Terrestrial Ecological Evaluation Summary Report

Northwest Pipeline GP
Meter Station Facilities
Throughout Washington State

Prepared For:

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1.0 INTRODUCTION

Environmental Partners, Inc. (EPI) has prepared this Terrestrial Ecological Evaluation Summary Report to document the activities performed and results of the Terrestrial Ecological Evaluations (TEEs) conducted for Northwest Pipeline GP (NWPL GP) meter station facilities located throughout Washington State.

NWPL GP prepared a *Terrestrial Ecological Evaluation Program* document dated April 2011, which was submitted to Ecology on April 15, 2011.

On May 13, 2011, The Washington State Department of Ecology (Ecology) submitted a *Transmittal of Ecology Approval and Comment of the revised Terrestrial Ecological Evaluation Program, Northwest Pipeline GP Meter Station Facilities throughout Washington State, April 2011, prepared by Williams Gas Pipeline; Environmental Partners, Inc; and Portnoy Environmental* to NWPL GP, conditionally approving the document. Subsequent to receipt of the conditional approval letter, EPI incorporated the single comment provided by Ecology into the May 2011 *Terrestrial Ecological Evaluation Program* document (TEE Program Document). The revised TEE Program Document is included in Attachment A; the conditional approval letter is presented as Attachment B.

1.1 Background

NWPL GP is evaluating the environmental conditions at over 70 meter station facilities throughout Washington State, which have soil impacted with inorganic mercury and/or arsenic, and which have similar site conditions (*i.e.*, uncapped commercial/industrial type facilities, in rural locations, identical site usage, and the same contaminants). The meter station facilities are where gas is being regulated and metered from the main supply pipelines to local distribution companies (LDCs) or wholesale customers.

Based on the similarities of site conditions and COCs, NWPL GP has created a Model TEE approach based on the Site-Specific TEE

2.0 OBJECTIVES

The general objectives of the Model TEE study for NWPL GP meter station facilities were to evaluate the initial soil cleanup levels for inorganic mercury and arsenic of 2 and 20 mg/kg, respectively, for protectiveness of potential ecological receptors.

The specific objectives of the Model TEE were as follows:

- Divide the state into representative areas;
- Establish site groupings and a representative facility within each representative area;
- Collect TEE samples from each representative facility and analyze for appropriate terrestrial and ecological protectiveness through bioassay testing and bioaccumulation study; and

- Establish appropriate TEE cleanup levels that are protective of all terrestrial and ecological receptors for each representative area.

3.0 METHODOLOGY

The methods utilized for conducting the TEEs are described in the following sections and in the TEE Program Document.

3.1 Modified Model TEE based upon Site-Specific TEE

The meter station facilities did not qualify for primary TEE exclusions or for the Simplified TEE process provided in MTCA due to the uncapped and often rural nature of the facilities, and the generally surficial nature of the COCs. As such, a modified model Site-specific TEE process was implemented. The modified model Site-specific TEE is composed of several components. These components include problem formulation and selection and implementation of appropriate terrestrial ecological evaluation methods.

3.1.1 Problem Formulation

A problem formulation was conducted as a part of the TEE in accordance with WAC 173-340-7493(2). Problem formulation includes identification of the chemicals of ecological concern, potential exposure pathways, potential terrestrial ecological receptors, and a toxicological assessment. The elements of the TEE problem formulation are detailed in the TEE Program Document and are summarized as follows:

- The identified chemicals of ecological concern are the COCs for the meter station facilities, inorganic mercury and arsenic.

- The primary exposure pathway for inorganic mercury and arsenic in soil at the NWPL GP meter stations occurs via direct contact.

- Contact with contaminated soil can directly impact vegetation and soil biota.

- The secondary exposure pathway is ingestion of affected vegetation and soil biota containing bioaccumulated COCs at significant levels by ground-feeding birds and mammals.

3.1.2 Site-Specific TEE Method Selection

3.1.2.1 Mercury

Soil containing inorganic mercury at the meter stations has been characterized to the MTCA Method A Soil Cleanup Level for Unrestricted Land Uses of 2 milligrams/kilogram (mg/kg), which is the initially selected cleanup level for NWPL GP meter station facilities.

The Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals (Table 749-3) are specified as 0.3 mg/kg, 0.1 mg/kg, and 5.5 mg/kg for Plants, Soil Biota, and Wildlife, respectively. Since wildlife receptors are protected at a soil concentration greater than the initially selected cleanup level of 2 mg/kg, soil at facilities that are in compliance with the 2 mg/kg mercury cleanup level will be protective of wildlife receptors. However, because the selected cleanup level of 2 mg/kg exceeds the limits established for the protection of plants and soil biota, modified site-specific TEE methods were selected in accordance with WAC 173-340-7493 for these potential exposures.

The selected TEE methods for mercury are site-specific soil bioassay for plants and soil biota.

3.1.2.2 Arsenic

Soil containing arsenic at the meter stations has been characterized to the MTCA Method A Soil Cleanup Level for Unrestricted Land Uses of 20 mg/kg, which is the initially selected cleanup level for NWPL GP meter station facilities.

The Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals (Table 749-3) are specified as 10 mg/kg, 60 mg/kg, and 7 mg/kg for Plants, Soil Biota, and Wildlife, respectively. Since soil biota receptors are protected at a soil concentration greater than the initially selected cleanup level of 20 mg/kg, soil at facilities that are in compliance with the 20 mg/kg arsenic cleanup level will be protective of soil biota receptors. However, because the selected cleanup level of 20 mg/kg exceeds the limits established for the protection of plants and wildlife, modified site-specific TEE methods were selected in accordance with WAC 173-340-7493 for these potential exposures.

The selected TEE methods for arsenic are site-specific soil bioassay for plants and site-specific bioaccumulation evaluation for wildlife. Calculated indicator concentrations for the Mammalian herbivore surrogate receptor (vole) using the default values supplied in Tables 749-4 and 749-5 indicate that the established initial soil cleanup level for arsenic of 20 mg/kg is protective of mammalian herbivores. As such, the site-specific bioaccumulation evaluations for wildlife were only for mammalian predator species (shrew) and avian predator species (American Robin).

3.2 Site Groupings and Representative Sites

In the May 13, 2011 conditional approval letter, Ecology approved the division of the meter station facilities into four representative groups based on geographic area and regional climate, and the terrestrial ecological evaluation of appropriate representative facilities within each area. Data collected

at the representative facility(s) will be used for determining compliance with TEE for the other meter stations within each representative area.

The rationale for the site groupings is detailed in the TEE Program Document. The proposed representative areas as they relate to the NWPL GP pipeline are depicted on **Figure 1**. The representative facilities and meter station facilities within each area are presented in the following sections.

3.2.1 Northwest Washington Representative Area

The representative facility for the Northwest Washington Representative Area is the Snohomish Compressor Station for both mercury and arsenic.

Data collected at this facility will be considered representative of the following NWPL GP meter station facilities:

- Chehalis
- Evergreen Shores (Black Lake)
- McCleary Aberdeen
- North Seattle – Everett
- North Tacoma
- Oak Harbor – Stanwood
- Olympia
- Sedro Woolley
- Shelton
- South Seattle
- South Tacoma
- Toledo

3.2.2 Southwest Washington/Columbia River Basin Representative Area

The representative facility for the Southwest Washington/Columbia River Basin Representative Area is the Washougal Compressor Station for both mercury and arsenic:

Data collected at this facility will be considered representative of the following NWPL GP meter station facilities:

- Deer Island
- Kalama
- Stevenson
- Stevenson #2
- Vanalco
- Vancouver
- Washougal

3.2.3 Central Washington Representative Area

The representative facility for the Central Washington Representative Area is Yakima Firing Center Meter Station for arsenic and Ellensburg Meter Station for mercury.

Data collected at these facilities will be considered representative of the following NWPL GP meter station facilities:

- Alcoa Wenatchee
- Burbank Heights
- Connell
- Ellensburg
- Goldendale
- Grandview
- John Day Dam
- Kawecki Chemical
- Kennewick
- Klickitat
- Lind
- Menan Starch
- Moses Lake
- Pasco
- Prosser
- Quincy
- Ritzville
- Sandvik Special Metals
- Sunnyside
- Unocal Finley
- Walla Walla
- Warden
- Wenatchee
- Yakima
- Zillah – Toppenish

3.2.4 Eastern Washington Representative Area

The representative facility for the Eastern Washington Representative Area is Spokane Mead Meter Station for arsenic and Star Road Meter Station for mercury.

Data collected at these facilities will be considered representative of the following NWPL GP meter station facilities:

- Cheney Medical Lake
- Colfax
- Genesee
- Pullman

- Spokane West
- Spokane – Mead
- Star Road

Note: In the Ecology approved TEE Program Document; it was originally proposed that the Cheney Medical Lake Meter Station facility would be used for the representative facility in the Eastern Washington sub-region. However, during the approval process for the TEE Program Document, the Cheney Medical Lake facility was remediated and there were no remaining soils at the site with the concentration ranges required for bioassay analysis. Therefore, an alternate location (*i.e.*, Starr Road) was selected as the representative facility for mercury.

