/08	
Control	9				#2	24.5	CR	7/2/08	
Control	10				#2	24.5	TS	7/3/08	
Control	11				#2	23.8	BH	7/4/08	
Control	12				#2	24.5	MMB	7/5/08	
Control	13				#2	24.5	MMB	7/6/08	
Control	14	5	7.3	7.5	#2	23.7	CR	7/7/08	

① Test room temp. lowered in AM, MMB 6/30/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
GEI-SS1	0	1	8.2	8.8			BH	6/23/08	
GEI-SS1	1								
GEI-SS1	2								
GEI-SS1	3								
GEI-SS1	4								
GEI-SS1	5								
GEI-SS1	6								
GEI-SS1	7								
GEI-SS1	8								
GEI-SS1	9								
GEI-SS1	10								
GEI-SS1	11								
GEI-SS1	12								
GEI-SS1	13								
GEI-SS1	14	5	7.2	7.6			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT	PROJECT	SPECIES 1	NEWFIELDS LABORATORY	PROTOCOL
Geoengineers	Irondale	*Eisinia foetida*	Port Gamble Bath 3	WDOE 96-327
NEWFIELDS JOB NUMBER	**PROJECT MANAGER**		**TEST START DATE**	**TEST END DATE**
1374-001-860-3	B. Hester		23-Jun-2008	7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP03	0	1	8.1	8.7			BH	6/23/08	
TP03	1								
TP03	2								
TP03	3								
TP03	4								
TP03	5								
TP03	6								
TP03	7								
TP03	8								
TP03	9								
TP03	10								
TP03	11								
TP03	12								
TP03	13								
TP03	14	5	7.6	7.4			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
DP01	0	1	8.4	8.8			BH	6/23/08	
DP01	1								
DP01	2								
DP01	3								
DP01	4								
DP01	5								
DP01	6								
DP01	7								
DP01	8								
DP01	9								
DP01	10								
DP01	11								
DP01	12								
DP01	13								
DP01	14	5	7.3	7.5			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
		pH			TEMP				
CLIENT/NEWFIELDS ID	DAY	meter	T^{0min}	T^{30min}	meter	°C	Tech	Date	Comments
TP22	0	1	8.2	8.3			BH	6/23/08	
TP22	1								
TP22	2								
TP22	3								
TP22	4								
TP22	5								
TP22	6								
TP22	7								
TP22	8								
TP22	9								
TP22	10								
TP22	11								
TP22	12								
TP22	13								
TP22	14	5	7.6	7.8			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP40	0	1	8.5	8.6			BH	6/23/08	
TP40	1								
TP40	2								
TP40	3								
TP40	4								
TP40	5								
TP40	6								
TP40	7								
TP40	8								
TP40	9								
TP40	10								
TP40	11								
TP40	12								
TP40	13								
TP40	14	5	7.5	7.8			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		**pH**			**TEMP (°C)**				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	**pH** meter	**pH** T^{0min}	**pH** T^{30min}	**TEMP** meter	**TEMP** °C	**Tech**	**Date**	**Comments**
TP08	**0**	1	8.7	8.8			BH	6/23/08	
TP08	**1**								
TP08	**2**								
TP08	**3**								
TP08	**4**								
TP08	**5**								
TP08	**6**								
TP08	**7**								
TP08	**8**								
TP08	**9**								
TP08	**10**								
TP08	**11**								
TP08	**12**								
TP08	**13**								
TP08	**14**	5	7.3	7.9			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP32	0	1	8.5	8.5			BH	6/23/08	
TP32	1								
TP32	2								
TP32	3								
TP32	4								
TP32	5								
TP32	6								
TP32	7								
TP32	8								
TP32	9								
TP32	10								
TP32	11								
TP32	12								
TP32	13								
TP32	14	5	7.7	7.9			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	22±2

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP06	0	1	8.3	8.3			BH	6/23/08	
TP06	1								
TP06	2								
TP06	3								
TP06	4								
TP06	5								
TP06	6								
TP06	7								
TP06	8								
TP06	9								
TP06	10								
TP06	11								
TP06	12								
TP06	13								
TP06	14	5	7.5	7.5			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP02	**0**	1	8.6	8.5			BH	6/23/08	
TP02	**1**								
TP02	**2**								
TP02	**3**								
TP02	**4**								
TP02	**5**								
TP02	**6**								
TP02	**7**								
TP02	**8**								
TP02	**9**								
TP02	**10**								
TP02	**11**								
TP02	**12**								
TP02	**13**								
TP02	**14**	5	7.7	8.2			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS		pH			TEMP (°C)				
		5 - 9			22±2				
CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP38	0	1	6.7	6.6			BH	6/23/08	
TP38	1								
TP38	2								
TP38	3								
TP38	4								
TP38	5								
TP38	6								
TP38	7								
TP38	8								
TP38	9								
TP38	10								
TP38	11								
TP38	12								
TP38	13								
TP38	14	5	6.3	6.5			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)	
	5 - 9	22±2	

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP18	0	1	8.0	8.0			BH	6/23/08	
TP18	1								
TP18	2								
TP18	3								
TP18	4								
TP18	5								
TP18	6								
TP18	7								
TP18	8								
TP18	9								
TP18	10								
TP18	11								
TP18	12								
TP18	13								
TP18	14	5	6.7	6.6			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Eisinia foetida*	NEWFIELDS LABORATORY Port Gamble Bath 3	PROTOCOL WDOE 96-327
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 23-Jun-2008	TEST END DATE 7-Jul-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)	
	5 - 9	22±2	

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Tech	Date	Comments
		meter	T^{0min}	T^{30min}	meter	°C			
TP41	0	1	7.9	7.8			BH	6/23/08	
TP41	1								
TP41	2								
TP41	3								
TP41	4								
TP41	5								
TP41	6								
TP41	7								
TP41	8								
TP41	9								
TP41	10								
TP41	11								
TP41	12								
TP41	13								
TP41	14	5	6.8	6.8			CR	7/7/08	

NEWFIELDS

14-DAY SOIL TOXICITY TEST OBSERVATION DATA SHEET 3

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
Geoengineers	Irondale	1374-001-860-3	B. Hester	Bath 3	WDOE 96-327	*Eisinia foetida*

Observation Key

#S= Number on the Surface (surface of soil)
#M= Number of Mortality (Dead on surface)
#A = Avoidance (Avoiding soil, on sides or chamber)
N=Normal

INITIAL # OF ORGANISMS: 10

ENDPOINT DATA & OBSERVATIONS

CLIENT / NEWFIELDS ID	REP	INITIAL # IF DIFF	Jar #	DATE / TECHN. / Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Number Remaining
				DATE / TECHN.	BH 6/24/08	BH 6/25/08	CR 6/26/08	CR 6/27/08	TS 6/28/08	TS 6/29/08	MMB 6/30/08	TS 7/1/08	CR 7/2/08	TS 7/3/08	BH 7/4/08	MMB 7/5/08	MMB 7/6/08	CR 7/7/08	
Control	1		22		N	N	N	N	N	N	N	N	N	N	N	N	N	N	10
Control	2		38																10
Control	3		11																10
GEI-SS1	1		21																10
GEI-SS1	2		27																10
GEI-SS1	3		31										↓						10
TP03	1		23										1S		↓				9
TP03	2		39										N		3A			↓	11
TP03	3		6										N		N	↓		1A	10
DP01	1		34										1S		1A	1A		1A	10
DP01	2		12					1A①					N		N	N		N	10
DP01	3		2																10
TP22	1		32													↓			10
TP22	2		33													2A	↓		10
TP22	3		28		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	N	1A	↓	10

①IE CR 6/27/08

NEWFIELDS

14-DAY SOIL TOXICITY TEST OBSERVATION DATA SHEET 3

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
Geoengineers	Irondale	1374-001-860-3	B. Hester	Bath 3	WDOE 96-327	*Eisinia foetida*

Observation Key

#S= Number on the Surface (surface of soil)
#M= Number of Mortality (Dead on surface)
#A = Avoidance (Avoiding soil, on sides or chamber)
N=Normal

INITIAL # OF ORGANISMS: 10

ENDPOINT DATA & OBSERVATIONS

CLIENT / NEWFIELDS ID	REP	INITIAL # IF DIFF	Jar #	DATE / TECHN. / Day	BH 6/24/08 1	BH 6/25/08 2	CR 6/26/08 3	CR 6/27/08 4	JS 6/28/08 5	JS 6/29/08 6	MMB 6/30/08 7	KD 7/1/08 8	CR 7/2/08 9	JS 7/3/08 10	BH 7/4/08 11	MMB 7/5/08 12	MMB 7/6/08 13	CR 7/7 14	Number Remaining
TP40	1		3		N	N	N	N	N	N	1S	1S	1A	3A	2A	2A ①	1A	1A	10
TP40	2		5								N	N	N	1A	1A	2A	4A	2A	9
TP40	3		19								4A		5A	4A	3A	7A ①	4A	4A	10
TP08	1		4								N		N	N	N	1A ①	1A	N	10
TP08	2		7			↓							N	N	N	1A ①	N	N	9
TP08	3		16			1A							1A	1A	4A	4A ①	2A	1A	10
TP32	1		14			N							N	N	1A	2A	3A	4A	10
TP32	2		24									↓	N	N	2A	N	4A	4A	10
TP32	3		26									1S	4A	1A	3A	2A ①	3A	2A	10
TP06	1		8									N	N	N	N	N	N	N	10
TP06	2		18																10
TP06	3		1																10
TP02	1		20																9
TP02	2		9													↓			10
TP02	3		37		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1A	↓	↓	10

① Siphoned standing water from surface of soil, MMB 7/5/08

NEWFIELDS

14-DAY SOIL TOXICITY TEST OBSERVATION DATA SHEET 3

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
Geoengineers	Irondale	1374-001-860-3	B. Hester	Bath 3	WDOE 96-327	*Eisinia foetida*

Observation Key

#S= Number on the Surface (surface of soil)
#M= Number of Mortality (Dead on surface)
#A = Avoidance (Avoiding soil, on sides or chamber)
N=Normal

INITIAL # OF ORGANISMS: 10

ENDPOINT DATA & OBSERVATIONS

CLIENT / NEWFIELDS ID	REP	INITIAL # IF DIFF	Jar #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Number Remaining
DATE / TECHN.				BH 6/24/08	BH 6/25/08	CR 6/26/08	CR 6/27/08	TS 6/28/08	TS 6/29/08	MMB 6/30/08	TS 7/1/08	CR 7/2/08	TS 7/3/08	BH 7/4/08	MMB 7/5/08	MMB 7/6/08	CR 7/7/08	
TP38	1		29	N	1A	N	N	N	N	N	N	N	N	N	N	N	N	10
TP38	2		13	↓	N	↓	↓	↓	↓	↓	↓	↓	↓	N	↓	↓	↓	10
TP38	3		17	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	2A	↓	↓	↓	10
TP18	1		36	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	N	↓	↓	↓	10
TP18	2		30	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP18	3		10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP41	1		15	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP41	2		35	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10
TP41	3		25	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	10

BIOLOGICAL TESTING OF SOILS FROM
THE IRONDALE IRON AND STEEL PLANT SITE
IRONDALE, WA

EARLY SEEDLING GROWTH BIOASSAY

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
Control	0	1	6.7	6.7	#2	22.6	1	89-112		BH	BH	8/8/08
Control	1				#2	23.1	1	92-110	BH	BH	BH	8/9
Control	2				#2	22.8	1	100-121	BH	BH	BH	8/10
Control	3				#2	22.4	1	85-101	BH	TS	BH	8/11
Control	4				#2	23.3	1	87-99	BH	mmB	BH	8/12
Control	5				#2	23.2	1	95-110	TS	mmB	TS	8/13
Control	6				#2	23.1	1	101-124	TS	TS	TS	8/14
Control	7				#2	22.9	1	96-108	TS	BH	TS	8/15
Control	8				#2	22.7	1	98-105	mmB	mmB	mmB	8/16
Control	9				#2	23.5	1	104-118	mmB	mmB	mmB	8/17
Control	10				#2	23.0	1	96-121	mmB	BH	mmB	8/18
Control	11				#2	23.3	1	100-124	BH	BH	BH	8/19
Control	12				#2	23.2	1	91-115	mmB	TS	mmB	8/20
Control	13				#2	22.9	1	95-120	CR	TS	CR	8/21
Control	14	3	7.3	7.2	#2	23.4	1	94-113	BH		BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
GEI-SS1	0	1	7.5	7.6							BH	8/8/08
GEI-SS1	1											
GEI-SS1	2											
GEI-SS1	3											
GEI-SS1	4											
GEI-SS1	5											
GEI-SS1	6											
GEI-SS1	7											
GEI-SS1	8											
GEI-SS1	9											
GEI-SS1	10											
GEI-SS1	11											
GEI-SS1	12											
GEI-SS1	13											
GEI-SS1	14	3	7.6	7.5							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP03	0	1	6.9	7.0							BH	8/8/08
TP03	1											
TP03	2											
TP03	3											
TP03	4											
TP03	5											
TP03	6											
TP03	7											
TP03	8											
TP03	9											
TP03	10											
TP03	11											
TP03	12											
TP03	13											
TP03	14	3	7.6	7.6							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	µEm^{-2}s^{-1}	AM Init	PM Init		
DP01	0	1	8.3	8.4							BH	8/8/08
DP01	1											
DP01	2											
DP01	3											
DP01	4											
DP01	5											
DP01	6											
DP01	7											
DP01	8											
DP01	9											
DP01	10											
DP01	11											
DP01	12											
DP01	13											
DP01	14	3	7.6	7.6							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP22	0	1	8.0	8.0							BH	8/8/08
TP22	1											
TP22	2											
TP22	3											
TP22	4											
TP22	5											
TP22	6											
TP22	7											
TP22	8											
TP22	9											
TP22	10											
TP22	11											
TP22	12											
TP22	13											
TP22	14	3	7.7	7.6							BH	8/8/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP40	0	1	8.4	8.5							BH	8/8/08
TP40	1											
TP40	2											
TP40	3											
TP40	4											
TP40	5											
TP40	6											
TP40	7											
TP40	8											
TP40	9											
TP40	10											
TP40	11											
TP40	12											
TP40	13											
TP40	14	3	7.7	7.8							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP08	0	1	8.6	8.6							BH	8/8/08
TP08	1											
TP08	2											
TP08	3											
TP08	4											
TP08	5											
TP08	6											
TP08	7											
TP08	8											
TP08	9											
TP08	10											
TP08	11											
TP08	12											
TP08	13											
TP08	14	3	7.9	7.8							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP32	0	1	8.4	8.5							BH	8/8/08
TP32	1											
TP32	2											
TP32	3											
TP32	4											
TP32	5											
TP32	6											
TP32	7											
TP32	8											
TP32	9											
TP32	10											
TP32	11											
TP32	12											
TP32	13											
TP32	14	3	7.8	7.6							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP06	**0**	1	8.3	8.3							BH	8/8/08
TP06	**1**											
TP06	**2**											
TP06	**3**											
TP06	**4**											
TP06	**5**											
TP06	**6**											
TP06	**7**											
TP06	**8**											
TP06	**9**											
TP06	**10**											
TP06	**11**											
TP06	**12**											
TP06	**13**											
TP06	**14**	3	7.8	7.6							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP02	0	1	8.6	8.5							BH	8/8/08
TP02	1											
TP02	2											
TP02	3											
TP02	4											
TP02	5											
TP02	6											
TP02	7											
TP02	8											
TP02	9											
TP02	10											
TP02	11											
TP02	12											
TP02	13											
TP02	14	3	8.0	7.9							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP38	0	1	6.9	7.0							BH	8/8/08
TP38	1											
TP38	2											
TP38	3											
TP38	4											
TP38	5											
TP38	6											
TP38	7											
TP38	8											
TP38	9											
TP38	10											
TP38	11											
TP38	12											
TP38	13											
TP38	14	3	7.8	7.4							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP18	0	1	8.0	8.1							BH	8/8/08
TP18	1											
TP18	2											
TP18	3											
TP18	4											
TP18	5											
TP18	6											
TP18	7											
TP18	8											
TP18	9											
TP18	10											
TP18	11											
TP18	12											
TP18	13											
TP18	14	3	7.9	7.6							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY DATA SHEET