3.3 TEE Sampling and Analysis

TEE samples were collected from each representative facility where previously collected data indicated that COCs in soil were close to the initially selected cleanup level for each COC (*i.e.*, 2 mg/kg for mercury and 20 mg/kg for arsenic). Prior to performing the necessary TEE analysis, a sample was collected from each TEE sample and submitted for confirmation analysis to verify the COC concentration.

Samples for confirmation analyses were submitted to Friedman & Bruya, Inc. of Seattle, Washington or ESC Lab Sciences of Mt. Juliet, Tennessee for analysis of mercury by EPA Method 7471 and arsenic by EPA Method 6010B, as applicable.

As indicated in the TEE Program Document, TEE samples qualified for bioassay analysis and bioaccumulation factor (BAF) testing if the concentration for mercury ranged from 2 mg/kg to 6 mg/kg, and/or the concentration for arsenic ranged from 20 mg/kg to 60 mg/kg. The TEE samples selected from each representative facility, original COC concentration, and confirmation concentration are presented in Table 1. Laboratory analytical reports for confirmation soil samples are provided in Attachment C.

With the exception of arsenic in the Southwestern Washington/Colombia River Basin, Central Washington, and Eastern Washington representative areas, each TEE sample presented in Table 1 qualified for bioassay analysis and/or BAF testing in accordance with the concentration ranges presented in the TEE Program Document. For the remaining representative areas, there were no concentrations detected above the initially selected arsenic cleanup level of 20 mg/kg. Therefore, the maximum arsenic concentration detected in each of the representative areas was analyzed for TEE compliance.

3.3.1 Soil Bioassay

Soil bioassay analyses were conducted to evaluate the protectiveness of mercury concentrations in soil to vascular plants and soil biota and arsenic concentrations in soil to vascular plants. Soil for bioassay analyses were submitted to Nautilus Environmental (Nautilus), a Department of Ecology accredited laboratory located in Tacoma, Washington.

As presented in the TEE Program Document, soil bioassay for plants was conducted in accordance with Ecology Publication No. 96-324, *Early Seedling Growth Protocol for Soil Toxicity Screening.* Soil

bioassay for soil biota was conducted in accordance with Ecology Publication No. 96-327, *Earthworm Bioassay Protocol for Soil Toxicity Screening.* No soil dilution was performed prior to analysis.

3.3.2 Bioaccumulation Study

In order to assess the protectiveness of the established initial cleanup level for arsenic in soil of 20 mg/kg for potential wildlife receptors, a 28-day earthworm (Eisenia *fetida*) bioaccumulation study was conducted, as allowed by WAC 173-340-7493(3)(c)(i). For predatory wildlife receptors, the surrogate species are the American Robin and the Shrew; both are ground-feeding carnivorous species. Therefore, in accordance with Ecology's Wildlife Exposure Model for Site-Specific Evaluations (WEM; Table 749-4), the potential exposure pathway for these receptors is through consumption of worms living in contaminated soil.

The selected soil samples were submitted to Nautilus. The methodology used for growing worms in contaminated media was in accordance with the *Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation Tests with the Lumbricid Earthworm Eisenia Fetida* (ASTM E1676-04, 2007).

Following the 28-day bioaccumulation incubation period, the earthworms were removed from the soil, placed in chemistry containers, and submitted to Test America of Seattle, Washington for determination of arsenic concentration by EPA method 6010B.

Results of the earthworm bioaccumulation study and confirmation soil sampling were subsequently used to calculate site-specific BAFs for the selected representative sites. BAFs were calculated by dividing the worm arsenic concentration by the confirmation soil arsenic concentration for each representative facility. The calculated site-specific BAFs were then used to calculate region-specific indicator concentrations that are considered protective of potential wildlife receptors using the equations provided in the WEM, Table 749-4 in MTCA. As no Toxicity Reference Value for the more toxic form of arsenic (arsenic III) was provided in MTCA Table 749-4 for the American Robin, EPI used a value of 2.24 mg/kg-day as provided in the U.S. EPA document, *Ecological Soil Screening Levels for Arsenic,* March 2005, to calculate the region-specific indicator concentrations for the avian predator. This is a more conservative value than that provided in MTCA for the less toxic arsenic V.

4.0 FINDINGS

The results of the bioassay analysis and BAF study are presented in the following sections. The Soil Toxicity Evaluation report prepared by Nautilus is included as Attachment D.

4.1 Lettuce Bioassay Tests

Results of the lettuce bioassay tests conducted on soils from representative meter station facilities impacted with mercury are as follows:

- Snohomish Compressor Station (Northwest Washington Representative Area) – mercury concentration 2.5 mg/kg – **soil not toxic**.

- Washougal Compressor Station (Southwest Washington/Columbia River Representative Area) – mercury concentration 2.6 mg/kg – **soil not toxic**.

- Ellensburg Meter Station (Central Washington Representative Area) – mercury concentration 2.8 mg/kg – **soil not toxic**.

- Star Road Meter Station (Eastern Washington Representative Area) – mercury concentration 3.3 mg/kg – **soil not toxic**.

Results of the lettuce bioassay tests indicate that the initially established soil cleanup level for mercury of 2 mg/kg is protective of plants in each of the representative areas.

Results of the lettuce bioassay tests conducted on soils from representative meter station facilities impacted with arsenic indicate:

- Snohomish Compressor Station (Northwest Washington Representative Area) – arsenic concentration 48.1 mg/kg – **soil not toxic**.

- Washougal Compressor Station (Southwest Washington/Columbia River Representative Area) – arsenic concentration 16 mg/kg – **soil not toxic**.

- Yakima Firing Center Meter Station (Central Washington Representative Area) – arsenic concentration 14 mg/kg – **soil not toxic**.

- Spokane Mead Meter Station (Eastern Washington Representative Area) – arsenic concentration 18.1 mg/kg – **results inconclusive***.

*Note: The control sample for the lettuce bioassay sample from Spokane Mead Meter Station did not meet the minimum criteria for seeding growth and therefore the results were inconclusive. The lettuce bioassay test will be re-performed on the TEE sample from Spokane Mead.

Results of the lettuce bioassay tests indicate that the initially established soil cleanup level for arsenic of 20 mg/kg is protective of plants in the Northwest Washington Representative Area. For the Southwest Washington/Colombia River and Central Washington Representative Areas, the concentration analyzed represents the arsenic concentration that is protective of plants. No arsenic concentration protective of plants has yet been established for the Eastern Washington Representative Area.

4.2 Earthworm Bioassay Tests

Results of the earthworm bioassay tests conducted on soils from representative meter station facilities impacted with mercury indicate:

- Snohomish Compressor Station (Northwest Washington Representative Area) – mercury concentration 2.5 mg/kg – **soil not toxic**.

- Washougal Compressor Station (Southwest Washington/Columbia River Representative Area) – mercury concentration 2.6 mg/kg – **soil not toxic**.

- Ellensburg Meter Station (Central Washington Representative Area) – mercury concentration 2.8 mg/kg – **soil not toxic**.

- Star Road Meter Station (Eastern Washington Representative Area) – mercury concentration 3.3 mg/kg – **soil not toxic**.

Results of the earthworm bioassay tests indicate that the initially established soil cleanup level for mercury of 2 mg/kg is protective of soil biota in each of the representative areas.

4.3 Earthworm 28-day Bioaccumulation Study

Results of the 28-day earthworm bioaccumulation study conducted using soils from representative meter station facilities impacted with arsenic indicate:

- For the Snohomish Compressor Station (Northwest Washington Representative Area), the calculated BAF was 0.16, and the calculated indicator concentrations for arsenic in soil that are considered protective of avian predators and mammalian predators are 58 mg/kg and 47 mg/kg, respectively.

- For the Washougal Compressor Station (Southwest Washington/Columbia River Representative Area), the calculated BAF was 0.26, and the calculated indicator concentrations for arsenic in soil that are considered protective of avian predators and mammalian predators are 45 mg/kg and 30 mg/kg, respectively.

- For the Yakima Firing Center Meter Station (Central Washington Representative Area), the calculated BAF was 0.53, and the calculated indicator concentrations for arsenic in soil that are considered protective of avian predators and mammalian predators are 29 mg/kg and 15 mg/kg, respectively.

- For the Spokane Mead Meter Station (Eastern Washington Representative Area), the calculated BAF was 0.13, and the calculated indicator concentrations for arsenic in soil that are considered protective of avian predators and mammalian predators are 63 mg/kg and 56 mg/kg, respectively.

Calculation worksheets for region-specific soil indicator concentrations that are considered protective of wildlife calculated using Site-specific BAF values determined from the 28-day earthworm bioaccumulation studies are presented as Attachment E.

4.4 Data Summary

Table 2 summarizes the cumulative TEE data collected during this study.

Based on the work documented herein, the TEE cleanup levels that are protective of all potential terrestrial and ecological receptors for the representative areas are as follows:

- Northwest Washington Representative Area
  - Arsenic – 47 mg/kg
  - Mercury – 2.5 mg/kg

- Southwest Washington/Colombia River Representative Area
  - Arsenic – 16 mg/kg
  - Mercury – 2.6 mg/kg

- Central Washington Representative Area
  - Arsenic – 14 mg/kg
  - Mercury – 2.8 mg/kg

- Eastern Washington Representative Area
  - Arsenic – No Value Yet Established
  - Mercury – 3.3 mg/kg

5.0 CONCLUSIONS

The conclusions of the modified Site-Specific TEE study conducted for the NWPL GP Meter Station Facilities in Washington State are as follows:

- Results of the lettuce and earthworm bioassay tests indicate that the established initial soil cleanup level for mercury of 2 mg/kg is protective of all potential ecological receptors at all of the selected representative meter station facilities.

- Results of the lettuce bioassay and earthworm bioaccumulation tests indicate that the established initial soil cleanup level for arsenic of 20 mg/kg is protective of potential ecological receptors in the Northwest Washington Representative Area.

- The TEE cleanup level for arsenic applicable to the Southwest Washington/Colombia River Representative Area is 16 mg/kg. This cleanup level is based on the protection of plants ecological pathway of concern.

- The TEE cleanup level for arsenic applicable to the Central Washington Representative Area is 14 mg/kg. This cleanup level is based on the protection of plants ecological pathway of concern.

- The TEE cleanup level for arsenic established for the Southwest Washington/Colombia River and Central Washington Representative areas are based upon the maximum concentrations detected in each region. If in the future, arsenic is detected at concentrations that exceed the current maximum concentrations, NWPL GP reserves the right to perform additional lettuce bioassay tests to assess the protectiveness of arsenic in soil for that particular region.

- Based on the work conducted as part of this TEE, no TEE cleanup level for arsenic was established for the Eastern Washington Representative Area. The absence of a TEE cleanup level for arsenic in the Eastern Washington Representative Area represents a data gap for this study. NWPL GP is currently working to fill this data gap and will submit an addendum to this report when complete.

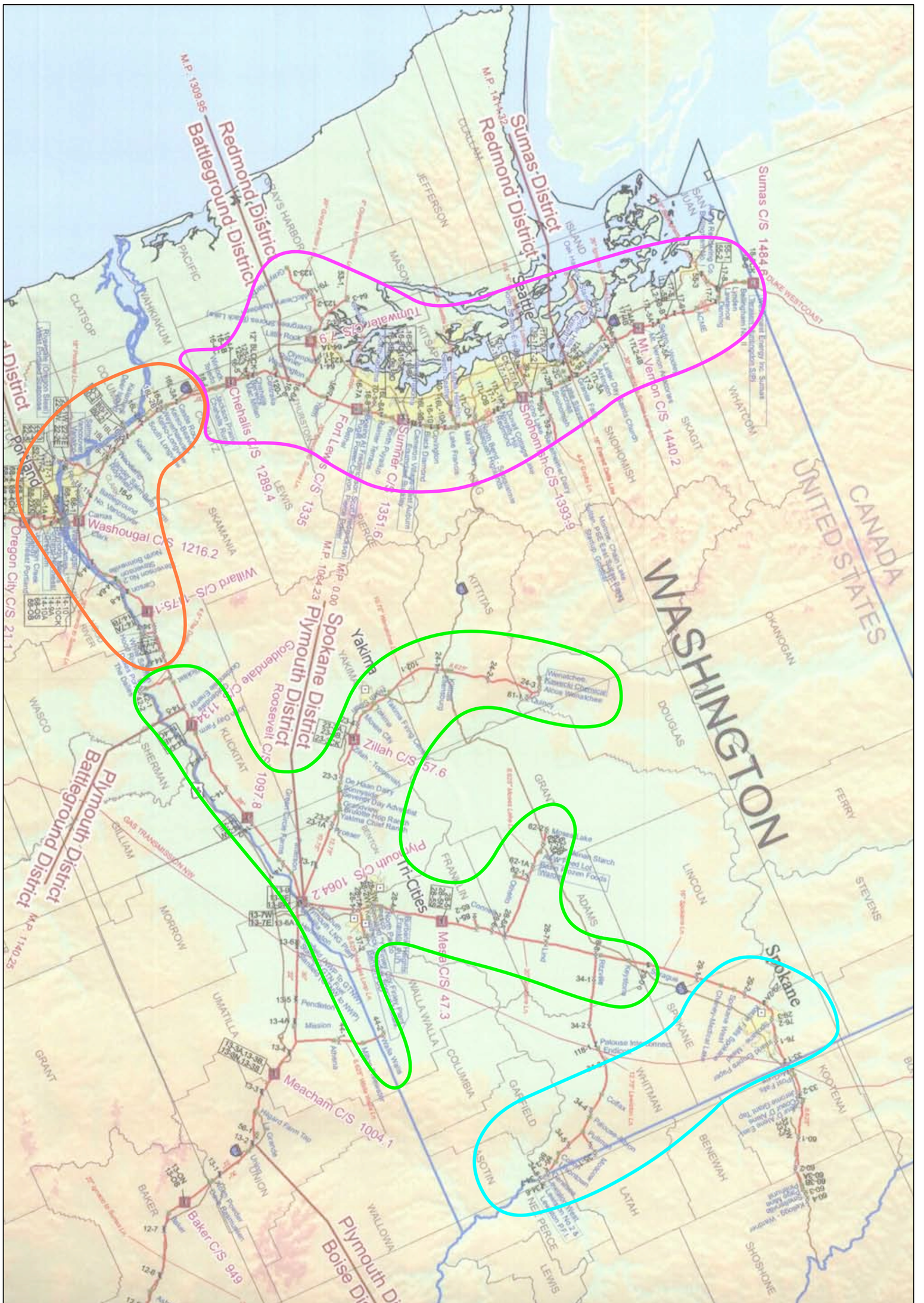
6.0 CLOSING

The representative area data described herein, and the cleanup levels that are protective of the potential ecological receptors developed during the site-specific TEEs will be used as a reference for compliance during the assessment and remediation of the individual meter station facilities. The procedures and methods for assessing and remediating each individual meter station facility will be presented in an *Assessment Results and Remedial Action Report* submitted for each meter station facility. These reports will include a section referencing the TEE work documented herein.

7.0 REFERENCES

Environmental Partners, Inc. (EPI)[1], Portnoy Environmental[2], Williams Gas Pipeline[2], 2011, Terrestrial Ecological Evaluation Program, Northwest Pipeline GP Meter Station Facilities Throughout Washington State; [1]Seattle, Washington; [2]Houston, Texas; May.

U.S. Environmental Protection Agency (EPA), 2005, Ecological Soil Screening Levels for Arsenic; Office of Solid Waste and Emergency Response, Washington, DC; March.



KEY:

- NORTHWEST WASHINGTON
- SOUTHWEST WASHINGTON/COLUMBIA BASIN
- CENTRAL WASHINGTON
- EASTERN WASHINGTON

NOT TO SCALE

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FIGURE 1

TEE SITE
"REPRESENTATIVE AREAS"

PROJECT	47308.33		
PREPARED FOR	NWPL GP/WILLIAMS		
LOCATION	WASHINGTON		
SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	ARM	EMK	01/13/11

Table 1
TEE Bioassay Soil and Bioaccumulation Confirmation Sample Results (in mg/kg)
and Bioaccumulation Factor for Arsenic
Northwest Pipeline GP
Wasington State Meter Station Facilities

Region	Representative Facility	TEE Sample	LAB Report	Mercury			Arsenic				
				Original Concentration[A]	Bioassay Sample Collection Date	Confirmation Sample Analytical Result[A]	Original Concentration[B]	Bioassay Sample Collection Date	Confirmation Sample Analytical Result[B]	E. *fetida* 28-Day Analytical Result[C]	Bioaccumulation Factor[D]
Northwest Washington Representation Area	Snohomish Compressor Station	SH4-W64	105017	NA	NA	NA	44	5/3/11	48.1	7.8	0.16
		SHSB2-3:18	105180	12	5/13/11	2.5	NA	NA	NA	NA	NA
Southwest Washington / Columbia River Basin Representation Area	Washougal Compressor Station	WS11-AM24	L517283	NA	NA	NA	26	5/17/11	16	4.1	0.26
		WSSB6-0910	L517283	2.7	5/17/01	2.6	NA	NA	NA	NA	NA
Central Washington Representation Area	Yakima Firing Center Meter Station	YFSS-D1	L517283	NA	NA	NA	<0.21	5/17/11	14	7.4	0.53
	Ellensburg Meter Station	ELSS-0810	L517283	2.3	5/17/11	2.8	NA	NA	NA	NA	NA
Eastern Washington Representation Area	Spokane Mead Meter Station	BKG	106382	NA	NA	NA	N/A	5/16/11	18.1	<2.3	0.13[E]
	Star Road Meter Station	1807	105338	3.3	5/16/11	3.3	NA	NA	NA	NA	NA

Notes: All concentrations in milligrams per kilogram (mg/kg) unless otherwise indicated.