CLIENT Geoengineers	PROJECT Irondale	SPECIES 1 *Lactuca sativa*	NEWFIELDS LABORATORY Port Gamble Test Room	PROTOCOL WDOE 96-324
NEWFIELDS JOB NUMBER 1374-001-860-3	PROJECT MANAGER B. Hester		TEST START DATE 8-Aug-2008	TEST END DATE 22-Aug-2008

SOIL QUALITY DATA

TEST CONDITIONS	pH	TEMP (°C)
	5 - 9	20-30

CLIENT/NEWFIELDS ID	DAY	pH			TEMP		Lighting		Hydrate		Tech	Date
		meter	T^{0min}	T^{30min}	meter	°C	meter	$\mu Em^{-2}s^{-1}$	AM Init	PM Init		
TP41	0	1	7.9	7.9							BH	8/8/08
TP41	1											
TP41	2											
TP41	3											
TP41	4											
TP41	5											
TP41	6											
TP41	7											
TP41	8											
TP41	9											
TP41	10											
TP41	11											
TP41	12											
TP41	13											
TP41	14	3	7.6	7.4							BH	8/22/08

NEWFIELDS

14-DAY SOIL TOXICITY TEST OBSERVATION DATA SHEET 3

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
Geoengineers	Irondale	1374-001-860-3	B. Hester	Test Room ~~Bath 3~~	WDOE 96-324	*Lactuca sativa*

Observation Key

INITIAL # OF ORGANISMS: 20

ENDPOINT DATA & OBSERVATIONS

CLIENT / NEWFIELDS ID	REP	INITIAL # IF DIFF	DATE / TECHN.		Seedling Survival	Tare Weight (mg)	Wet Weight (mg)	Dry Weight (mg)
			Jar #	Day				
Control	1				20	1 196.19	667.95	219.19
Control	2				19	2 208.61	924.95	240.73
Control	3				19	3 208.02	713.45	234.62
GEI-SS1	1				19	4 167.21	806.68	211.80
GEI-SS1	2				19	5 197.70	922.73	240.58
GEI-SS1	3				20	6 195.25	889.872	232.40
TP03	1				14	7 199.72	765.19	221.46
TP03	2				16	8 188.49	1226.15	240.52
TP03	3				10	9 193.00	555.03	208.84
DP01	1				15	10 194.66	563.88	216.98
DP01	2				20	11 229.30	456.70	246.83
DP01	3				17	12 204.95	500.79	230.10
TP22	1				11	13 214.59	380.43	231.11
TP22	2				16	14 235.44	435.60	256.85
TP22	3				16	15 213.47	454.41	235.53

NEWFIELDS

14-DAY SOIL TOXICITY TEST OBSERVATION DATA SHEET 3

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
Geoengineers	Irondale	1374-001-860-3	B. Hester	Test Room ~~Bath 3~~	WDOE 96-324	*Lactuca sativa*

Observation Key

INITIAL # OF ORGANISMS 20

ENDPOINT DATA & OBSERVATIONS

CLIENT / NEWFIELDS ID	REP	INITIAL # IF DIFF	DATE / TECHN.		Seedling Survival	Tare Weight (mg)	Wet Weight (mg)	Dry Weight (mg)
			Jar #	Day				
TP40	1				19	16 216.83	868.20	247.52
TP40	2				15	17 208.87	729.38	234.09
TP40	3				10	18 221.75	525.50	~~238.0~~ ~~237.81~~ 238.06
TP08	1				17	19 218.02	522.37	250.73
TP08	2				19	20 202.81	560.14	238.01
TP08	3				20	21 212.13	681.20	250.47
TP32	1				17	22 225.04	800.60	251.62
TP32	2				16	23 220.01	827.30	244.99
TP32	3				16	24 205.33	917.15	236.~~51~~ 60
TP06	1				10	25 210.32	465.21	223.04
TP06	2				8	26 197.65	329.70	204.45
TP06	3				14	27 229.33	552.44	246.74
TP02	1				19	28 203.46	662.40	239.19
TP02	2				20	29 210.92	752.17	254.67
TP02	3				20	30 233.65	817.22	275.48

NEWFIELDS

14-DAY SOIL TOXICITY TEST OBSERVATION DATA SHEET 3

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL	SPECIES
Geoengineers	Irondale	1374-001-860-3	B. Hester	Test ~~Bath 3~~ Room	WDOE 96-324	*Lactuca sativa*

Observation Key

INITIAL # OF ORGANISMS 20

ENDPOINT DATA & OBSERVATIONS

CLIENT / NEWFIELDS ID	REP	INITIAL # IF DIFF	DATE / TECHN. Jar #	Day	Seedling Survival	Tare Weight (mg)	Wet Weight (mg)	Dry Weight (mg)
TP38	1				14	31 221.83	778.30	247.65
TP38	2				16	32 196.73	996.14	232.20
TP38	3				12	33 211.06	688.53	233.14
TP18	1				20	34 211.38	11356.01	254.48
TP18	2				20	35 206.38	1216.99	259.88
TP18	3				19	36 215.85	1542.40	276.70
TP41	1				10	37 215.63	403.78	226.32
TP41	2				15	38 202.34	497.55	222.09
TP41	3				16	39 230.25	560.67	252.48

	Germination (%)		Statistical Comparison*		Dry Weight per Germinated Seed (mg)		Dry Weight per Initial Seed (mg)		Statistical Comparison*		Metal Concentrations (mg/kg)					
Treatment	Mean	Std Dev	Sig < Control	Sig < TP18	Mean	Std Dev	Mean	Std Dev	Sig < Control	Sig < TP18	Arsenic	Copper	Iron	Lead	Nickel	Zinc
Control	96.7	2.9	--	N	1.41	0.27	1.36	0.23	--	Y	0	0	0	0	0	0
TP18	98.3	2.9	N	--	2.68	0.52	2.62	0.45	N	--	3.1	16.3	14,200	20	22	39
TP02	98.3	2.9	N	N	2.05	0.16	2.02	0.21	N	N	1.9	14.4	16,100	10	36	42
GEI-SS1	96.7	2.9	N	N	2.15	0.26	2.08	0.19	N	N	4.8	74	37,800	20	6	55
TP08	93.3	7.6	N	N	1.90	0.04	1.77	0.14	N	Y	8.4	298	26,700	8	31	45
DP01	86.7	12.6	N	N	1.28	0.35	1.08	0.19	N	Y	4.8	97.1	31,700	8	33	86
TP32	81.7	2.9	N	Y	1.69	0.23	1.38	0.16	N	Y	38.5	883	106,000	50	13	84
TP40	73.3	22.5	N	Y	1.64	0.03	1.20	0.36	N	Y	43.6	876	202,000	110	70	90
TP22	71.7	14.4	Y	Y	1.41	0.09	1.00	0.15	N	Y	2.0	9.5	15,300	3	28	32
TP38	70.0	10.0	Y	Y	1.97	0.22	1.39	0.35	N	Y	3.0	23.8	18,400	147	36	79
TP41	68.3	16.1	Y	Y	1.26	0.17	0.88	0.30	N	Y	2.5	32.0	17,400	7	33	48
TP03	66.7	15.3	Y	Y	2.13	0.97	1.49	0.97	N	Y	29.1	260	130,000	280	54	1,460
TP06	53.3	15.3	Y	Y	1.12	0.24	0.62	0.27	N	Y	6.2	127	24,800	91	31	106

*** Germination data are normally distributed with homogeneous variance: ANOVA performed on arcsine transformed data (prob<0.001).**
Growth data are not normally distributed and variance is not homogeneous: ANOVA performed on rankits (prob<0.001).

```
                  Irondale Statistical Comparison
                        Means by treatment

species    endpoint              Treatment         mean    notrans

Lettuce    Dry Weight Initial    Control         1.36200      .
Lettuce    Dry Weight Initial    DP01            1.08333      .
Lettuce    Dry Weight Initial    GEI-SS1         2.07700      .
Lettuce    Dry Weight Initial    TP02            2.02183      .
Lettuce    Dry Weight Initial    TP03            1.49350      .
Lettuce    Dry Weight Initial    TP06            0.61550      .
Lettuce    Dry Weight Initial    TP08            1.77083      .
Lettuce    Dry Weight Initial    TP18            2.62417      .
Lettuce    Dry Weight Initial    TP22            0.99983      .
Lettuce    Dry Weight Initial    TP32            1.38050      .
Lettuce    Dry Weight Initial    TP38            1.38950      .
Lettuce    Dry Weight Initial    TP40            1.20367      .
Lettuce    Dry Weight Initial    TP41            0.87783      .
Lettuce    Survival              Control         1.35909    96.6667
Lettuce    Survival              DP01            1.14495    86.6667
Lettuce    Survival              GEI-SS1         1.35909    96.6667
Lettuce    Survival              TP02            1.46494    98.3333
Lettuce    Survival              TP03            0.74210    66.6667
Lettuce    Survival              TP06            0.57017    53.3333
Lettuce    Survival              TP08            1.28001    93.3333
Lettuce    Survival              TP18            1.46494    98.3333
Lettuce    Survival              TP22            0.81232    71.6667
Lettuce    Survival              TP32            0.95686    81.6667
Lettuce    Survival              TP38            0.78206    70.0000
Lettuce    Survival              TP40            0.87497    73.3333
Lettuce    Survival              TP41            0.76632    68.3333
```

```
                  Irondale Statistical Comparison
                   Results of Assumption Checks

                                                  Prob          Prob
species     endpoint                            Normal    Homogeneous

Lettuce     Dry Weight Initial                 0.03113       0.00341
Lettuce     Survival                           0.65494       0.37457
```

```
                              Irondale Statistical Comparison
                                      ANOVA Results

----------------------------------------- species=Lettuce endpoint=Survival -----------------------------------------

                                    The GLM Procedure

                                  Class Level Information

          Class           Levels    Values

          Treatment           13    Control DP01 GEI-SS1 TP02 TP03 TP06 TP08 TP18 TP22 TP32 TP38 TP40 TP41


                            Number of Observations Read          39
                            Number of Observations Used          39
```

```
                                            Irondale Statistical Comparison
                                                     ANOVA Results

------------------------------------------ species=Lettuce endpoint=Survival ------------------------------------------

                                                   The GLM Procedure

Dependent Variable: result

                                                          Sum of
                  Source                      DF         Squares     Mean Square    F Value    Pr > F

                  Model                       12      3.51016201      0.29251350       5.65    0.0001

                  Error                       26      1.34630550      0.05178098

                  Corrected Total             38      4.85646750

                                  R-Square     Coeff Var      Root MSE    result Mean

                                  0.722781      21.78706      0.227554       1.044447

                  Source                      DF       Type I SS     Mean Square    F Value    Pr > F

                  Treatment                   12      3.51016201      0.29251350       5.65    0.0001

                  Source                      DF     Type III SS     Mean Square    F Value    Pr > F

                  Treatment                   12      3.51016201      0.29251350       5.65    0.0001
```

```
                                           Irondale Statistical Comparison
                                                    ANOVA Results

------------------------------------------ species=Lettuce endpoint=Survival ------------------------------------------

                                                  The GLM Procedure

                                       Dunnett's One-tailed t Tests for result

     NOTE: This test controls the Type I experimentwise error for comparisons of all treatments against a control.


                                       Alpha                              0.05
                                       Error Degrees of Freedom             26
                                       Error Mean Square              0.051781
                                       Critical Value of Dunnett's t   2.65182
                                       Minimum Significant Difference   0.4927


                           Comparisons significant at the 0.05 level are indicated by ***.


                                                 Difference
                                 Treatment          Between     Simultaneous 95%
                                Comparison            Means    Confidence Limits

                              TP02    - TP18         0.0000    -Infinity  0.4927
                              Control - TP18        -0.1059    -Infinity  0.3868
                              GEI-SS1 - TP18        -0.1059    -Infinity  0.3868
                              TP08    - TP18        -0.1849    -Infinity  0.3078
                              DP01    - TP18        -0.3200    -Infinity  0.1727
                              TP32    - TP18        -0.5081    -Infinity -0.0154  ***
                              TP40    - TP18        -0.5900    -Infinity -0.0973  ***
                              TP22    - TP18        -0.6526    -Infinity -0.1599  ***
                              TP38    - TP18        -0.6829    -Infinity -0.1902  ***
                              TP41    - TP18        -0.6986    -Infinity -0.2059  ***
                              TP03    - TP18        -0.7228    -Infinity -0.2301  ***
                              TP06    - TP18        -0.8948    -Infinity -0.4021  ***
```

```
------------------------------------ species=Lettuce endpoint=Dry Weight Initial -------------------------------------

                                              The GLM Procedure

                                           Class Level Information

           Class          Levels    Values

           Treatment          13    Control DP01 GEI-SS1 TP02 TP03 TP06 TP08 TP18 TP22 TP32 TP38 TP40 TP41


                                   Number of Observations Read          39
                                   Number of Observations Used          39
```

```
                                   Irondale Statistical Comparison
                                       ANOVA Results - Rankits

------------------------------------ species=Lettuce endpoint=Dry Weight Initial ------------------------------------

                                         The GLM Procedure

Dependent Variable: result

                                                        Sum of
                  Source                      DF       Squares     Mean Square    F Value    Pr > F

                  Model                       12   10.92360464      0.91030039       6.59    <.0001

                  Error                       26    3.59301967      0.13819306

                  Corrected Total             38   14.51662431


                                 R-Square     Coeff Var      Root MSE    result Mean

                                 0.752489      25.57032      0.371743       1.453808


                  Source                      DF     Type I SS     Mean Square    F Value    Pr > F

                  Treatment                   12   10.92360464      0.91030039       6.59    <.0001


                  Source                      DF   Type III SS     Mean Square    F Value    Pr > F

                  Treatment                   12   10.92360464      0.91030039       6.59    <.0001
```

```
------------------------------------- species=Lettuce endpoint=Dry Weight Initial -------------------------------------

                                                   The GLM Procedure

                                        Dunnett's One-tailed t Tests for result

     NOTE: This test controls the Type I experimentwise error for comparisons of all treatments against a control.


                                        Alpha                              0.05
                                        Error Degrees of Freedom             26
                                        Error Mean Square              0.138193
                                        Critical Value of Dunnett's t   2.65182
                                        Minimum Significant Difference   0.8049


                            Comparisons significant at the 0.05 level are indicated by ***.


                                                   Difference
                                  Treatment           Between     Simultaneous 95%
                                 Comparison             Means     Confidence Limits

                              GEI-SS1 - TP18          -0.5472    -Infinity   0.2577
                              TP02    - TP18          -0.6023    -Infinity   0.2026
                              TP08    - TP18          -0.8533    -Infinity  -0.0484  ***
                              TP03    - TP18          -1.1307    -Infinity  -0.3258  ***
                              TP38    - TP18          -1.2347    -Infinity  -0.4298  ***
                              TP32    - TP18          -1.2437    -Infinity  -0.4388  ***
                              Control - TP18          -1.2622    -Infinity  -0.4573  ***
                              TP40    - TP18          -1.4205    -Infinity  -0.6156  ***
                              DP01    - TP18          -1.5408    -Infinity  -0.7359  ***
                              TP22    - TP18          -1.6243    -Infinity  -0.8194  ***
                              TP41    - TP18          -1.7463    -Infinity  -0.9414  ***
                              TP06    - TP18          -2.0087    -Infinity  -1.2038  ***
```