[A]Mercury analysis by EPA Method 1631E and Method 7471

[B]Arsenic analysis by Method 200.8

[C]Arsenic analysis by EPA Method 6010B

[D]Unitless

[E]Bioaccumulation Factor calclated using the E. *foetida* 28-day detection limit.

Table 2
TEE Cleanup Level Summary
Northwest Pipeline GP
Wasington State Meter Station Facilities

Region	Representative Facility	COC	Concentration Protective of Soil Biota	Concentration Protective of Plants	Concentration Protective of Mamallian and Avian Predators	Final TEE Cleanup Level
Northwest Washington Representation Area	Snohomish Compressor Station	Arsenic	60[a]	48.1	47	**47**
		Mercury	2.5	2.5	5.5[b]	**2.5**
Southwest Washington / Columbia River Basin Representation Area	Washougal Compressor Station	Arsenic	60[a]	16	30	**16**
		Mercury	2.6	2.6	5.5[b]	**2.6**
Central Washington Representation Area	Yakima Firing Center Meter Station	Arsenic	60[a]	14	15	**14**
	Ellensburg Meter Station	Mercury	2.8	2.8	5.5[b]	**2.8**
Eastern Washington Representation Area	Spokane Mead Meter Station	Arsenic	60[a]	NVE	56	**NVE**
	Star Road Meter Station	Mercury	3.3	3.3	5.5[b]	**3.3**

Notes: All concentrations in milligrams per kilogram (mg/kg) unless otherwise indicated.

a Book value for arsenic concentration protective of soil biota (MTCA Table 749-3)

b Book value for mercury concentration protective of mamalian and avian predators (MTCA Table 749-3)

NVE Lettuce bioassay control sample not valid, result inconclusive and therefore no value yet established

Attachment A

Terrestrial Ecological Evaluation Program

Northwest Pipeline GP
Meter Station Facilities
Throughout Washington State

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May 2011

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1.0 INTRODUCTION

This *Terrestrial Ecological Evaluation Program* document provides the rationale, methodology, and procedures proposed for Terrestrial Ecological Evaluations (TEEs) for Northwest Pipeline General Partnership (NWPL GP) meter station facilities, as required by the Model Toxics Control Act (RCW 70.105D) and its implementing regulations (WAC 173-340), which are collectively referred to herein as "MTCA".

NWPL GP is evaluating the environmental conditions at over 70 meter station facilities throughout Washington State, which have similar site conditions (*i.e.*, uncapped commercial/industrial type facilities, in rural locations, identical site usage, and the same single contaminant). The meter station facilities are where gas is being regulated and metered from the main supply pipelines to local distribution companies (LDCs) or a wholesale customers. The LDC then distributes the gas to local consumers.

NWPL GP originally submitted a draft *Terrestrial Ecological Evaluation Program* document to Mr. Dave Sternberg at Ecology on October 11, 2010. The October 11, 2010 document was disseminated to and reviewed by each of the four Ecology regional Voluntary Cleanup Program (VCP) managers for NWPL GP facilities. Consolidated comments were returned to NWPL GP via email on November 8, 2010.

NWPL GP submitted a *Technical Memorandum Re: Response to Ecology Comments – Terrestrial Ecological Evaluation Program: Northwest Pipeline GP Meter Station Facilities Throughout Washington State* dated January 13, 2011 (Technical Memorandum). The Technical Memorandum was again disseminated to and reviewed by each of the four Ecology regional VCP managers. Ecology comments and concerns were consolidated and communicated via Letter *Re: Transmittal of Ecology Comments on the* [Technical Memorandum] dated March 29, 2011.

This revised document incorporates each of the comments and concerns raised by Ecology in the March 29, 2011 transmittal letter.

This document has been prepared in order to evaluate NWPL GP meter station facilities for TEE compliance for the two confirmed contaminants of concern (COCs); inorganic mercury and arsenic. No other COCs have been identified for NWPL GP meter station facilities. The procedures and methods for assessing each individual meter station facility will be presented in an *Assessment Results and Remedial Action Report* submitted for each meter station facility.

1.1 Facility Description

Meter station facilities are small (typically less than ½ acre) and are relatively simple to assess and remediate. A meter station typically consists of several pipe runs and a small meter building or canopy cover, within a fenced, gravel-covered lot. Meter stations are typically located proximal to the main pipeline. The meter stations have controlled access and the general maintenance of these facilities includes active housekeeping, maintenance such as weed suppression, and maintenance of the integrity of the fencing, gates, and interior buildings/structures.

Based on work conducted since 2005 and prior knowledge of site conditions, a thorough understanding of typical site conditions such as mode of release, vertical and horizontal migration of impacts, hot spots, and contaminant distribution has been formed.

1.2 Conceptual Site Model

The principal COC at NWPL GP meter station facilities is inorganic mercury. The primary source of mercury releases has been accidental spillage of inorganic mercury during historic maintenance and calibration of a certain type of differential pressure manometer (meters) that contained mercury (*i.e.*, American A-88 meters). NWPL GP used such manometers to measure the differential pressures across orifice plates in order to calculate flow volumes through the pipelines, laterals, and taps that supply its customers. It is important to note that not all of the manometers historically used by NWPL GP contained mercury and that the installation of manometers that utilized mercury was phased out in the mid-to-late 1980's.

A secondary, and less common source of potential mercury releases at NWPL GP meter station facilities has been from "thermowells". Thermowells are test tube-shaped "wells" installed in the meter station piping into which thermometers were placed to measure gas temperatures. In some instances, mercury was also placed in the well to improve the thermal conductance between the well and thermometer. The practice of placing mercury in thermowells varied regionally along the NWPL GP pipeline system. The thermowells did not contain large amounts of mercury, but there was the potential for some spillage or drippage when a thermowell was filled and/or when a thermometer was inserted and/or removed. The use of mercury in thermowells was phased out by 1993.

Both the former A-88 meters and the thermowells are point sources of release. These releases have generally been to either bare soil or gravel covered surfaces beneath and adjacent to the meters and above grade portions of the piping runs. These areas are typically either under cover of a supported metal roof or inside a metal building to protect the equipment from the weather.

A less common COC at NWPL GP meter station facilities is arsenic. Although the exact source of arsenic is not known, releases of arsenic appear to be operationally related, surficial releases. Arsenic impacts have typically been identified near buildings and operational equipment. Concentrations are highest at or near the ground surface and attenuate quickly with depth.

2.0 PROBLEM FORMULATION

MTCA requires the completion of a TEE in accordance with WAC 173-340-7490.

2.1 Primary TEE Exclusions

The NWPL GP meter station facilities typically do not qualify for the primary exclusions from the TEE documented in WAC 173-340-7491(1) because of their often rural locations, uncapped site conditions (*i.e.*, typically the facilities are gravel-covered), and the contamination is surficial in nature (*i.e.*, typically less than 3 feet). Therefore, further evaluation is required.

2.2 Simplified TEE Standards

On June 23, 2010, NWPL GP participated in a video conference meeting with the Ecology Voluntary Cleanup Program (VCP) managers to present a proposed "model approach" program by which NWPL GP meter stations could qualify for a Simplified TEE based on the qualifying regulations documented in WAC 173-340-7491(2)(a). While Ecology agreed that on an individual basis certain meter station facilities *may* qualify for a Simplified TEE, Ecology had too many concerns to approve the program as a whole using the model approach presented.

2.3 Modified Model TEE based upon Site-Specific TEE

Since Ecology had concerns with approving a model approach for justifying a Simplified TEE for meter station facilities, NWPL GP is proposing a modified model approach TEE program herein based upon the Site-Specific TEE procedures documented in WAC 173-340-7493.

As previously indicated, the primary COC at the meter stations is inorganic mercury and a less common COC is arsenic.

Inorganic mercury soil impacts at the meter stations have been characterized to the MTCA Method A Soil Cleanup Level for Unrestricted Land Uses of 2 milligrams/kilogram (mg/kg), which is the initially selected cleanup level for NWPL GP meter station facilities. The Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals (Table 749-3) are specified as 0.3 mg/kg, 0.1 mg/kg, and 5.5 mg/kg for Plants, Soil Biota, and Wildlife, respectively. Since wildlife receptors are protected at a soil concentration greater than the initially selected cleanup level of 2 mg/kg, facilities that are in compliance with the 2 mg/kg mercury cleanup level will be protective of wildlife receptors. However, because the selected cleanup level of 2 mg/kg exceeds the limits established for the protection of plants and soil biota, it is proposed to perform a modified Site-Specific TEE according to WAC 173-340-7493 for these potential exposures.