BIOLOGICAL TESTING OF SOILS FROM
THE IRONDALE IRON AND STEEL PLANT SITE
IRONDALE, WA

ORGANISM RECIEPT LOGS

Territorial Seed Company
P.O. Box 158 • Cottage Grove, OR 97424 • 541-942-9547
www.territorialseed.com info@territorialseed.com

JPB

	Date	Order No.
1	05/06/08	823737A

BILL TO
BRIAN HESTER
NEWFIELDS NORTHWEST LLC
PO BOX 216
PORT GAMBLE, WA 98364-0216

SHIP TO
BRIAN HESTER
NEWFIELDS NORTHWEST LLC
4729 NE VIEW DR.
PORT GAMBLE, WA 98364

Customer No.	Sales I.D.	Reference #	Media Code	Terms
1003831	WW /WW		/HSES	XXXXXXXX1002 AMERICAN

			Phone Number	Total Wt.	Zone	# Packages	Ship Via
			(360) 297-6040	0.0	303	1	UP3

Message: Thank you for your order!

Ordered	B/O*	Shipped	Item #	Description		Unit Price	Disc	Extension
1	0	1	UP3	UPS 3-DAY SELECT		0.00	--	0.00
1	0	1	LT392/P	LETTUCE-BUTTERCRUNCH	4G	2.65	--	2.65
				MERCHANDISE INVOICE TOTAL $				2.65
				SHIPPING & HANDLING $				16.40
				INVOICE TOTAL $				19.05
				CR. CARD: AX, APPR:248228 $				-19.05

*** B/O - Products with a quantity in the B/O column are currently on back order. We will ship those items as soon as possible. You will not be charged additional shipping on back orders.**

NEWFIELDS

ORGANISM RECEIPT LOG

Date: 6/10/08

Time: 1440

NewFields Batch No. AR05378

Organism: Eisenia foetida

Source: Aquatic Research Organisms

Address: On File

Invoice Attached [✓ Yes] No

Phone: On File

Contact: Stan Sinitski

No. Ordered: 600

No. Received: 600 +

Source Batch: Hatchery

Condition of Organisms: Good

Approximate Size or Age: Mixed Age Adults

Shipper: Fed Ex

B of L (Tracking No.) 6884 6175 5378

Condition of Container: Good

Received By: MMB

Confirmation of ID of Organism: Yes [✓ No]

Technician (Initials): MMB

Notes:

pH (Units)	Temp. (°C)	D.O. (mg/L)	Conductivity or Salinity (Include Units)	Technician (Initials)
—	—	—	—	MMB

Notes: Shipped in moist soil

Aquatic Research Organisms

DATA SHEET

I. Organism History

Species Eisenie foetida

Source: Lab reared ____ Hatchery reared ✓ Field collected ____

Hatch date Mixed age adults Receipt date ____

Lot number 060908EF Strain ____

Brood origination F1

II. Water Quality N/A

Temperature ____ °C Salinity ____ ppt D.O. ____ ppm

pH ____ su Hardness ____ ppm Alkalinity ____ ppm

III. Culture Conditions

Freshwater ____ Saltwater ____ Other TOPSOIL/PEATMOSS

Recirculating ____ Flow through ____ Static ____

DIET: Flake food ____ Phytoplankton ____ Trout chow ____

Artemia ____ Rotifers ____ YCT ____ Other WORM CHOW

Prophylactic treatments: ____

Comments: keep worms moist, NOT WET!!
Keep cool.

IV. Shipping Information

Client: NewFields # of Organisms 600+

Carrier: FED EX Date shipped 6/9/08

Biologist: Stan [illegible]

NEWFIELDS

ORGANISM RECEIPT LOG

Date: 6/20/08

Time: 1700

NewFields Batch No. ARO 5632

Organism: Eisinia

Source: ARO

Address: On File

Invoice Attached Yes [✓ No]

Phone: On File

Contact: Stan

No. Ordered: 900

No. Received: 900 r

Source Batch: Mixed age culture

Condition of Organisms: Good

Approximate Size or Age: > 90 days

Shipper: FedEx

B of L (Tracking No.) 6884-6175-5632

Condition of Container: Good

Received By:

Confirmation of ID of Organism: Yes [✓ No]

Technician (Initials):

Notes:

pH (Units)	Temp. (°C)	D.O. (mg/L)	Conductivity or Salinity (Include Units)	Technician (Initials)
* NA				

Notes: * terrestrial earthworms

Aquatic Research Organisms

DATA SHEET

I. Organism History

Species Eisenia foeTida

Source: Lab reared ____ Hatchery reared ____ Field collected ____

Hatch date mixed age adults > 90 DAYS Receipt date ____

Lot number 061908EF Strain ____

Brood origination FL

II. Water Quality N/A

Temperature ____ °C Salinity ____ ppt D.O. ____ ppm

pH ____ su Hardness ____ ppm Alkalinity ____ ppm

III. Culture Conditions

Freshwater ____ Saltwater ____ Other peatmoss/topsoil

Recirculating ____ Flow through ____ Static ____

DIET: Flake food ____ Phytoplankton ____ Trout chow ____

Artemia ____ Rotifers ____ YCT ____ Other worm feed

Prophylactic treatments: ____

Comments: ____

IV. Shipping Information

Client: NEWFIELDS NH # of Organisms 900+

Carrier: FED EX Date shipped 6-19-08

Biologist: Stan Lemke

PO BOX 1271 HAMPTON NH 03843-1271 (603) 926-1650 AROFISH@AOL.COM

CHAIN OF CUSTODY

NEWFIELDS

NewFields N west, LLC.
Shipping: 4729 NE View Dr.
Mailing: P.O. Box 216
Port Gamble, WA. 98364
Tel: (360) 297-6040, Fax: (360)297-7268

CHAIN OF CUST Y

13274

Destination Lab: Port Gamble
Destination Contact: Brian Hester
Date: 6/6/08
Turn-Around-Time
Project Name: Irondale
Contract/PO:

Sample Originator:
Contact Name:
Address:
Phone:
Fax:
E-mail

Report Results To: Neil Morton
Contact Name: @ GeoEngineers
Address: Seattle WA
600 Stewart St Suite 1700
Phone: 206-728-2674
Fax:
Email: nmorton@geoengineers.c

Invoicing To:
Comments or Special Instructions:

No.	Sample ID	Matrix	No. & Type of Container	Date & Time	Analysis Bio Assay						Preservation	Sample Temp Upon Receipt	LAB ID
1	TP12-BA-080605-2	S	2 gal	6/5/08 915	X								
2	TP18-BA-080605-2			1610									
3	GEI-SS1-BA-080605-1			1135									
4	TP10-BA-080605-1			1210									
5	TP41-BA-080605-2			1250									
6	TP42-BA-080605-2.5			1350									
7	DP01-BA-080605-4			1330									
8	TP06-BA-080605-1			1500									
9	TP02-BA-080605-2.5			1530									
10	TP38-BA-080605-2			1600									
11	TP40-BA-080605-1		↓	1645									
12	TP15-BA-080606-2			6/6/08 940									
13	TP22-BA-080606-3			830									
14	TP03-BA-080606-2			1015									
15	TP32-BA-080606-3			1130									
16	TP24-BA-080606-3			1120									
17	TP11-BA-080606-3			1140									
18	TP08-BA-080606-4			1245									
19	TP23-BA-080600-2	↓	↓	↓ 930	↓								
20													

Relinquished by:	Recieved by:	Relinquished by:	Recieved by:
Print Name: Scott Lathen	Print Name: Mary Bacon	Print Name:	Print Name:
Signature:	Signature: Mary Bacon	Signature:	Signature:
Affiliation: Geo-Engineers	Affiliation: NewFields	Affiliation:	Affiliation:
Date/Time: 6/6/08 1445	Date/Time: 6/6/08, 1445	Date/Time:	Date/Time:

Matrix Codes
FW = Fresh Water
WW = Waste Water
SB = Salt & Brackish Water
SS = Soil & Sediment
TS = plant & Animal Tissue
OT = Other

WHITE – return to originator • YELLOW – lab • PINK – retained by originator

APPENDIX F

APOLLO GEOPHYSICS GEOPHYSICAL REPORT

APOLLO GEOPHYSICS
PO Box 28520
Bellingham, WA 98228
Phone: (360) 647-8303
Fax: (425) 671-0865
www.apollogeophysics.com

TECHNICAL MEMORANDUM

Geophysical Exploration Report

Project Identification: Irondale Iron & Steel Plant
Irondale, WA

Submitted to: Ron Bek, GeoEngineers, Inc.

Date(s) Field Effort Completed: Thursday, June 14, 2007

Owner: Jefferson County

Equipment Used: Noggin 250 Smart Cart & Electromagnetic

Project/Submittal No.: 07.2041

Field Effort Performed/Report Prepared by: MCR/LGB/LMR

This technical memorandum presents the results of geophysical exploration to determine the approximate depth and extents of potential metallic fill located at the former Irondale Iron & Steel Plant site in Irondale, Washington. A two-person field crew from **APOLLO GEOPHYSICS** completed the geophysical field program on Thursday, June 14, 2007.

We investigated the site, as directed by GeoEngineers, Inc. personnel, with an Electromagnetic (EM) instrument, to delineate the approximate lateral extents of potential metallic fill. We traversed the site with the EM instrument on grid of approximate 5-foot line spacings. We further investigated the site using Ground Penetrating Radar (GPR), which enabled us to map the relative depth and extents of potential metallic fill.

RESULTS OF THE GEOPHYSICAL SURVEY

This survey was completed to ascertain the subsurface conditions based on historical site use. We traversed the survey area with the EM instrument on a grid of 5-foot line spacings. Ten GPR traverses, A through J, were also completed in the survey area. The GPR traverses range from 50-feet to 695-feet in length. The approximate location of the EM and GPR survey area is presented on the Site Plan in Figure 1.

Overall the EM and GPR data correlate well. Potential metallic fill appears to be greatly concentrated to the Southeast near the 'Slag Outcrop' with concentrations decreasing to the Northwest, as shown by the dashed red line in Figure 2 . Both the EM and GPR data show minimal metallic fill along GPR Traverse A. The EM survey showed little evidence of potential metallic fill extending to the Northwest beyond the existing road.

EM and GPR anomalies, which may indicate the presence of potential underlying metallic fill, were located utilizing a Garmin 76CSx DGPS instrument. The GPS plot illustrating the approximate lateral extents of EM and GPR anomalies is presented on the Electromagnetic Survey – Lateral Extent Plot in Figure 2.

The GPR Imagery for the traverses is presented in Figures 3 through 7. The approximate interpreted bounds of metallic fill is presented on the GPR Imagery as dashed and solid yellow lines. Interpreted inter-mixed sands/metallic fill is shown as a dashed orange circle.

The ‘GPR Imagery’ presented in Figures 3 through 7 have a horizontal scale of approximately 1 inch equals 50 feet and vertical scale of approximately 1 inch equals 5 feet. With regard to the estimated vertical scale, the normal relationship between radar time and actual depth for the Northwest Region is approximately 4 to 4.5 nanoseconds per foot. It should be noted that this relationship holds true in a general sense. Variations of water content, silt content and other factors, such as the presence of concrete flooring, may also change this relationship. Therefore it should be expected that the vertical scale is an estimate only and may vary from the shown scale.

APOLLO GEOPHYSICS

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Bellingham, WA 98228
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TECHNICAL MEMORANDUM
Geophysical Exploration Report

Project Identification:
Irondale Iron & Steel Plant
Irondale, WA

Submitted to:
Ron Bek, GeoEngineers, Inc.

Date(s) Field Effort Completed:
Thursday, June 14, 2007

Owner:
Jefferson County

Equipment Used:
Noggin 250 SmartCart & Electromagnetic

Project/Submittal No.:
07.2041

Field Effort Performed/Report Prepared by:
MCR/LGB/LMR

ELECTROMAGNETIC

The electromagnetic, or EM device, transmits and receives an electromagnetic signal. The EM signal is transmitted through the ground, which in turn radiates a signal that is dependent on the ground conductivity and which is also received at the receiver. The two signals, the transmitted and ground response EM waves, are balanced for a zero response in the instrument. When the ground conditions change, for example, when the transmitted signal encounters buried metal, the balance or null point changes, and the instrument responds with an audible signal. Depending on the size of the metal object, the penetration is up to 10 feet in depth.

GROUND PENETRATING RADAR

APOLLO GEOPHYSICS uses a Noggin 250 SmartCart antenna for shallow subsurface investigations. The radar antenna transmits an electromagnetic step-pulse at a frequency of 250 MHz at a selected stack rate of 32. When the signal encounters a change in electrical properties/permittivity, a portion of the signal energy is reflected back to the surface. The character of the reflection is used to define the source of the reflection. The reflected signal is received by the antenna, processed and the raw data is recorded by the on-board Digital Video Logger (DVL) with a 256 MB compact flash drive. The DVL allows for control, display, and recording of real-time data. The radar displays the data in real-time, which enables us to review the data in the field for on the spot evaluation. The raw data, as recorded by the DVL, is then later processed to remove unwanted peripheral effects by proprietary GPR software. **APOLLO GEOPHYSICS** is a manufacturer representative of the Noggin SmartCart systems.