Arsenic soil impacts at the meter stations have been characterized to the MTCA Method A Soil Cleanup Level for Unrestricted Land Uses of 20 mg/kg, which is the initially selected cleanup level for NWPL GP meter station facilities. The Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals (Table 749-3) are specified as 10 mg/kg, 60 mg/kg, and 7 mg/kg for Plants, Soil Biota, and

Wildlife, respectively. Since soil biota receptors are protected at a soil concentration greater than the initially selected cleanup level of 20 mg/kg, facilities that are in compliance with the 20 mg/kg arsenic cleanup level will be protective of soil biota receptors. However, because the selected cleanup level of 20 mg/kg exceeds the limits established for the protection of plants and wildlife, it is proposed to perform a modified Site-Specific TEE according to WAC 173-340-7493 for these potential exposures.

2.3.1 Exposure Pathways

The primary exposure pathway for inorganic mercury and arsenic at the NWPL GP meter stations occurs via direct contact. The contact with contaminated soil can directly impact vegetation and soil biota. Indirect impacts can occur when animals feed on affected media, resulting in bioaccumulation of contaminants through the food chain. These secondary receptors could include ground-feeding birds and mammals, and small-mammal predators. Plants exposed to contaminants may directly uptake the contamination from the soil in their roots. Animals may be exposed from direct contact with contaminated soil or by consuming affected plants and/or soil biota.

2.3.2 Receptors of Concern

The receptors of concern differ for mercury and arsenic. The receptors of concern for both of these compounds are summarized below.

2.3.2.1 Receptors of Concern – Mercury

As indicated above, the inorganic mercury cleanup level for NWPL GP meter station facilities is 2 mg/kg. The inorganic mercury ecological indicator soil concentration for protection of wildlife receptors is 5.5 mg/kg, which is based on Ecology's Wildlife Exposure Model for Site-specific Evaluations (Table 749-4). Therefore, wildlife receptors such as potentially exposed avian or mammalian receptors are not considered receptors of concern at NWPL GP meter station facilities that meet the 2 mg/kg cleanup level.

Assuming that the 2 mg/kg selected cleanup level for inorganic mercury has been achieved, the primary receptors of concern for mercury include vascular vegetation and soil biota.

2.3.2.2 Receptors of Concern – Arsenic

The arsenic cleanup level for NWPL GP meter stations is 20 mg/kg. The arsenic ecological indicator soil concentration for protection of soil biota receptors is 60 mg/kg. Therefore, soil biota receptors such are not considered receptors of concern at NWPL GP meter station facilities that meet the 20 mg/kg arsenic cleanup level.

Assuming that the 20 mg/kg selected cleanup level for arsenic has been achieved, the primary receptors of concern for arsenic include vascular vegetation and wildlife.

2.3.3 Toxicological Assessment

The mercury cleanup levels established in MTCA on Table 749-3 for the TEE are based on toxicological effects described in the EPA document *Mercury Study: Report to Congress, Volume VI: An Ecological Assessment for Anthropogenic Mercury Emissions in the United States* (EPA-452/R-97-008, December 1997), which stated that "earthworms accumulated an average of 21.3 times the mercury concentration of the soil to which they were exposed" (Beyer *et al.,* 1985).

Much of the research done on the effects of mercury toxicity is based on methylmercury. Methylmercury is a neurotoxin capable of impacting reproductive health, causing nervous tissue and liver damage, and impairing motor functions in birds and mammals (EPA-425/R-97-008).

Since the impacts at NWPL GP meter stations are from inorganic mercury, which can be converted to the more toxic form of methylmercury through biological methylation, collecting site-specific toxicological data is essential for determining if the initially selected cleanup level of 2 mg/kg is protective of vascular vegetation and soil biota.

An initial toxicological literature study was performed to determine if arsenic could be ruled out for any of the potential receptors of concern. Based on the toxicological information obtained, it is unlikely that arsenic can be ruled out of TEE consideration. The sampling proposed herein will provide empirical site- and compound-specific toxicological data to determine protective concentrations of arsenic. This data will be more beneficial than performing an overly exhaustive literature study for arsenic.

3.0 METHODOLOGY

The proposed modified Site-Specific TEE will identify and address the issue of soil toxicity at the NWPL GP meter stations and its effects on vascular plants and soil biota.

The approach proposed herein is to divide Washington State into representative areas based on regional climate and geography and to collect empirical data at a representative facility within each area. The other meter stations assessed and remediated within a given representative area will utilize the data collected at the area's representative facility for determining compliance with TEE.

The proposed division of Washington State includes four ecological regions, focusing mainly on geographic location and its associated climate systems. These proposed representative areas include:

a. Northwest Washington: located in the Puget Sound trough with a maritime climate, forested foothills, and abundant riparian habitat. Experiences high volumes of rainfall, averaging 40-80-inches annually. Significant development has occurred along the Interstate-5 corridor, which the NWPL GP pipeline parallels.

b. Southwest Washington/Columbia River Basin: located to the west of the Cascade Mountain Range. Climate is similar to Northwest Washington; however, rainfall is slightly greater, receiving an annual precipitation of 55-140-inches.

c. Central Washington: located to the east and in the rain shadow of the Cascade Mountain Range and stretches east toward the Columbia Plateau of central Washington. Precipitation averages 20-inches annually, encouraging growth of shrub-steppe vegetation.

d. Eastern Washington: located near the Washington/Idaho border, near the foothills of the Canadian Rocky Mountain Range. Precipitation averages 30-inches annually and vegetation ranges from a sage-steppe ecosystem to evergreen forests.

The proposed representative areas as they relate to the NWPL GP pipeline are depicted on **Figure 1**.

3.1 Soil Bioassay

Soil bioassay analysis will be necessary to evaluate the protectiveness of mercury concentrations for vascular plants and soil biota. Bioassay analysis will be necessary to evaluate the protectiveness of arsenic concentrations for vascular plants.

In order to address whether chemical impacts to representative soils are protective of vascular plants and soil biota, soil samples will be subjected to bioassay screening as specified in WAC 173-340-7493(3)(b)(i). The samples for bioassay screening analyses will be collected from areas where the concentrations of impacts are representative of the initial cleanup levels selected for each compound

(*i.e.*, 2 mg/kg for mercury and 20 mg/kg for arsenic). The previously collected assessment data will be used to determine the sampling location. No soil dilution will be performed prior to analysis.

In order to confirm the contaminant concentration prior to bioassay analysis, a sample will be submitted from the bioassay sample collected and will be analyzed for mercury using EPA Method 7471 and arsenic using EPA Method 6010B.

Bioassay tests proposed herein are to be performed on concentrations of soil that are at, or slightly higher than the initially selected cleanup level of 2 mg/kg for mercury and 20 mg/kg for arsenic, meaning that soils that are representative of the cleanup level for each COC, or slightly more contaminated than post-remedial concentrations, will be used for the bioassays. Therefore, if the bioassays on the more-highly contaminated soil are shown to be protective of ecological risks, soils from sites remediated to 2 mg/kg for mercury and 20 mg/kg for arsenic are also considered protective.

For purposes of this TEE, the acceptable range of concentrations for performing the bioassay analysis shall be considered between 2 and 6 mg/kg for mercury, and between 20 mg/kg and 60 mg/kg for arsenic.

If the bioassay screening analysis determines that the soils are not protective of plants and/or soil biota for a particular region, then serial dilutions of samples will be performed to determine concentrations that are protective. If serial dilutions are necessary, contaminant analysis will be performed on the diluted soils to confirm the concentration of COCs prior to performing additional bioassay analysis.

The methodology for the soil bioassay for plants will be in accordance with the Ecology Publication No. 96-324, *Early Seedling Growth Protocol for Soil Toxicity Screening.* The methodology for soil bioassay for soil biota will be in accordance with the Ecology Publication No. 96-327, *Earthworm Bioassay Protocol for Soil Toxicity Screening*. The soil bioassay analysis will be performed by Nautilus Environmental, a Department of Ecology accredited laboratory located in Tacoma, Washington.

3.2 Bioaccumulation Factor Calculation

As presented above, arsenic is the only COC applicable to potential wildlife receptors and requires further evaluation for protectiveness.

For wildlife receptors, the surrogate species are the American Robin and the Shrew; both are ground-feeding carnivorous species. Therefore, in accordance with Ecology's Wildlife Exposure Model for Site-Specific Evaluations (WEM; Table 749-4), the potential exposure pathway for these receptors is through consumption of worms living in contaminated soil. The driving factor in calculating a site-specific indicator concentration using the WEM is the bioaccumulation factor (BAF) for worms living in the contaminated media. In order to calculate site-specific indicator concentrations for wildlife receptors, site-specific BAFs for arsenic will be assessed as allowed by WAC 173-340-7493(3)(c)(i).

The BAFs for biota will be measured by collecting and analyzing worm samples living in representative arsenic-contaminated soils. If worms are not available in the representative soils, other biota (*e.g.*, spiders, potato bug, etc.) will be collected and analyzed in lieu of worms.

If no biotas are present in the representative soils, worms will be grown in contaminated media and then analyzed for arsenic concentration. Using previously collected assessment data to determine the sampling location, contaminated media will be collected for purposes of growing worms. In order to confirm the contaminant concentration prior to growing worms, a sample will be submitted from the contaminated media collected and analyzed for arsenic.

Methodology for growing worms in contaminated media will be in accordance with the *Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation Tests with the Lumbricid Earthworm Eisenia Fetida* (ASTM E1676-04, 2007).

After growing the worms in the contaminated media using the above method, the worms will be analyzed for arsenic.

The BAFs are determined by dividing the concentrations of arsenic within the biota samples by the concentration within the soil in which the biota were collected or grown. The resulting BAFs will then be used in the WEM equations to calculate site-specific concentrations that are protective of wildlife receptors.

4.0 SITE GROUPINGS AND REPRESENTATIVE SITES

The following summarizes the NWPL GP proposed representative areas, the associated NWPL GP meter station facilities, and the proposed representative facility for each area; see **Figure 1.**

4.1 Northwest Washington Representative Area

The representative facility for the Northwest Washington Representative Area is the Snohomish Compressor Station for both arsenic and mercury.

Data collected at this facility will be representative of the following NWPL GP meter station facilities:

- Chehalis
- Evergreen Shores (Black Lake)
- McCleary Aberdeen
- North Seattle – Everett
- North Tacoma
- Oak Harbor – Stanwood
- Olympia
- Sedro Woolley
- Shelton
- South Seattle
- South Tacoma
- Toledo

4.2 Southwest Washington/Columbia River Basin Representative Area

The representative facility for the Southwest Washington/Columbia River Basin Representative Area is the Washougal Compressor Station for both arsenic and mercury:

Data collected at this facility will be representative of the following NWPL GP meter station facilities:

- Deer Island
- Kalama
- Stevenson
- Stevenson #2
- Vanalco
- Vancouver
- Washougal

4.3 Central Washington Representative Area

The representative facility for the Central Washington Representative Area is Yakima Firing Center Meter Station for arsenic and Ellensburg Meter Station for mercury.

Data collected at these facilities will be representative of the following NWPL GP meter station facilities:

- Alcoa Wenatchee
- Burbank Heights
- Connell
- Ellensburg
- Goldendale*
- Grandview*
- John Day Dam*
- Kawecki Chemical
- Kennewick
- Klickitat*
- Lind
- Menan Starch
- Moses Lake
- Pasco
- Prosser*
- Quincy
- Ritzville*
- Sandvik Special Metals
- Sunnyside
- Unocal Finley
- Walla Walla
- Warden
- Wenatchee
- Yakima*
- Zillah – Toppenish*

4.4 Eastern Washington Representative Area

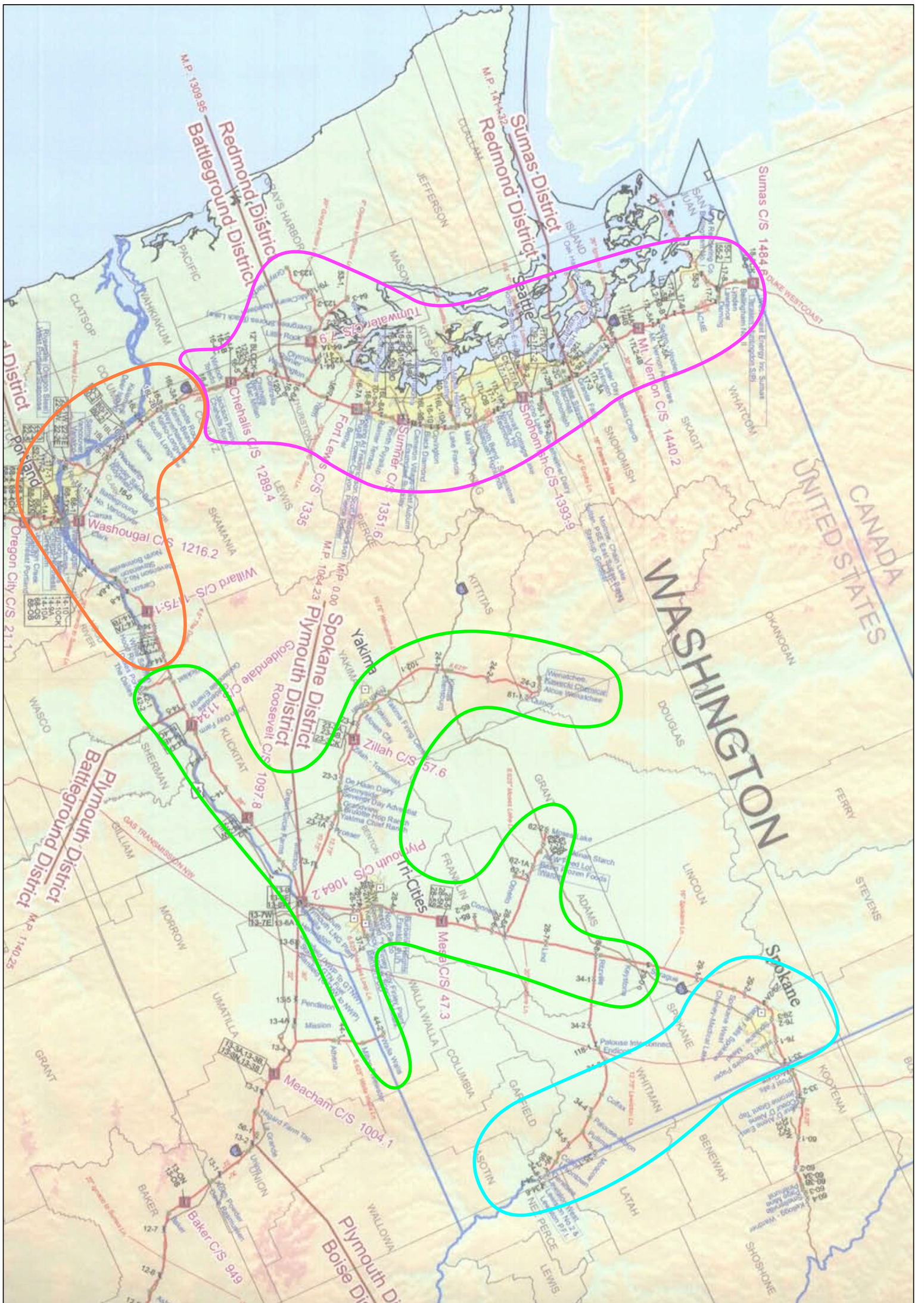
The representative facility for the Eastern Washington Representative Area is Spokane Mead Meter Station for arsenic and Cheney Medical Lake Meter Station for mercury:

Data collected at these facilities will be representative of the following NWPL GP meter station facilities:

- Cheney Medical Lake
- Colfax
- Genesee
- Pullman
- Spokane West
- Spokane - Mead

5.0 CLOSING

Upon written acceptance of this proposed modified Site-Specific TEE program by Ecology, an individual TEE will be submitted for each meter station facility/site using this document and the representative facility data as a reference for compliance.



KEY:

- NORTHWEST WASHINGTON
- SOUTHWEST WASHINGTON/COLUMBIA BASIN
- CENTRAL WASHINGTON
- EASTERN WASHINGTON

NOT TO SCALE

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

FIGURE 1

TEE SITE
"REPRESENTATIVE AREAS"

PROJECT	47308.33		
PREPARED FOR	NWPL GP/WILLIAMS		
LOCATION	WASHINGTON		
SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	ARM	EMK	01/13/11

Attachment B

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

RECEIVED
MAY 19 2011

May 13, 2011

Mr. Aaron Galer, Environmental Scientist III
Williams - Northwest Pipeline
295 Chipeta Way # 1
Salt Lake City, UT 84108-1285

Mr. Mark S. Nelson, P.E., Group Leader, Environmental Remediation
Williams Gas Pipeline
P.O. Box 1396
Houston, TX 77251

Re: Transmittal of Ecology Approval and Comment on the revised *Terrestrial Ecological Evaluation Program, Northwest Pipeline GP Meter Station Facilities throughout Washington State,* April 2011, prepared by Williams Gas Pipeline; Environmental Partners, Inc; and Portnoy Environmental.

Dear Mr. Galer and Mr. Nelson:

Thank you for submitting the above-referenced revised Terrestrial Ecological Evaluation (TEE) Program document in response to our comments. **Ecology approves the above-referenced document <u>provided that the following comment is incorporated</u>**:

- The 3rd paragraph of Section 3.1 states that in order to confirm the contaminant concentration prior to bioassay analysis, samples will be analyzed for mercury and arsenic. However, a similar statement is not provided in Section 3.2. Please also add this to Section 3.2.