WARRANTY OF SERVICES: All geophysical information presented is based upon geophysical measurements made by generally accepted methods and field procedures and **APOLLO GEOPHYSICS'** interpretation of these data. The geophysical results are, therefore, interpretative in nature and are considered to be a reasonably accurate presentation of existing conditions within the limitations of the methods employed. Services performed by **APOLLO GEOPHYSICS** under this agreement are conducted in a manner consistent with, but no less than, that level of care skill ordinarily exercised by members of the profession currently practicing under similar conditions. We cannot guarantee the accuracy or correctness of any interpretation, and we shall not be liable or responsible for any loss, cost, damages or expenses incurred or sustained by the Client resulting from any interpretation made by any of our officers, agents or employees. No other warranty, expressed or implied, is made. **APOLLO GEOPHYSICS** recognizes that subsurface conditions may vary from those encountered at the location where geophysical or other explorations are made. The data interpretations and recommendations made by **APOLLO GEOPHYSICS** are based solely on the information available to them at the time of performance; and **APOLLO GEOPHYSICS** shall not be responsible for the interpretation, by others, of the information developed.

We appreciate the opportunity to conduct the Geophysical Exploration for this project. Please do not hesitate to contact us if you have any questions or comments. Please keep us informed on the developments pertaining to the project.

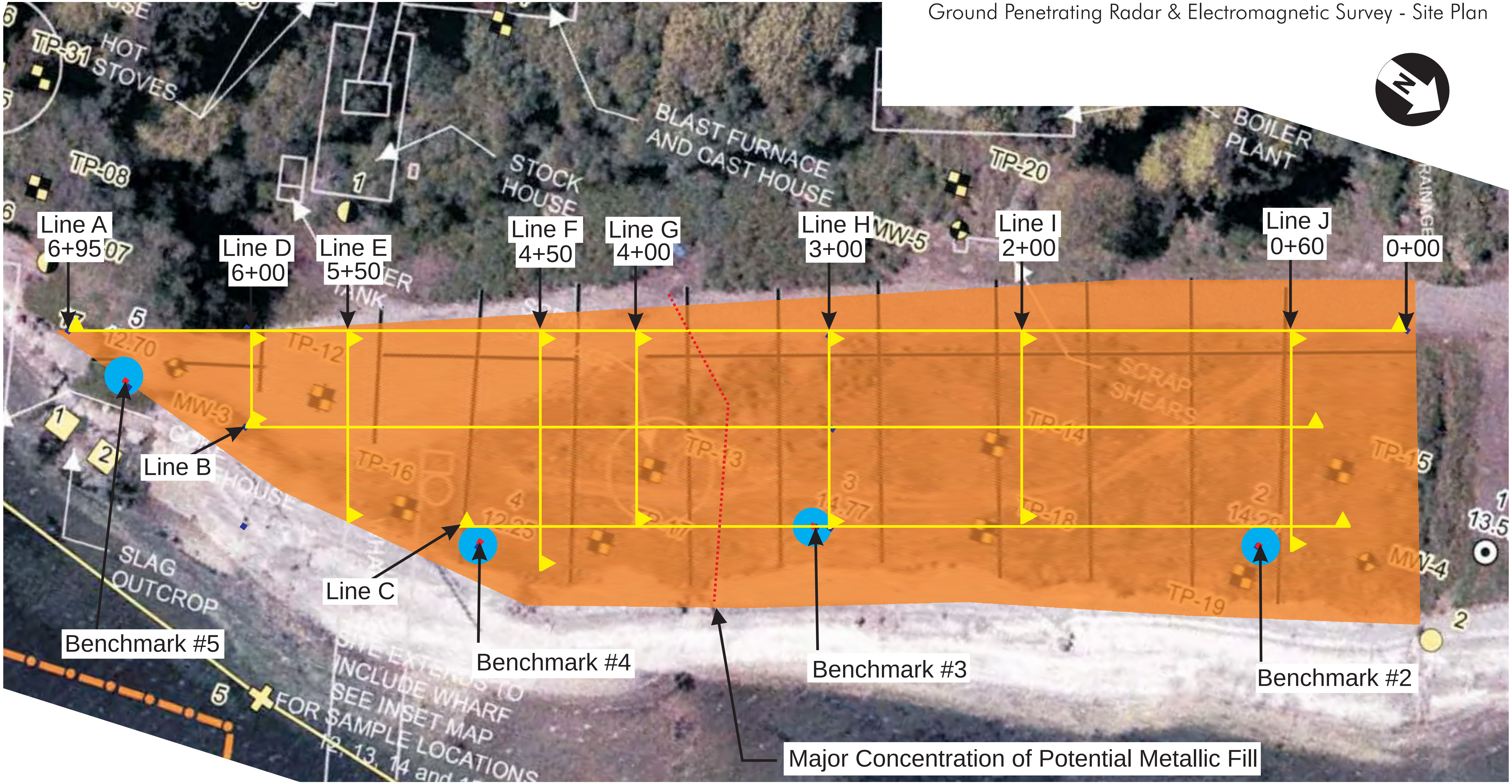
Attachment: Figures 1 through 7

Signed: Lynn M. Ringstad

Lynn M. Ringstad, Licensed Engineering Geologist

Date: Thursday, August 16, 2007

Ground Penetrating Radar & Electromagnetic Survey - Site Plan



🟧 Approximate Limits of EM Survey

▲—▲ Ground Penetrating Radar Traverses

0 50 100

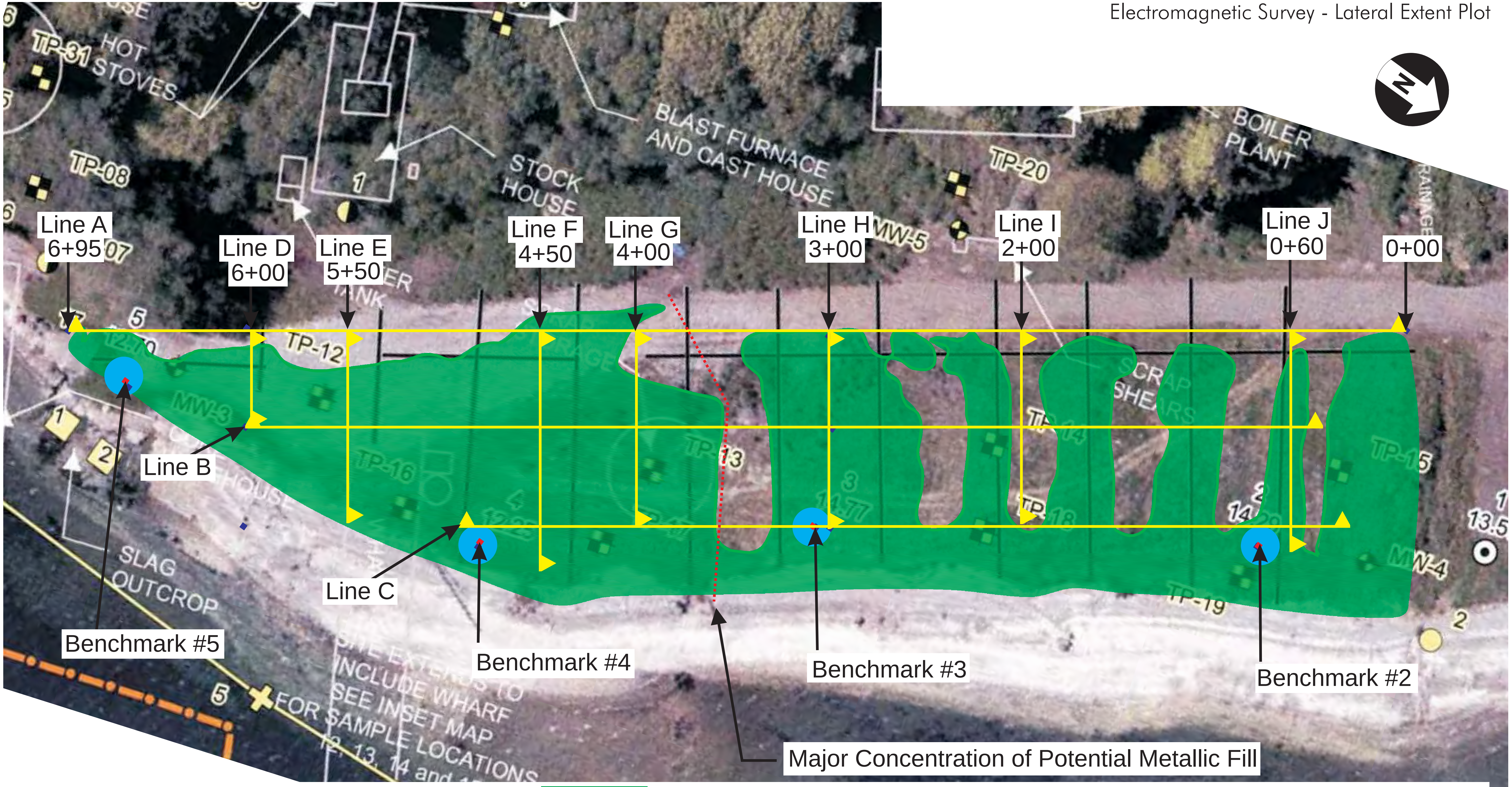
Approximate Scale 1" = 50'

NOTE: Site Plan based on an undated Site Map titled, "Approximate Sample Locations," by GeoEngineers. Locations of all features shown are approximate.

APOLLO GEOPHYSICS

Irondale Iron and Steel Plant Irondale, WA		**FIGURE** 1
FILE NO. 07.2041	**DATE** August 2007	

Electromagnetic Survey - Lateral Extent Plot



🟩 Approximate Lateral Extent of Potential Metallic Fill

▲—▲ Ground Penetrating Radar Traverses

0 50 100

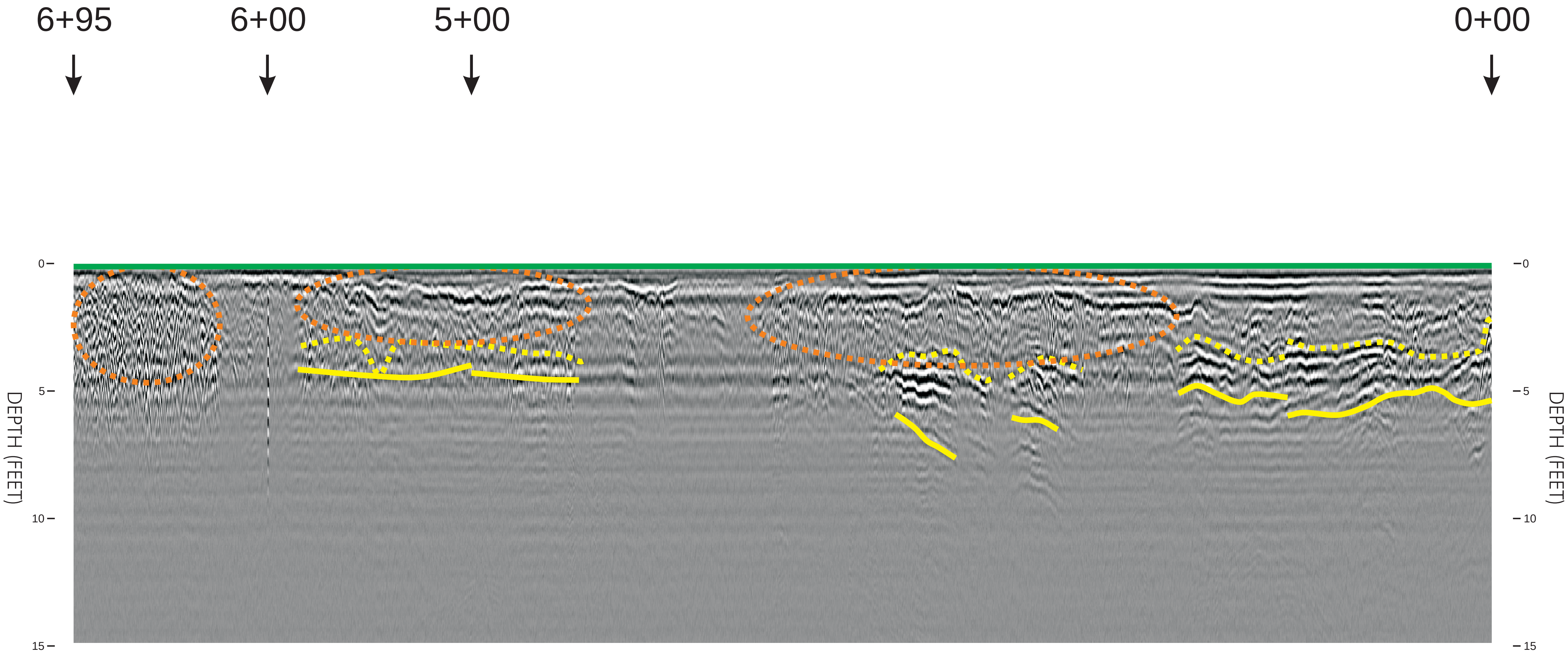
Approximate Scale 1" = 50'

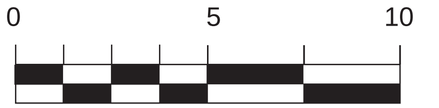
NOTE: Site Plan based on an undated Site Map titled, "Approximate Sample Locations," by GeoEngineers. Locations of all features shown are approximate.

APOLLO GEOPHYSICS

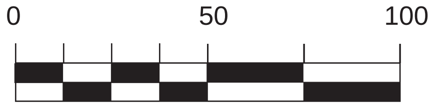
Irondale Iron and Steel Plant Irondale, WA		**FIGURE** 2
FILE NO. 07.2041	**DATE** August 2007	

Ground Penetrating Radar Imagery - LINE A





Approximate VERTICAL Scale 1" = 5'



Approximate HORIZONTAL Scale 1" = 50'

NOTE: The normal relationship between radar time and actual depth for the Northwest Region is approximately 4 to 4.5 nanoseconds per foot. It should be noted, that this relationship holds true in a general sense. Variations of water content, silt content, void space and other factors, such as the presence of concrete flooring, may also change this relationship.