If you have any questions, please contact me at (360) 407-6247 or via e-mail at stee461@ecy.wa.gov.

Sincerely,

SSTeel

Steve Teel, LHG
Site Manager/Hydrogeologist
Toxics Cleanup Program
Southwest Regional Office

ST/ksc:TEE M-S approval May 2011

By certified mail: (7010 0780 0002 3400 6118 // 7010 0780 0002 3400 6088)

cc: Eric Koltes, Environmental Partners, Inc.
Mr. Alan Hopkins, P.G., Portnoy Environmental
Scott Rose – Ecology-SWRO
Dale Myers – Ecology-NWRO
Norm Peck – Ecology-CRO
Jason Shira – Ecology-CRO
Patti Carter – Ecology-ERO
Mike Hibbler – Ecology-ERO
Brendan Dowling – Ecology-ERO

Attachment C

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

May 3, 2011

Clint Moseley, Project Manager
Portnoy Environmental
1414 W Sam Houston Pkwy N, Suite 170
Houston, TX 77043

RE: Snohomish TEE 534512-RXG99, F&BI 105017

Dear Mr. Moseley:

Included are the results from the testing of material submitted on May 3, 2011 from the Snohomish TEE 534512-RXG99, F&BI 105017 project. There are 7 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: Eric Koltes, Tim Jenkins, Alan Hopkins, Mike Portnoy
PRT0503R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on May 3, 2011 by Friedman & Bruya, Inc. from the Portnoy Environmental Snohomish TEE 534512-RXG99 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Portnoy Environmental
105017-01	SH3-AX36
105017-02	SH4-W64
105017-03	SH9-Q39

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 200.8

Client ID:	SH3-AX36	Client:	Portnoy Environmental
Date Received:	05/03/11	Project:	Snohomish TEE 534512-RXG99
Date Extracted:	05/03/11	Lab ID:	104017-01
Date Analyzed:	05/03/11	Data File:	104017-01.016
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	93	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	40.6

Analysis For Total Metals By EPA Method 200.8

Client ID:	SH4-W64	Client:	Portnoy Environmental
Date Received:	05/03/11	Project:	Snohomish TEE 534512-RXG99
Date Extracted:	05/03/11	Lab ID:	104017-02
Date Analyzed:	05/03/11	Data File:	104017-02.017
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	95	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	48.1

Analysis For Total Metals By EPA Method 200.8

Client ID:	SH9-Q39	Client:	Portnoy Environmental
Date Received:	05/03/11	Project:	Snohomish TEE 534512-RXG99
Date Extracted:	05/03/11	Lab ID:	104017-03
Date Analyzed:	05/03/11	Data File:	104017-03.018
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	88	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	2.17

Analysis For Total Metals By EPA Method 200.8

Client ID:	Method Blank	Client:	Portnoy Environmental
Date Received:	Not Applicable	Project:	Snohomish TEE 534512-RXG99
Date Extracted:	05/02/11	Lab ID:	I1-307 mb
Date Analyzed:	05/03/11	Data File:	I1-307 mb.015
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	91	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1

Date of Report: 05/03/11
Date Received: 05/03/11
Project: Snohomish TEE 534512-RXG99, F&BI 105017

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 200.8

Laboratory Code: 104291-22 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	6.07	89 b	89 b	44-151	0 b

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	99	80-120

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

A1 – More than one compound of similar molecule structure was identified with equal probability.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for this range fell outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte indicated may be due to carryover from previous sample injections.

d - The sample was diluted. Detection limits may be raised due to dilution.

ds - The sample was diluted. Detection limits are raised due to dilution and surrogate recoveries may not be meaningful.

dv - Insufficient sample was available to achieve normal reporting limits and limits are raised accordingly.

fb - Analyte present in the blank and the sample.

fc – The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. The variability is attributed to sample inhomogeneity.

ht - Analysis performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of normal control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j – The result is below normal reporting limits. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The analyte result in the laboratory control sample is out of control limits. The reported concentration should be considered an estimate.

jr - The rpd result in laboratory control sample associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the compound indicated is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc – The sample was received in a container not approved by the method. The value reported should be considered an estimate.

pr – The sample was received with incorrect preservation. The value reported should be considered an estimate.

ve - 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.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

105017 ME 05/03/11 AI1

Portnoy Environmental

Alternate billing information:
Direct Bill to
Mark Nelson

Report to: Alan Hopkins
Email to: NWPL TEAM

Project Description: Snohomish TEG
City/State Collected:
Phone:
FAX:
Client Project #:
ESC Key: PORTENVTX- WAHG
Collected by: C. Moseley
Site/Facility ID#:
P.O.#: 534512-RXG99
Collected by (signature):
Packed on Ice N Y

Rush? (Lab MUST Be Notified)
____ Same Day. 200%
____ Next Day. 100%
____ Two Day 50%

Date Results Needed:
Email? __No__Yes
FAX? __No__Yes

Analysis/Container/Preservative
All Samples need TS, QC2MOD,EDD
Total Hg

Chain of Custody Page 1 of 1

Prepared by: Friedman + Bruya/c
ENVIRONMENTAL SCIENCE CORP
12065 Lebanon Road
Mt. Juliet, TN 37122
Phone (615) 758-5858
Phone (800) 767-5859
FAX (615) 758-5859

CoCode portenvtx (lab use only)
Template/Prelogin
Shipped Via:

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No of Cntrs	Lab ID	Remarks/Contaminant	Sample # (lab only)
SH3-AX36		Soil		5/2/11		1	01	✓ per cm	
SH4-W64						1	02	5/4/11	
SH9-Q39						1	03	ac	

*Matrix: SS - Soil/Solid GW - Groundwater WW - WasteWater DW - Drinking Water OT - Other_____

pH _____ Temp _____

Remarks:

Flow _____ Other _____

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by: (Signature)	5/3/11	0930	Received by: (Signature)
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)

Samples returned via: ☐ FedEx ☐ Courier ☐ UPS
Temp: Bottles Received:
Date: Time:

Condition (lab use only)
Received: NCF:

Samples received at 16 °C

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

May 17, 2011

Eric Koltes, Project Manager
Environmental Partners, Inc.
295 NE Gilman Blvd., Suite 201
Issaquah, WA 98027

RE: Snohomish C/S Job 47308.36, F&BI 105180

Dear Mr. Koltes:

Included are the results from the testing of material submitted on May 13, 2011 from the Snohomish C/S Job 47308.36, F&BI 105180 project. There are 4 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
EPI0517R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on May 13, 2011 by Friedman & Bruya, Inc. from the Environmental Partners Snohomish C/S Job 47308.36, F&BI 105180 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Environmental Partners
105180-01	SHSB2-3:18

All quality control requirements were acceptable.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 05/17/11
Date Received: 05/13/11
Project: Snohomish C/S Job 47308.36, F&BI 105180
Date Extracted: 05/17/11
Date Analyzed: 05/17/11

RESULTS FROM THE ANALYSIS OF THE SOIL SAMPLES FOR TOTAL MERCURY USING EPA METHOD 1631E

Results Reported on a Dry Weight Basis
Results Reported as mg/kg (ppm)

Sample ID Laboratory ID	Total Mercury
SHSB2-3:18 105180-01 1/2	2.5
Method Blank	<0.1

Date of Report: 05/17/11
Date Received: 05/13/11
Project: Snohomish C/S Job 47308.36, F&BI 105180

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL MERCURY USING EPA METHOD 1631E

Laboratory Code: 105187-03 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Mercury	mg/kg (ppm)	0.125	<0.1	101	100	45-162	1

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Mercury	mg/kg (ppm)	0.125	107	63-144

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

A1 – More than one compound of similar molecule structure was identified with equal probability.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for this range fell outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte indicated may be due to carryover from previous sample injections.

d - The sample was diluted. Detection limits may be raised due to dilution.

ds - The sample was diluted. Detection limits are raised due to dilution and surrogate recoveries may not be meaningful.

dv - Insufficient sample was available to achieve normal reporting limits and limits are raised accordingly.

fb - Analyte present in the blank and the sample.

fc – The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. The variability is attributed to sample inhomogeneity.

ht - Analysis performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of normal control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j – The result is below normal reporting limits. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The analyte result in the laboratory control sample is out of control limits. The reported concentration should be considered an estimate.

jr - The rpd result in laboratory control sample associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the compound indicated is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc – The sample was received in a container not approved by the method. The value reported should be considered an estimate.

pr – The sample was received with incorrect preservation. The value reported should be considered an estimate.

ve - 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.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

105180

SAMPLE CHAIN OF CUSTODY MG 05-11-11

PAGE # 1 OF 1

Send Report To Eric Koltes

Company Environmental Partners, Inc.

Address 295 NE Gilman Blvd.