🟩 Approximate Existing Ground Surface

◌ Interpreted Inter-Mixed Sands/Metallic Fill

▬ ▬ ▬ Interpreted Bounds of Metallic Fill

APOLLO GEOPHYSICS

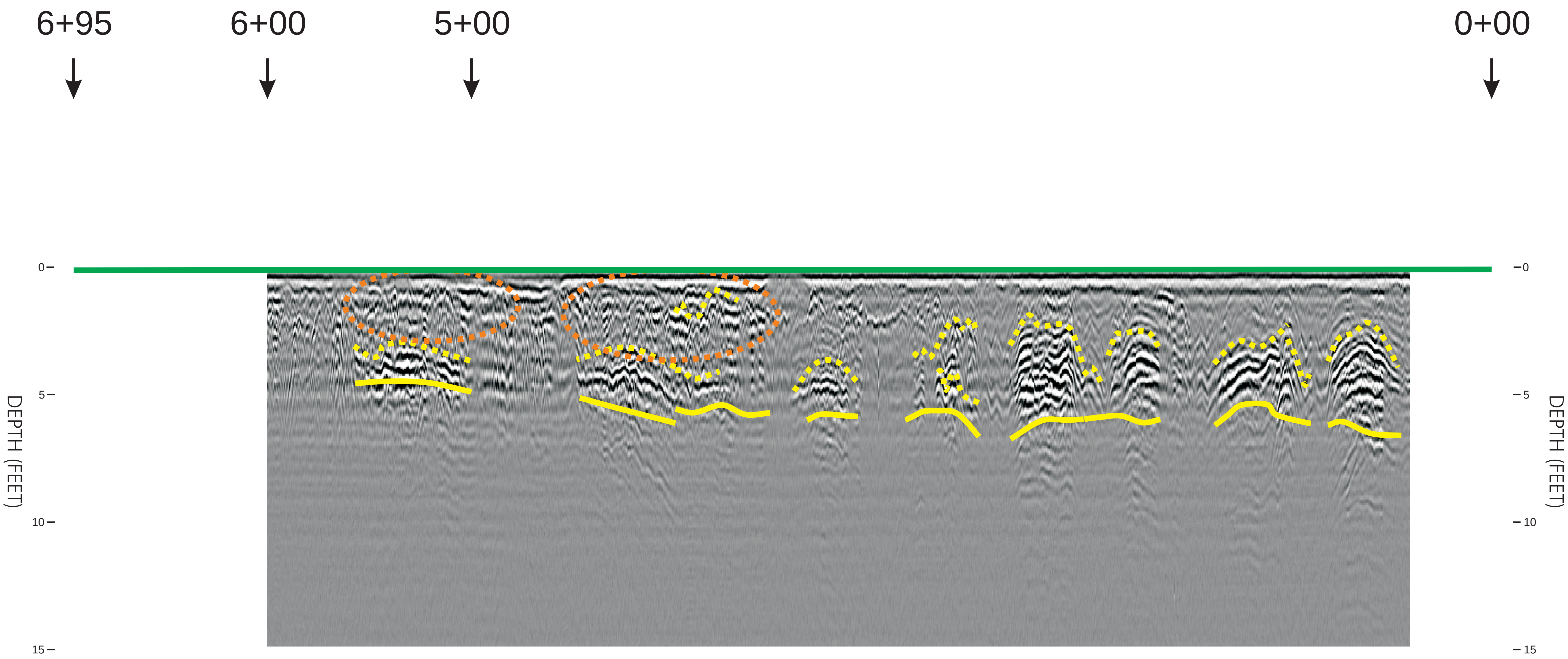
Irondale Iron and Steel Plant
Irondale, WA

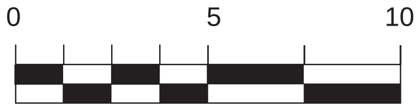
FIGURE
3

FILE NO.
07.2041

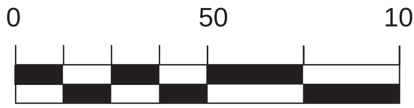
DATE
August 2007

Ground Penetrating Radar Imagery - LINE B





Approximate VERTICAL Scale 1" = 5'



Approximate HORIZONTAL Scale 1" = 50'

NOTE: The normal relationship between radar time and actual depth for the Northwest Region is approximately 4 to 4.5 nanoseconds per foot. It should be noted, that this relationship holds true in a general sense. Variations of water content, silt content, void space and other factors, such as the presence of concrete flooring, may also change this relationship.

━ Approximate Existing Ground Surface

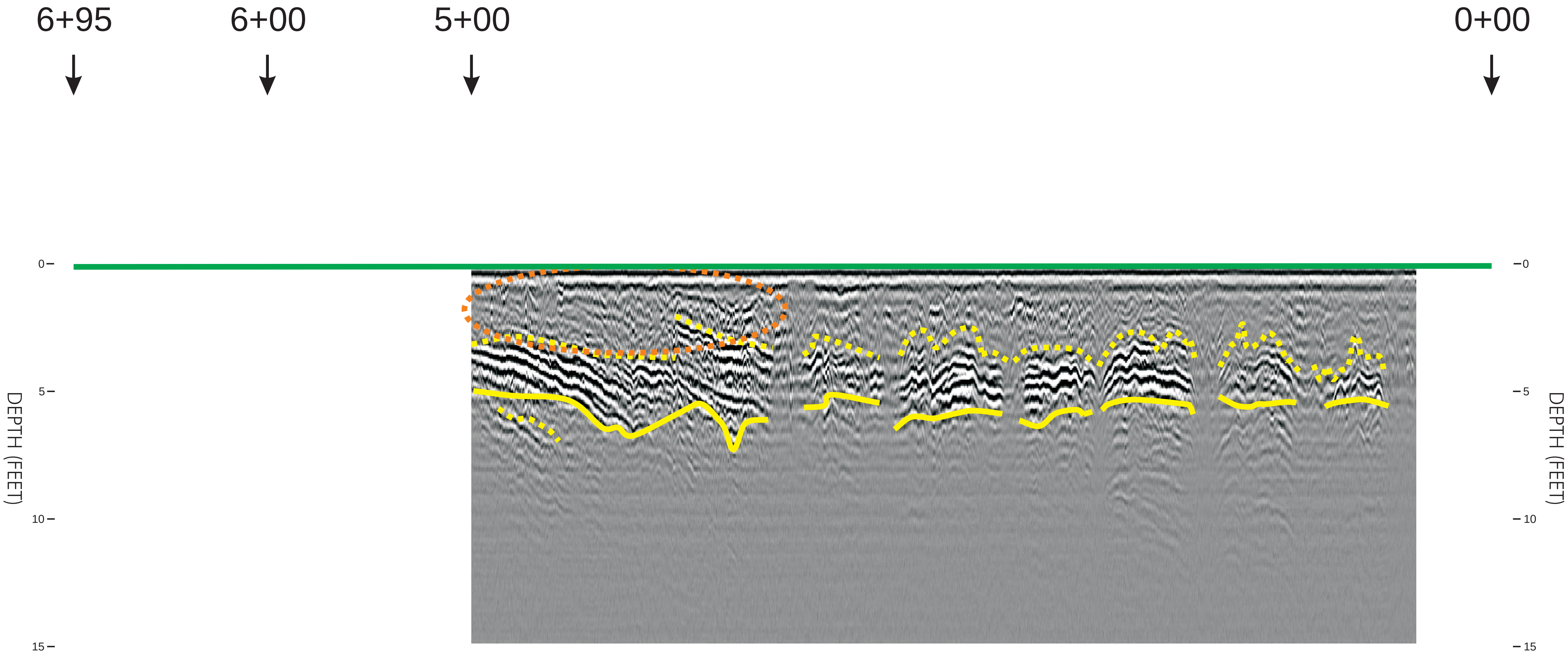
◌ Interpreted Inter-Mixed Sands/Metallic Fill

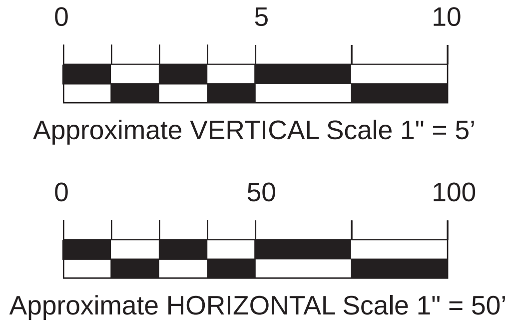
┅ ━ Interpreted Bounds of Metallic Fill

APOLLO GEOPHYSICS

Irondale Iron and Steel Plant Irondale, WA		**FIGURE** 4
FILE NO. 07.2041	**DATE** August 2007	

Ground Penetrating Radar Imagery - LINE C





NOTE: The normal relationship between radar time and actual depth for the Northwest Region is approximately 4 to 4.5 nanoseconds per foot. It should be noted, that this relationship holds true in a general sense. Variations of water content, silt content, void space and other factors, such as the presence of concrete flooring, may also change this relationship.

🟩 Approximate Existing Ground Surface

○ Interpreted Inter-Mixed Sands/Metallic Fill

- - - Interpreted Bounds of Metallic Fill

APOLLO GEOPHYSICS

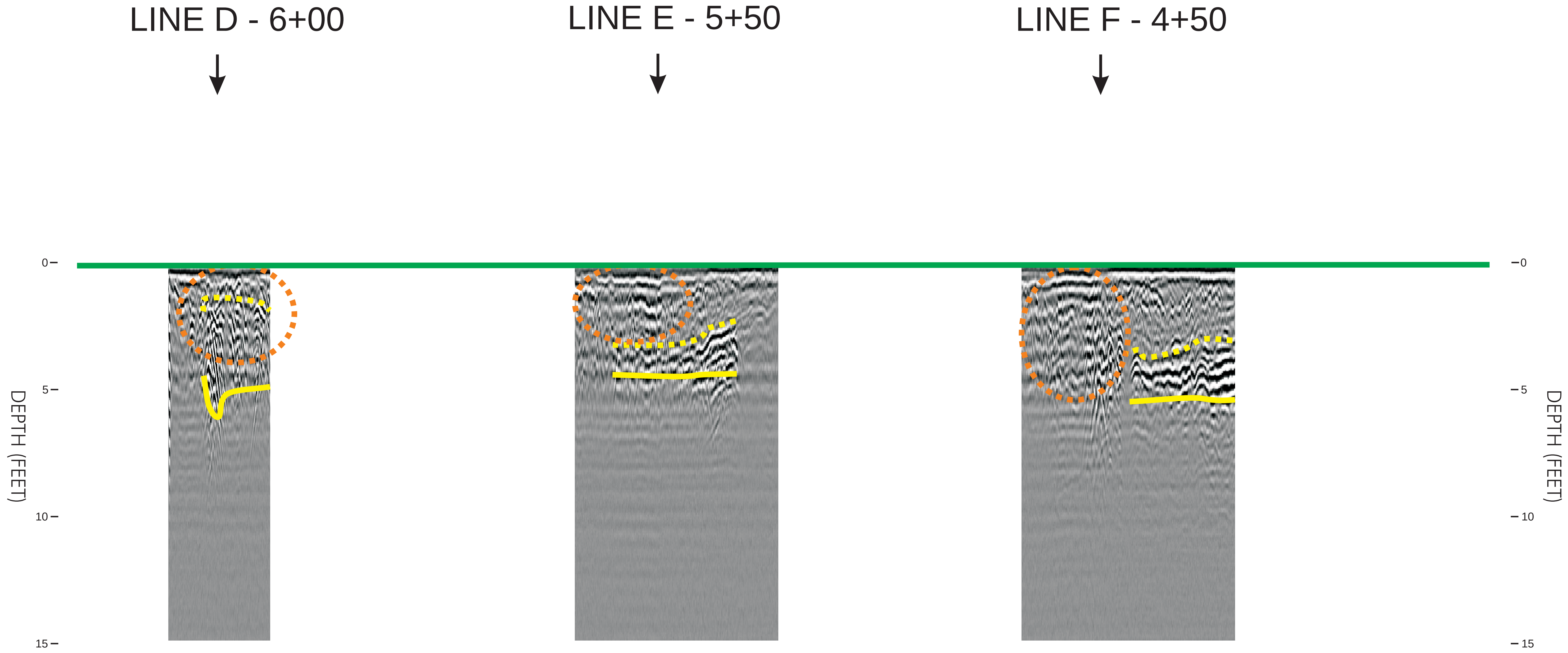
Irondale Iron and Steel Plant
Irondale, WA

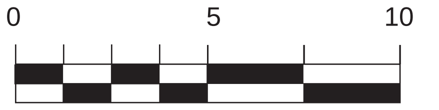
FIGURE
5

FILE NO.
07.2041

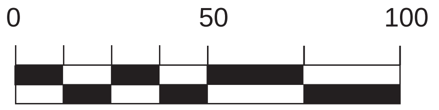
DATE
August 2007

Ground Penetrating Radar Imagery - LINE D through F





Approximate VERTICAL Scale 1" = 5’



Approximate HORIZONTAL Scale 1" = 50’

NOTE: The normal relationship between radar time and actual depth for the Northwest Region is approximately 4 to 4.5 nanoseconds per foot. It should be noted, that this relationship holds true in a general sense. Variations of water content, silt content, void space and other factors, such as the presence of concrete flooring, may also change this relationship.

━ Approximate Existing Ground Surface

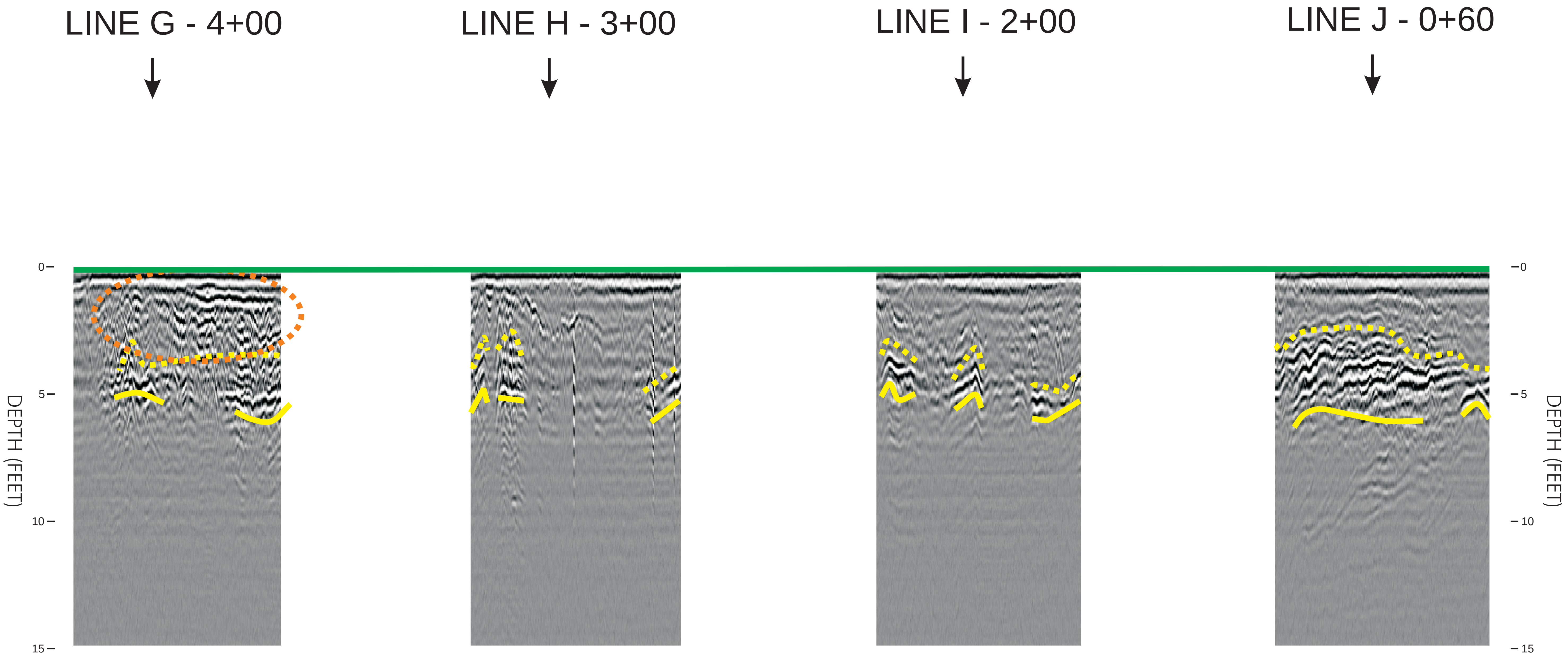
◌ Interpreted Inter-Mixed Sands/Metallic Fill

╌ ━ Interpreted Bounds of Metallic Fill

APOLLO GEOPHYSICS

Irondale Iron and Steel Plant Irondale, WA		**FIGURE** 6
FILE NO. 07.2041	**DATE** August 2007	

Ground Penetrating Radar Imagery - LINE G through J



0 5 10

Approximate VERTICAL Scale 1" = 5'

0 50 100

Approximate HORIZONTAL Scale 1" = 50'

NOTE: The normal relationship between radar time and actual depth for the Northwest Region is approximately 4 to 4.5 nanoseconds per foot. It should be noted, that this relationship holds true in a general sense. Variations of water content, silt content, void space and other factors, such as the presence of concrete flooring, may also change this relationship.

━ Approximate Existing Ground Surface

○ Interpreted Inter-Mixed Sands/Metallic Fill

- - - ━ Interpreted Bounds of Metallic Fill

aG
APOLLO GEOPHYSICS

Irondale Iron and Steel Plant Irondale, WA		**FIGURE** 7
FILE NO. 07.2041	**DATE** August 2007	

APPENDIX G

ATSDR HEALTH CONSULTATION

Health Consultation

Evaluation of Selected Metals in Irondale Beach Park and Chimacum Creek Tidelands Shellfish

IRONDALE, JEFFERSON COUNTY, WASHINGTON

JULY 28, 2008

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR Toll Free at
1-800-CDC-INFO
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

Evaluation of Selected Metals in Irondale Beach Park and Chimacum Creek Tidelands Shellfish

IRONDALE, JEFFERSON COUNTY, WASHINGTON

Prepared By:
Washington State Department of Health
Under Cooperative Agreement with the
The U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Forward

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This health consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of this health consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on specific health issues so that DOH can respond to requests from concerned residents or agencies for health information on hazardous substances. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health. The findings in this report are relevant to conditions at the site during the time of this health consultation, and should not necessarily be relied upon if site conditions or land use changes in the future.

For additional information or questions regarding DOH or the contents of this health consultation, please call the health advisor who prepared this document:

Lenford O’Garro
Washington State Department of Health
Office of Environmental Health Assessments
P.O. Box 47846
Olympia, WA 98504-7846
(360) 236-3376
FAX (360) 236-2251
1-877-485-7316
Web site: www.doh.wa.gov/ehp/oehas/sas.htm

For persons with disabilities this document is available on request in other formats. To submit a request, please call 1-800-525-0127 (voice) or 1-800-833-6388 (TTY/TDD).

For more information about ATSDR, contact the ATSDR Information Center at 1-888-422-8737 or visit the agency’s Web site: www.atsdr.cdc.gov/.

Table of Contents

Glossary

Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Aquifer	An underground formation composed of materials such as sand, soil, or gravel that can store and/or supply groundwater to wells and springs.
Cancer Risk Evaluation Guide (CREG)	The concentration of a chemical in air, soil or water that is expected to cause no more than one excess cancer in a million persons exposed over a lifetime. The CREG is a *comparison value* used to select contaminants of potential health concern and is based on the *cancer slope factor* (CSF).
Cancer Slope Factor	A number assigned to a cancer causing chemical that is used to estimate its ability to cause cancer in humans.
Carcinogen	Any substance that causes cancer.
Comparison value	Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.
Contaminant	A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.
Dermal Contact	Contact with (touching) the skin (see route of exposure).
Dose (for chemicals that are not radioactive)	The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An “exposure dose” is how much of a substance is encountered in the environment. An “absorbed dose” is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.
Environmental Media Evaluation Guide (EMEG)	A concentration in air, soil, or water below which adverse non-cancer health effects are not expected to occur. The EMEG is a *comparison value* used to select contaminants of potential health concern and is based on ATSDR’s *minimal risk level* (MRL).

Environmental Protection Agency (EPA)	United States Environmental Protection Agency.
Exposure	Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].
Groundwater	Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.
Ingestion	The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].
Ingestion rate	The amount of an environmental medium that could be ingested typically on a daily basis. Units for IR are usually liter/day for water, and mg/day for soil.
Inhalation	The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].
Inorganic	Compounds composed of mineral materials, including elemental salts and metals such as iron, aluminum, mercury, and zinc.
Lowest Observed Adverse Effect Level (LOAEL)	The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.
Maximum Contaminant Level (MCL)	A drinking water regulation established by the federal Safe Drinking Water Act. It is the maximum permissible concentration of a contaminant in water that is delivered to the free flowing outlet of the ultimate user of a public water system. MCLs are enforceable standards.
Media	Soil, water, air, plants, animals, or any other part of the environment that can contain contaminants.

Minimal Risk Level (MRL)	An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see **reference dose**].
Model Toxics Control Act (MTCA)	The hazardous waste cleanup law for Washington State.
No apparent public health hazard	A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.
No Observed Adverse Effect Level (NOAEL)	The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.
Oral Reference Dose (RfD)	An amount of chemical ingested into the body (i.e., dose) below which health effects are not expected. RfDs are published by EPA.
Organic	Compounds composed of carbon, including materials such as solvents, oils, and pesticides that are not easily dissolved in water.
Parts per billion (ppb)/Parts per million (ppm)	Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene (TCE) in 1 million ounces of water is 1 ppm. 1 ounce of TCE in 1 billion ounces of water is 1 ppb. If one drop of TCE is mixed in a competition size swimming pool, the water will contain about 1 ppb of TCE.
Plume	A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.
Reference Dose Media Evaluation Guide (RMEG)	A concentration in air, soil, or water below which adverse non-cancer health effects are not expected to occur. The RMEG is a *comparison value* used to select contaminants of potential health concern and is based on EPA's oral reference dose (RfD).
Route of exposure	The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Surface Water	Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with **groundwater**].
Volatile organic compound (VOC)	Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Summary and Statement of Issues

The Washington State Department of Health (DOH) prepared this health consultation to evaluate contaminants found in shellfish from Irondale Beach Park and Chimacum Creek Tidelands. The purpose of this health consultation is to fulfill a data gap based on a single composite sample from Jefferson County Public Health (JCPH). DOH prepares health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

Background

Irondale Beach Park is located along the sheltered Port Townsend Bay on the northeastern corner of the Olympic Peninsula in Irondale, Jefferson County, Washington State (see Figure 1). The city of Irondale was platted in 1909 with a population of 1500 and plans were made for a booming city of 20,000 in three years [1]. The community was named for an iron smelting plant. Irondale Furnace, Puget Sound Iron Company (Irondale Furnace) was built in 1880-1881 and operated a hot blast, open top furnace that produced # 1 foundry pig iron with an annual capacity of 10,000 tons [2]. Irondale Furnace operated through 1889 then closed. The smelting plant later reopened as Western Steel Company and smelting continued intermittently into the early 1900’s.

Today, Irondale is an unincorporated community and is part of the “Tri-Area” of Irondale, Chimacum and Port Hadlock in central-east Jefferson County. In 2001, Jefferson County purchased the 13-acre former industrial site and shoreline area (Irondale Beach Park). In 2005, a citizen complained of oil on the beach and the Washington State Department of Ecology (Ecology) investigated and took three samples. These samples revealed the presence of severely weathered fuel oil that exceeded the state's Model Toxic Control Act (MTCA) cleanup level. In March 2006, Ecology placed the site on the suspected contaminated site list. Irondale Beach Park has been identified as a high-priority cleanup area as part of Governor Christine Gregoire’s Puget Sound Initiative, to protect and restore Puget Sound and Hood Canal to good ecosystem health by 2020.

In December 2006, Irondale Beach Park was closed pending concerns about potential human health risks. Jefferson County Public Health (JCPH) conducted additional tests including a single multi-species composite shellfish sample. The shellfish tissue was analyzed for polycyclic aromatic hydrocarbons (PAHs) and metals. The sample results indicated that lead may be of concern to human health especially for young children, but the nature in which the sample was taken did not follow standard protocols. Therefore, DOH recommended additional shellfish sampling at the site. In April 2007, Irondale Beach Park was reopened to the public. However, JCPH and Jefferson County posted signs warning of possible risk to human health from consumption of intertidal shellfish harvested in the area. Currently, DOH Office of Shellfish and Water Protection has a marine biotoxin closure for butter clams in the Chimacum Creek Tidelands and Irondale Beach Park area.

The Washington State Department of Fish and Wildlife (WDFW) indicated that there are sufficient numbers of native littleneck clams (*Protothaca staminea*) at Irondale Beach Park. The WDFW also indicated the adjoining Chimacum Creek Tidelands has native littleneck clams, butter clams (*Saxidomus giganteus*), horse clams (*Tresus nuttalli* and *Tresus capax*) and eastern softshell clams (*Mya arenaria*). According to WDFW beach surveys, about 1,334 recreational harvesters collected shellfish from the Irondale Beach Park growing area in 2005.

Sample Collection, preparation, and analysis

Two different regions were sampled by DOH, Figure 2: (A) Irondale Beach Park and (B) Chimacum Creek Tidelands. Table 1 shows the species and sample location. All shellfish samples were collected during a low tidal cycle on June 14, 2007, as close to the water as practical. All clams taken for analysis were of legal size and all specimens were unbroken. Each sample of the primary species (Littleneck clams) consisted of 30 individual organisms with the exception of the two samples from Irondale Beach Park, which consisted of 23 and 24 individual of the same species. Each sample of the secondary species (Butter clams) consisted of 15 individual organisms of the same species. Each sample was placed in zipper-locked plastic bags, given a unique identifier, placed on ice, and hand delivered to Severn Trent Laboratories (STL) Seattle located in Fife. Samples were shucked, and then the tissues were homogenized and analyzed by STL. Tissues were analyzed for total arsenic, cadmium, chromium, copper, lead, and zinc.

Table1. Sample summary for shellfish sampled in Irondale beach and Chimacum Creek Tidelands, Irondale, Jefferson County, Washington. Note: each sample was composed of 15 to 30 individuals (see text above).

Sample species	Number of samples	
	Irondale	Chimacum
Littleneck clams	2	3
Butter clams	2	1

Results

Results of the shellfish analyses are presented in Tables 2 - 5. The mean and maximum concentrations for each species are shown in Tables 4 and 5. There were no obvious differences in metal concentrations between sample locations where Littleneck clams were taken. However, there may be differences in metals (arsenic, cadmium and copper) concentrations between species (Table 2). Due to small sample size from each area, variances in species differences were not calculated. When compared to the mean range for metals found in littleneck clams in the Puget Sound, the littleneck clam means from Irondale Beach Park and Chimacum Creek Tidelands are within the Puget Sound range (Table 3).

Table 2: Analytical results for sample taken from Irondale Beach Park and Chimacum Creek Tidelands in Irondale, Washington.

Littleneck	**Arsenic (ppm)**	**Cadmium (ppm)**	**Chromium (ppm)**	**Copper (ppm)**	**Lead (ppm)**	**Zinc (ppm)**
1	1.7	0.24	0.11 J	1.4	0.13 J	13 B
2	1.9	0.27	0.14 J	1.4	0.061 J	13 B
3	2.1	0.44	0.084 J	1.3	0.027 J	16 B
4	1.7	0.27	0.12 J	1.2	0.029 J	14 B
5	1.9	0.28	0.074 J	1.2	0.030 J	17 B
Butter	**Arsenic (ppm)**	**Cadmium (ppm)**	**Chromium (ppm)**	**Copper (ppm)**	**Lead (ppm)**	**Zinc (ppm)**
1	2.8	0.060 J	0.52	1.8	0.11 J	12 B
2	2.7	0.084 J	0.52	2.1	0.14 J	13 B
3	2.5	0.083 J	0.36	2.1	0.056 J	15 B

J - Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
B - Compound was found in the blank and sample.
PPM – parts per million

Table 3: Comparison of the Irondale Beach Park and Chimacum Creek Tidelands littleneck clam mean to the Puget Sound littleneck clam mean range, Washington.

Location	**Arsenic (ppm)**	**Cadmium (ppm)**	**Copper (ppm)**	**Lead (ppm)**	**Zinc (ppm)**
Puget Sound Littleneck clams mean range	1.36 – 2.54	0.16 – 0.33	0.73 – 1.8	0.0 – 0.24	10.32 – 15.08
IBP & CCT Littleneck clams mean	1.9	0.3	1.3	0.06 J	15.0 B

J - Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
B - Compound was found in the blank and sample.
PPM – parts per million

Discussion

Contaminants of Concern

Contaminants of concern (COC) in shellfish were determined by employing a screening process. Screening values (SV) were developed according to EPA guidance and are used to narrow the focus of evaluation to contaminants that are present at potential levels of public health concern [3]. Maximum shellfish contamination levels from each contaminant were screened against SV for cancer and non-cancer health effects (see Table 4, 5 and Appendix A).

For chemicals that cause cancer, SV represent levels that are calculated to increase the risk of cancer by about one in one hundred thousand. With the exception of lead, SV for chemicals that do not cause cancer represent levels that are not expected to cause any health problems. These types of SV often form the basis for cleanup. In general, if a contaminant's maximum concentration is greater than its SV, then the contaminant is evaluated further. However, for lead the evaluation is based on the goal of keeping blood lead levels in most children below 10 micrograms per deciliter (µg/dl).

The contaminants of concern are highlighted in bold in Table 4 and 5 below. These contaminants will be evaluated in the following section. Other contaminants are not present at levels of concern and are not evaluated in this document.

Table 4: Mean and maximum metal concentrations found in shellfish and screening value used in evaluating shellfish from Irondale beach, Irondale, Jefferson County, Washington.

Metals	**Littleneck clams** Concentration (ppm)		**Butter clams** Concentration (ppm)		**Screening Value** Concentration (ppm)		**Contaminant of concern**
	Mean	Maximum	Mean	Maximum	Non-Cancer	Cancer	
Total Arsenic	1.8	1.9	2.75	2.8	NA	NA	NA
Inorganic Arsenic 1 % of total	**0.018**	**0.019**	**0.0275**	**0.028**	0.065	**0.00038**	**Yes**
Cadmium	**0.255**	**0.27**	0.072	0.084 J	**0.22**	NA*	**Yes**
Chromium	0.125	0.14 J	0.52	0.52	0.65	NA	No
Copper	1.4	1.4	1.95	2.1	8.7	NA	No
Lead	0.096	0.13 J	0.125	0.14 J	NA**	NA**	**Yes**
Zinc	13.0	13.0 B	12.5	13.0 B	65.2	NA	No

NA- Not applicable
* Cadmium cancer risk is based on inhalation not ingestion.
**IEUBK - Integrated Exposure Uptake Biokinetic Model for Lead in Children is used to predict blood lead in children.
J - Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
B - Compound was found in the blank and sample.
PPM – parts per million

Table 5: Mean and maximum metal concentrations found in shellfish and screening value used in evaluating shellfish from Chimacum Creek Tidelands, Irondale, Jefferson County, Washington.

Metals	**Littleneck clams** Concentration (ppm)		**Butter clams** Concentration (ppm)	**Screening Value** Concentration (ppm)		**Contaminant of concern**
	Mean	Maximum	Maximum	Non-Cancer	Cancer	
Total Arsenic	1.9	2.1	2.5	NA	NA	NA
Inorganic Arsenic 1 % of total	**0.019**	**0.021**	**0.025**	0.065	**0.00038**	**Yes**
Cadmium	**0.33**	**0.44**	0.083 J	**0.22**	NA*	**Yes**
Chromium	0.093	0.12 J	0.36	0.65	NA	No
Copper	1.23	1.3	2.1	8.7	NA	No
Lead	0.029	0.03 J	0.056 J	NA**	NA**	No
Zinc	15.7	17.0 B	15.0 B	65.2	NA	No

NA- Not applicable
* Cadmium cancer risk is based on inhalation not ingestion.
**IEUBK - Integrated Exposure Uptake Biokinetic Model for Lead in Children is used to predict blood lead in children.
J - Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
B - Compound was found in the blank and sample.
PPM – parts per million

Chemical Specific Toxicity

Lead – *Occurrence, Health Concerns, and Risks*

Lead is a naturally occurring chemical element that is normally found in soil. In Washington, normal soil background concentrations rarely exceed 20 ppm [4]. However, the widespread use of certain products (such as leaded gasoline, lead-containing pesticides, and lead-based paint) and the emissions from certain industrial operations (such as smelters) has resulted in significantly higher levels of lead in soil in many areas of the state.

Elimination of lead in gasoline and solder used in food and beverage cans has greatly reduced exposure to lead. Currently, the main pathways of lead exposure in children are ingestion of paint chips, contaminated soil and house dust, and drinking water in homes with old plumbing.

Children less than seven years old are particularly vulnerable to the effects of lead. Compared to older children and adults, they tend to ingest more dust and soil, absorb significantly more of the lead that they swallow, and more of the lead that they absorb can enter their developing brain. Pregnant women and women of childbearing age should also be aware of lead in their environment because lead ingested by a mother can affect the unborn fetus.

Health effects

Exposure to lead can be monitored by measuring the level of lead in the blood. In general, blood lead rises 3-7 μg/dl for every 1,000 ppm increase in soil or dust concentration [5]. For children, the Centers for Disease Control and Prevention (CDC) has defined an elevated blood lead level (BLL) as greater than or equal to 10 micrograms of lead per deciliter of blood (μg/dl) [6]. However, there is growing evidence that damage to the central nervous system resulting in learning problems can occur at blood lead levels less than 10 μg/dl. About 2.2 percent of children in the U.S. have blood lead levels greater than 10 μg/dl.

Lead poisoning can affect almost every system of the body and often occurs with no obvious or distinctive symptoms. Depending on the amount of exposure a child has, lead can cause behavioral and learning problems, central nervous system damage, kidney damage, reduced growth, hearing impairment, and anemia [7].

In adults, lead can cause health problems such as high blood pressure, kidney damage, nerve disorders, memory and concentration problems, difficulties during pregnancy, digestive problems, and pain in the muscles and joints [7]. These have usually been associated with blood lead levels greater than 30 μg/dl.

Because of chemical similarities to calcium, lead can be stored in bone for many years. Even after exposure to environmental lead has been reduced, lead stored in bone can be released back into the blood where it can have harmful effects. Normally this release occurs relatively slowly. However, certain conditions, such as pregnancy, lactation, menopause, and hyperthyroidism can cause more rapid release of the lead, which could lead to a significant rise in blood lead level [8].

Arsenic

Arsenic is a naturally occurring element in the earth's soil. Background soil arsenic concentrations in Puget Sound Basin range from about 1.5 to 17.1 ppm [4]. However, the widespread use of arsenic-containing pesticides and emissions from certain smelters has resulted in significantly higher levels of arsenic on many properties in the state. There are two forms of arsenic - organic and inorganic. The EPA established oral reference dose (RfD) for arsenic is 0.0003 mg/kg/day based on skin color changes and excessive growth of tissue (human data) [9]. EPA classifies the inorganic form of arsenic as a human carcinogen. The recent EPA IRIS review draft presented a cancer slope factor for combined lung and bladder cancer of 5.7 per mg/kg/day [10]. The slope factor calculated from the work by the National Research Council is about 21 per mg/kg/day [11]. These slope factors could be higher if the combined risk for all arsenic-associated cancers (bladder, lung, skin, kidney, liver, etc.) were evaluated. For this health consultation, DOH used a slope factor of 5.7 per mg/kg/day, which appears to reflect EPA's most recent assessment.

Studies have shown inorganic arsenic is much more harmful than organic arsenic. Therefore, DOH will base this health evaluation on the levels of inorganic arsenic present in shellfish samples. Generally, inorganic arsenic in fish and shellfish normally ranged from about 1-20% of the total arsenic [9, 11, 12, 13]. Ecology's evaluation of shellfish in the Puget Sound indicated that less than 1% of the total arsenic found was in the inorganic form of arsenic [14]. For this health consultation, DOH assumed that 1% of the total arsenic detected was inorganic arsenic. Therefore, 1% of the concentration was used to calculate the estimated dose from exposure to inorganic arsenic in shellfish.

Cadmium

Cadmium is a naturally occurring element in the earth's crust. Cadmium is used mainly in batteries, pigments, metal coatings, and metal alloys. Cadmium is found in most foods at low levels, with the lowest levels found in fruits and the highest found in leafy vegetables and potatoes. Shellfish have higher cadmium levels (up to 1 ppm) than other types of fish or meat. Cadmium is stored in the liver and kidneys and slowly leaves the body in the urine and feces [15]. However, high levels of cadmium will cause kidney damage, and causes bones to become fragile and break easily. Occupational exposure to inhaled cadmium is suspected to be a cause of lung cancer in workers, while animal studies have confirmed the ability of cadmium to cause lung tumors via the inhalation route. Studies of workers exposed to airborne cadmium also suggest a link with prostate cancer. The ability of cadmium to cause cancer via the oral route is disputed. The RfD for cadmium that is ingested with food is 0.001 mg/kg/day.

Evaluating non-cancer hazards

Exposure assumptions for estimating contaminant doses from shellfish exposure are found in Appendix B, Table B1 – B2. In order to evaluate the potential for non-cancer adverse health affects that may result from exposure to contaminated media (i.e., air, water, soil, and sediment), a dose is estimated for each contaminant of concern. These doses are calculated for situations (scenarios) in which area residents or vacationers might be exposed to the contaminated media. The estimated dose for each contaminant under each scenario is then compared to EPA's oral reference dose (RfD). RfDs are doses below which non-cancer adverse health effects are not expected to occur (so-called "safe" doses). They are derived from toxic effect levels obtained from human population and laboratory animal studies. These toxic effect levels can be either the lowest-observed adverse effect level (LOAEL) or a no-observed adverse effect level (NOAEL). In human or animal studies, the LOAEL is the lowest dose at which an adverse health effect is seen, while the NOAEL is the highest dose that did not result in any adverse health effects.

Because of uncertainty in these data, the toxic effect level is divided by "safety factors" to produce the lower and more protective RfD. If a dose exceeds the RfD, this indicates only the potential for adverse health effects. The magnitude of this potential can be inferred from the degree to which this value is exceeded. If the estimated exposure dose is only slightly above the

RfD, then that dose will fall well below the toxic effect level. The higher the estimated dose is above the RfD, the closer it will be to the actual toxic effect level. This comparison is called a hazard quotient (HQ) and is given by the equation below:

$$HQ = \frac{\text{Estimated Dose (mg/kg-day)}}{\text{RfD (mg/kg-day)}}$$

Estimated exposure doses, exposure assumptions, and hazard quotients are presented in Appendix B for COCs (arsenic and cadmium) found in shellfish. Based on exposure estimates quantified in Appendix B, the general population (adults and children) are not likely to experience adverse non-cancer health effects from exposure to chemical contaminants in shellfish. High end consumption, estimated doses from exposure to cadmium in shellfish species from Irondale Beach Park and Chimacum Creek Tidelands, resulted in hazard quotients in excess of one (see Appendix B, Table B3). However, as mentioned above, if the estimated exposure dose is only slightly above the RfD, then that dose will likely fall well below the toxic effect level. The higher the estimated dose is above the RfD, the closer it will be to the actual toxic effect level. In addition, based on the Suquamish Tribe shellfish species-specific consumption rate for 90th percentile consumers only, high-end consumption would not result in hazard quotients in excess of one.

Evaluating exposure to lead

The biokinetics of lead are different from most toxicants because it is stored in bone and remains in the body long after it is ingested. Children’s exposure to lead is evaluated through the use of the Integrated Exposure Uptake Biokinetic Model for lead in children (IEUBK) developed by the EPA. The IEUBK predicts blood lead levels in a distribution of exposed children based on the amount of lead that is in environmental media (e.g. shellfish) [16]. It is important to note that the IEUBK model is not expected to accurately predict the blood lead level of a child (or a small group of children) at a specific point in time. In part, this is because a child (or group of children) may behave differently, and therefore have different amounts of exposure to contaminated soil and dust, than the average group of children used by the model to calculate blood lead levels. For example, the model does not take into account reductions in exposure that could result from community education programs. Despite this limitation, the IEUBK model is a useful tool to help prevent lead poisoning because of the information it can provide about the hazards of environmental lead exposure. For children who are regularly exposed to lead-contaminated shellfish, the IEUBK model can estimate the percentage of young children who are likely to have blood lead concentrations that exceed a level that may be associated with health problems (usually 10 µg/dl).

Average shellfish lead concentrations and estimated blood lead levels

The IEUBK model was used to estimate the percentage of children that could have elevated blood lead levels if they frequently eat lead contaminated shellfish. Exposure assumptions for estimating blood lead from shellfish exposure are found in Appendix C, Table C1. Default parameters were used for all other model inputs [16]. Exposure were based on a general population scenario of children eating 0.57 g/day or Tribal high-end consumer scenario of children eating 34.8 g/day of shellfish containing the average or maximum concentration of lead. Based on these scenarios, the model indicates no children would exceed the EPA's criteria of no more than 5% of the community with BLLs above 10 µg/dL (see Appendix C, Table C1 – C2).

The adult lead model was used to estimate the percentage of fetus that would have elevated blood lead levels if women frequently ate lead contaminated shellfish. Exposure assumptions for estimating blood lead from shellfish exposure are found in Appendix C, Table C3 – C4. Exposures were based on a general population scenario of adults eating 17.5 g/day or Tribal high-end consumer scenario of adults eating 322 g/day of shellfish containing the average or maximum concentration of lead. Based on these scenarios, the model indicates only Tribal high-end consumer (mothers) fetus would exceed the EPA's criteria of no more than 5% of the community with BLLs above 10 µg/dL (see Appendix C, Table C3). However, based on the Suquamish Tribe shellfish species-specific consumption rate for the 90th percentile consumers only, high-end consumption would not result in over 5 % of fetuses with blood lead levels greater than 10 µg/dl (see Appendix C, Table C4).

Evaluating Cancer Risk

Some chemicals have the ability to cause cancer. Cancer risk is estimated by calculating a dose similar to that described above and multiplying it by a cancer potency factor, also known as the cancer slope factor (CSF). Some cancer potency factors are derived from human population data. Others are derived from laboratory animal studies involving doses much higher than are encountered in the environment. Use of animal data requires extrapolation of the cancer potency obtained from these high dose studies down to real-world exposures. This process involves much uncertainty.

[redacted]

Current regulatory practice suggests that there is no "safe dose" of a carcinogen and that a very small dose of a carcinogen will result in a very small cancer risk. Cancer risk estimates are, therefore, not yes/no answers but measures of chance (probability). Such measures, however uncertain, are useful in determining the magnitude of a cancer threat because any level of a carcinogenic contaminant carries an associated risk. The validity of the "no safe dose" assumption for all cancer-causing chemicals is not clear. Some evidence suggests that certain chemicals considered to be carcinogenic must exceed a threshold of tolerance before initiating cancer. For such chemicals, risk estimates are not appropriate. More recent guidelines on cancer risk from EPA reflect the potential that thresholds for some carcinogenesis exist. However, EPA still assumes no threshold unless sufficient data indicate otherwise [17].

This document describes cancer risk that is attributable to site-related contaminants in qualitative terms like low, very low, slight and no significant increase in cancer risk. These terms can be better understood by considering the population size required for such an estimate to result in a single cancer case. For example, a low increase in cancer risk indicates an estimate in the range of one cancer case per ten thousand persons exposed over a lifetime. A very low estimate might result in one cancer case per several tens of thousands exposed over a lifetime and a slight estimate would require an exposed population of several hundreds of thousands to result in a single case. DOH considers cancer risk insignificant when the estimate results in less than one cancer per one million exposed over a lifetime. The reader should note that these estimates are for excess cancers that might result in addition to those normally expected in an unexposed population.

Cancer is a common illness and its occurrence in a population increases with age. Depending on the type of cancer, a population with no known environmental exposure could be expected to have a substantial number of cancer cases. There are many different forms of cancer that result from a variety of causes; not all are fatal. Approximately 1/4 to 1/3 of people living in the United States will develop cancer at some point in their lives [18].

Cancer risk from exposure to shellfish was calculated for arsenic only (see Appendix B, Table B4 – B5). The lifetime increase of cancer risk associated with exposure to arsenic at maximum in shellfish is low to slight (4.51×10^{-4}) or (5 in 10,000) to (2.63×10^{-6}) or (3 in 1,000,000). However, based on the Suquamish Tribe shellfish species-specific consumption rate for the 90th percentile consumers only, high-end consumption would result in a lifetime increase of cancer risk ranging from low to very low (2.62×10^{-5}) or (3 in 100,000) to (2.09×10^{-5}) or (2 in 100,000) for butter and littleneck clams respectively. These risks do not exceed the range of cancer risks considered acceptable by EPA (1×10^{-4} to 1×10^{-6}).

No cancer risk was calculated for cadmium because cancer caused via the oral route by cadmium is disputed. In addition, the CSF for cadmium is for cadmium via the inhalation route, which is not a likely exposure route in this case.

Children’s Health Concerns

ATSDR recognizes that infants and children may be more vulnerable to exposures than adults may, when faced with contamination of air, water, soil, or food. This vulnerability is a result of the following factors:

- Children are smaller and receive higher doses of chemical exposure per body weight

- Children’s developing body systems are more vulnerable to toxic exposures, especially during critical growth stages in which permanent damage may be incurred.

Special consideration will be given to children’s exposure to contaminants by assuming that children eat proportionately more shellfish than adults do.

Conclusions

1. Exposure to arsenic, cadmium and lead in Irondale Beach Park and Chimacum Creek Tidelands shellfish represents *no apparent public health hazard.*

    i. Maximum arsenic concentration would result in a lifetime cancer risk for high-end (subsistence) consumers of about 5 in 10,000, assuming all shellfish consumed contains the maximum level of arsenic and are from this area only. However, based on the Suquamish Tribe shellfish species-specific consumption rate for the 90th percentile consumers only, subsistence consumption would result in a lifetime cancer risk of about 2 in 100,000. The average or background total arsenic level for littleneck clams at Irondale Beach Park and Chimacum Creek Tidelands is similar to that in the rest of the Puget Sound at about 1.9 ppm.

    ii. Adults and children consuming shellfish from Irondale Beach Park and Chimacum Creek Tidelands that contain the maximum reported lead concentration (0.14 ppm) would not be expected to have elevated blood lead levels. On the other hand, fetuses of subsistence consumers would exceed the EPA's criteria of no more than 5% of the community with BLLs above 10 µg/dL. However, based on the Suquamish Tribe shellfish species-specific consumption rate for the 90th percentile consumers only, subsistence consumer fetuses would not result in elevated blood lead levels.

- Average or subsistence consumption of shellfish from Irondale Beach Park and Chimacum Creek Tidelands is not likely to result in non-cancer health effects.

Recommendations

The Department of Health's Office of Shellfish and Water Protection (OSWP), JCPH and Jefferson County should use this health consultation to guide their decision for recreational harvesting of shellfish in the Irondale Beach Park and Chimacum Creek Tidelands area.

Public Health Action Plan

Actions completed

1. Sampling and analysis of clam for inorganic contaminants has been conducted to determine whether or not chemical contaminants are present at levels of health concern.

2. Butter and Littleneck clams inorganic contaminant data has been evaluated by DOH and presented within this health consultation.

Action Planned

1. The OSWP will use this health consultation as part of the pollution source evaluation for this area.

2. DOH will send copies of the health consultation to concerned parties and provided hard copies to repository located: Jefferson County Rural Library District - 620 Cedar Ave, Port Hadlock, WA 98339 (360) 385-6544.

Authors

Lenford O'Garro
Washington State Department of Health
Office of Environmental Health Assessments
Site Assessment Section

Designated Reviewer

Dan Alexanian, Manager
Site Assessment Section
Office of Environmental Health Assessments
Washington State Department of Health

ATSDR Technical Project Officer

Jeff Kellam
U.S. Public Health Service
National Centers for Environmental Health
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation

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Figure 1. Port Townsend Bay, Irondale Beach Park Shellfish Growing area, Jefferson County Washington State

Figure 2. Irondale Beach Park (A) and adjacent Chimacum Creek Tidelands (B) shellfish collection area, Jefferson County Washington State

Appendix A

Screening Value Calculations

For Non-cancer Health Effects

SV = [(MRL or RfD)*BW]/CR

SV = Screening value (mg/kg or ppm)
MRL = Minimal risk level (mg/kg/day)
RfD = Reference dose (mg/kg/day)
BW = Mean body weight (kg)
CR = Suquamish Tribe 90th percentile adult (all shellfish) daily consumption rate (kg/day) [19]

BW = 70kg
CR = 0.322 kg/day

If maximum concentration is greater than screening value, further evaluation is required.

For Cancer Health Effects

Cadmium cancer risk is based on inhalation and not ingestion therefore; cadmium would not be evaluated for cancer risk.

SV = (Risk Level * BW) / (CR * CPF)

Risk Level = an assigned level of maximum acceptable individual lifetime risk (e.g., RL = 10-5 for a level of risk not to exceed one excess case of cancer in 100,000 individual exposed over a 70 yr lifetime.

If maximum concentration is greater than screening value, further evaluation is required.

Appendix B

This section provides calculated exposure doses and assumptions used for exposure to chemicals in shellfish from Irondale Beach Park and Chimacum Creek Tidelands. These exposure scenarios were developed to model exposures that might occur. These scenarios were devised to represent exposures to the general population and Suquamish Tribe. The following exposure parameters and dose equations were used to estimate exposure doses from ingestion with chemicals in shellfish.

Ingestion Route

$$\text{Dose}_{(\text{non-cancer (mg/kg-day)})} = \frac{C \times CF_1 \times IR \times CF_2 \times EF \times ED}{BW \times AT_{\text{non-cancer}}}$$

$$\text{Cancer Risk} = \frac{C \times CF_1 \times IR \times CF_2 \times EF \times CPF \times ED}{BW \times AT_{\text{cancer}}}$$

Table B1. Exposure Assumptions used in exposure evaluation to contaminants in shellfish samples taken from Irondale Beach Park and Chimacum Creek Tidelands, in Irondale, Washington.

Parameter	Value	Unit	Comments
Concentration (C)	Variable	ug/kg	Average detected value
Conversion Factor (CF_1)	0.001	mg/ug	Converts contaminant concentration from milligrams (mg) to kilograms (kg)
Conversion Factor (CF_2)	0.001	kg/g	Converts mass of shellfish from grams (g) to kilograms (kg)
Ingestion Rate (IR)	0.57	g/day	Body weight-adjusted consumption rates to account for children eating nearly 1.6 times as much fish per body weight as do adults (see table B2)
Ingestion Rate (IR)	34.8		90th percentile Suquamish Tribe child (all shellfish) [19]
Ingestion Rate (IR)	0.81		Body weight-adjusted consumption rates to account for an older child eating 0.81 times as much fish per body weight as do adults (see table B2)
Ingestion Rate (IR)	188.6		Based on 90th percentile Suquamish Tribe adult - older child eating at the same rate as an adult (body weight adjusted consumption rate)
Ingestion Rate (IR)	1.7		Average general population adult
Ingestion Rate (IR)	322		90th percentile Suquamish Tribe adult (all shellfish) [19]
Exposure Frequency (EF)	365	Days/year	Assumes daily exposure
Exposure Duration (ED)	6	years	Number of years at one residence (child)
Exposure Duration (ED)	30		Number of years at one residence (adult)
Body weight (BW)	15	kg	Mean body weight child
Body weight (BW)	70		Mean body weight adult
Averaging Time$_{\text{non-cancer}}$ (AT)	Variable	days	Equal to Exposure Duration
Averaging Time$_{\text{cancer}}$ (AT)	25550	days	70 years
Cancer Potency Factor (CPF)	Variable	mg/kg-day^{-1}	Source: EPA – Chemical specific

Table B2. Derivation of child and older child shellfish consumption rates for the general U.S. population.

Row	Parameter	Adult	Older Child (6-17 yrs)	Child (0-5 yrs)
1	Reported All Fish Consumption Rate-gram fish per kg bodyweight per day (g/kg/day)	0.277	0.225	0.433
2	Ratio to Adult All Fish Consumption Rate	1	0.81	1.6
3	Reported Shellfish Consumption (g/day)	1.70 (average)	Not Reported	Not Reported
4	Average Body Weight (kg)	70	41	15
5	Ratio to Adult BW	1	0.59	0.21
6	Adjusted Shellfish Consumption Rates (g/day) = Row 2 x Row 3 x Row 5	1.70 (average)	0.81 (average)	0.57 (average)

Table B3. Exposure dose and Non-cancer risk from ingesting shellfish at maximum concentration of contaminant from Irondale Beach Park and Chimacum Creek Tidelands in Irondale, Washington.

Contaminant	Maximum Concentration (ppm)		Estimated Dose (mg/kg/day)		RfD (mg/kg/day)	Hazard quotient Average population	Hazard quotient 90th percentile Suquamish Tribe
			Average population	90th percentile Suquamish Tribe			
Arsenic	0.028	Child	1.06E-6	6.50E-5	3.00E-4	0.004	0.22
		Older child	5.53E-7	1.29E-4		0.002	0.43
		Adult	6.80E-7	1.29E-4		0.002	0.43
Cadmium	0.44	Child	1.67E-5	1.02E-3	1.00E-3	0.02	1.02
		Older child	8.69E-6	2.02E-3		0.01	2.02
		Adult	1.07E-5	2.02E-3		0.01	2.02

PPM – parts per million

Table B4. Cancer risk from ingesting shellfish at maximum concentration of contaminant from Irondale Beach Park and Chimacum Creek Tidelands in Irondale, Washington.

Contaminant	**Maximum Concentration** (ppm)	**Cancer Potency Factor** (mg/kg-day^{-1})		**Increased Cancer Risk**		**Total Cancer Risk** Average population	**Total Cancer Risk** 90^{th} percentile Suquamish Tribe
				Average population	90^{th} percentile Suquamish Tribe		
Arsenic	0.028	5.7	Child	5.20E-7	3.17E-5	2.63E-6	4.51E-4
			Older child	4.50E-7	1.05E-4		
			Adult	1.66E-6	3.15E-4		

PPM – parts per million

Table B5. Cancer risk from ingesting shellfish at maximum arsenic concentration from Irondale Beach Park and Chimacum Creek Tidelands, based on the Suquamish Tribe shellfish species-specific consumption rate for the 90^{th} percentile consumers only, Washington.

Clam Species	**Species-specific consumption rate (g/day)**	**Maximum Concentration (ppm)**	**Cancer Potency Factor** (mg/kg-day^{-1})		**Increased Cancer Risk**	**Total Cancer Risk**
Littleneck	11.4	0.021	5.7	Child	7.80E-6	2.09E-5
				Older child	4.75E-6	
				Adult	8.35E-6	
Butter	10.7	0.028		Child	9.76E-6	2.62E-5
				Older child	5.95E-6	
				Adult	1.05E-5	

PPM – parts per million

Appendix C

Lead exposure shellfish ingestion scenario used in the IEUBK model

This section provides inputs for the IEUBK model. The following inputs to the model were used to account for the average shellfish ingestion lead exposure from Irondale Beach Park and Chimacum Creek Tidelands, Irondale, Washington.
Consumption rates: General population (Gen.) child – 0.57 g/day: Suquamish Tribe (Sub) Child – 34.8 g/day.
IEUBK model assumes that a child's total meat intake is 93.5 g/day. EPA's target cleanup goal is no more than 5 % of the community with BLLs above 10 µg/dL. Default assumptions were used unless noted.

Table C1. Blood lead values determined using the IEUBK model for lead in shellfish from Irondale Beach Park, Irondale, Washington.

Clam Species	Average Concentration (ppm)		Percent meat intake as shellfish (%)		Blood Lead level in percent above 10ug/dl Age range 0 - 84 months			
	Mean	Max	Gen Child	Sub Child	Mean		Max	
					Gen Child	Sub Child	Gen Child	Sub Child
Littleneck	0.096	0.13	0.61	37.2	1.21	2.3	1.22	2.8
Butter	0.125	0.14			1.22	2.7	1.22	3.0

PPM – parts per million

Table C2. Blood lead values determine using the IEUBK model for lead in shellfish from Chimacum Creek Tidelands, Irondale, Washington.

Clam Species	Average Concentration (ppm)		Percent meat intake as shellfish (%)		Blood Lead level in percent above 10ug/dl Age range 0 - 84 months			
	Mean	Max	Gen Child	Sub Child	Mean		Max	
					Gen Child	Sub Child	Gen Child	Sub Child
Littleneck	0.029	0.03	0.61	37.2	1.2	1.4	1.2	1.4
Butter	NA	0.056			NA		1.2	1.7

PPM – parts per million

Lead exposure shellfish ingestion scenario used in the Adult lead model

This section provides inputs for the Adult lead model. The following inputs to the model were used to account for the average shellfish ingestion lead exposure from Irondale Beach Park and Chimacum Creek Tidelands, Irondale, Washington.
Consumption rates: General population (Gen.) 1.7 g/day: Suquamish Tribe (Sub) 322 g/day
EPA’s target cleanup goal is no more than 5 % of the community with BLLs above 10 µg/dL.
Default assumptions were used unless noted.

Table C3. Blood lead values determined using the Adult lead model for lead in shellfish from Irondale Beach Park, Irondale, Washington.

Clam Species	**Average Concentration (ppm)**		**Average Mother Blood Lead concentration in ug/dl Fetus Blood Lead in percent above 10ug/dl**				
	Mean	**Max**		**Mean**		**Max**	
				Gen	Sub	Gen	Sub
Littleneck	0.096	0.13	mother	1.5	3.0	1.5	3.5
			fetus	0.4	3.8	0.4	**6.0**
Butter	0.125	0.14	mother	1.5	3.4	1.5	3.7
			fetus	0.4	**5.7**	0.4	**6.7**

PPM – parts per million

Table C4. Blood lead values determined using the Adult lead model for lead in shellfish from Chimacum Creek Tidelands, Irondale, Washington.

Clam Species	**Average Concentration (ppm)**		**Average Mother Blood Lead concentration in ug/dl Fetus Blood Lead in percent above 10ug/dl**				
	Mean	**Max**		**Mean**		**Max**	
				Gen	Sub	Gen	Sub
Littleneck	0.029	0.03	mother	1.5	1.9	1.5	2.0
			fetus	0.3	0.9	0.4	1.0
Butter	NA	0.056	mother	NA		1.5	2.4
			fetus			0.4	1.9

PPM – parts per million

Table C5. Blood lead values determined using the Adult lead model for lead in shellfish from Irondale Beach Park, Irondale based on the Suquamish Tribe shellfish species-specific consumption rate for the 90th percentile consumers only.

Clam Species	**species-specific consumption rate (g/day)**	**Average Concentration (ppm)**	**Average Mother Blood Lead concentration in ug/dl Fetus Blood Lead in percent above 10ug/dl**	
		Maximum		**Maximum**
				Sub
Littleneck	11.4	0.13	mother	1.6
			fetus	0.4
Butter	10.7	0.14	mother	1.6
			fetus	0.4

PPM – parts per million

Certification

This Health Consultation was prepared by the Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

Jeff Kellam
Technical Project Officer, CAT, SPAB, DHAC
ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Alan G. Park for Alan Yarbrough

Alan Yarbrough
Team Lead, CAT, SPAB, DHAC
ATSDR