City, State, ZIP Issaquah, WA 98027

Phone # (425) 395-0010 Fax # (425) 395-0011

SAMPLERS (signature)

PROJECT ID/ADDRESS: Snohomish C/S

JOB #: 47308.36

SITE NAME: TEE

REMARKS:

TURNAROUND TIME
- ☐ Standard
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Return samples
- ☐ Will call with instructions

Sample ID	LAB ID	Date Sampled	Time Sampled	Matrix	# of jars	ANALYSES REQUESTED: 8015 - GRO	8015 - DRO	BTEX by 8021B	BTEX by 602	VOC by 8260C	VOC by 524	MTBE only				Notes
SASB2-3:18	01	5/13/11	1300	SOIL								X				

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Ashley Hjorten	EPI	5/13/11	4:38
Received by:	Michael Erdahl	FB	5/13/11	4:38
Relinquished by:				
Received by:		Samples received at 4 °C		

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Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite 170
Houston, TX 77043

Report Summary

Friday May 27, 2011

Report Number: L517283
Samples Received: 05/20/11
Client Project:

Description:

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Entire Report Reviewed By:

Tom Mellette , ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 100789, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375/DW21704, ND - R-140
NJ - TN002,NJ NELAP - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, NV - TN000032008A,
TX - T104704245, OK-9915

Accreditation is only applicable to the test methods specified on each scope of accreditation held by ESC Lab Sciences.
Note: The use of the preparatory EPA Method 3511 is not approved or endorsed by the CA ELAP.

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Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-01

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : YFSS-1110

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	96.		96.		%	2540G	05/27/11
Arsenic	12.	1.0	12.	1.0	mg/kg	6010B	05/25/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
The reported analytical results relate only to the sample submitted.
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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-02

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : YFSS-D1

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	97.		97.		%	2540G	05/27/11
Arsenic	14.	1.0	14.	1.0	mg/kg	6010B	05/25/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-03

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : YFSS-D2

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	96.		96.		%	2540G	05/27/11
Arsenic	8.4	1.0	8.7	1.0	mg/kg	6010B	05/25/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-04

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : WS11-AM24

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	76.		76.		%	2540G	05/27/11
Arsenic	12.	1.0	16.	1.3	mg/kg	6010B	05/24/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
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Reported: 05/27/11 13:39 Printed: 05/27/11 13:39

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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-05

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : WSSB11-2

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	87.		87.		%	2540G	05/27/11
Arsenic	4.8	1.0	5.5	1.1	mg/kg	6010B	05/24/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-06

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : WSSB11-1

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	89.		89.		%	2540G	05/27/11
Arsenic	5.4	1.0	6.0	1.1	mg/kg	6010B	05/24/11

BDL - Below Detection Limit
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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-07

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : ELSS-0810

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	92.		92.		%	2540G	05/27/11
Mercury	2.6	1.0	2.8	1.1	mg/kg	7471	05/25/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
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Reported: 05/27/11 13:39 Printed: 05/27/11 13:39

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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-08

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : ELSS-1009

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	95.		95.		%	2540G	05/27/11
Mercury	1.4	0.20	1.5	0.21	mg/kg	7471	05/25/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-09

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : ELSS-1109

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	96.		96.		%	2540G	05/27/11
Mercury	13.	2.0	14.	2.1	mg/kg	7471	05/25/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
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Reported: 05/27/11 13:39 Printed: 05/27/11 13:39

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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-10

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : WS6-AT35

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	90.		90.		%	2540G	05/27/11
Mercury	1.8	0.40	2.0	0.44	mg/kg	7471	05/25/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
The reported analytical results relate only to the sample submitted.
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Reported: 05/27/11 13:39 Printed: 05/27/11 13:39

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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-11

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : WSSB6-0910

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	93.		93.		%	2540G	05/27/11
Mercury	2.4	1.0	2.6	1.1	mg/kg	7471	05/25/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
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This report shall not be reproduced, except in full, without the written approval from ESC.
Reported: 05/27/11 13:39 Printed: 05/27/11 13:39

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REPORT OF ANALYSIS

May 27,2011

Alan Hopkins and NWPL Team
Portnoy Environmental
1414 W. Sam Houston Pkwy. N., Suite
Houston, TX 77043

ESC Sample # : L517283-12

Date Received : May 20, 2011
Description :

Site ID :

Sample ID : WSSB6-0911

Project # :

Collected By :
Collection Date : 05/19/11 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	93.		93.		%	2540G	05/27/11
Mercury	2.4	1.0	2.5	1.1	mg/kg	7471	05/25/11

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
The reported analytical results relate only to the sample submitted.
This report shall not be reproduced, except in full, without the written approval from ESC.
Reported: 05/27/11 13:39 Printed: 05/27/11 13:39

Summary of Remarks For Samples Printed
05/27/11 at 13:39:32

TSR Signing Reports: 690
R5 - Desired TAT

See Tom M prior to all non Template logins for special notes if any. Tom M cell 406-3470

Sample: L517283-01 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-02 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-03 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-04 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-05 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-06 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-07 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-08 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-09 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-10 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-11 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068
Sample: L517283-12 Account: PORTENVTX Received: 05/20/11 08:45 Due Date: 05/27/11 00:00 RPT Date: 05/27/11 13:39
Refer to 05-0068

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

June 28, 2011

Eric Koltes, Project Manager
Environmental Partners, Inc.
295 NE Gilman Blvd., Suite 201
Issaquah, WA 98027

RE: Job 77380.36, F&BI 106382

Dear Mr. Koltes:

Included are the results from the testing of material submitted on June 28, 2011 from the Job 47380.36, F&BI 106382 project. There are 5 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
EPI0628R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on June 28, 2011 by Friedman & Bruya, Inc. from the Environmental Partners Job 47380.36, F&BI 106382 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Environmental Partners
106382-01	SMSS-BG

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 200.8

Client ID:	SMSS-BG	Client:	Environmental Partners
Date Received:	06/28/11	Project:	Job 47380.36, F&BI 106382
Date Extracted:	06/28/11	Lab ID:	106382-01
Date Analyzed:	06/28/11	Data File:	106382-01.013
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	86	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	18.1

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Analysis For Total Metals By EPA Method 200.8

Client ID:	Method Blank	Client:	Environmental Partners
Date Received:	Not Applicable	Project:	Job 47380.36, F&BI 106382
Date Extracted:	06/27/11	Lab ID:	I1-438 mb
Date Analyzed:	06/28/11	Data File:	I1-438 mb.008
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	88	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1

Date of Report: 06/28/11
Date Received: 06/28/11
Project: Job 47380.36, F&BI 106382

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 200.8

Laboratory Code: 106364-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	6.60	100 b	95 b	44-151	5 b

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	100	80-120

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

A1 – More than one compound of similar molecule structure was identified with equal probability.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for this range fell outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte indicated may be due to carryover from previous sample injections.

d - The sample was diluted. Detection limits may be raised due to dilution.

ds - The sample was diluted. Detection limits are raised due to dilution and surrogate recoveries may not be meaningful.

dv - Insufficient sample was available to achieve normal reporting limits and limits are raised accordingly.

fb - Analyte present in the blank and the sample.

fc – The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. The variability is attributed to sample inhomogeneity.

ht - Analysis performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of normal control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j – The result is below normal reporting limits. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The analyte result in the laboratory control sample is out of control limits. The reported concentration should be considered an estimate.

jr - The rpd result in laboratory control sample associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the compound indicated is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc – The sample was received in a container not approved by the method. The value reported should be considered an estimate.

pr – The sample was received with incorrect preservation. The value reported should be considered an estimate.

ve - 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.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

106382

SAMPLE CHAIN OF CUSTODY

ME 06/28/11

AT 1

Send Report To Eric Koltes

Company Environmental Partners, Inc.

Address 295 NE Gilman Blvd.

City, State, ZIP Issaquah, WA 98027

Phone # (425) 395-0010 Fax # (425) 395-0011

SAMPLERS (signature)

PROJECT ID/ADDRESS

JOB # 47308.36

SITE NAME EE

REMARKS

PAGE # 1 OF 1

TURNAROUND TIME

- ☐ Standard
- ☒ RUSH BY END OF 6/28

Rush charges authorized by:

SAMPLE DISPOSAL

- ☐ Dispose after 30 days
- ☐ Return samples
- ☐ Will call with instructions

Sample ID	LAB ID	Date Sampled	Time Sampled	Matrix	# of jars	ANALYSES REQUESTED: 8015 - GRO	8015 - DRO	BTEX by 8021B	BTEX by 602	VOC by 8260C	VOC by 524	TOTAL As				Notes
SMSS-BG	01	6/27/11		SOIL	1							X				
																Samples received at 24°C

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:				
Received by:	Michael Erdahl	FBInc	6/28/11	7:50AM
Relinquished by:				
Received by:				

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

May 31, 2011

Eric Koltes, Project Manager
Environmental Partners, Inc.
295 NE Gilman Blvd., Suite 201
Issaquah, WA 98027

RE: Tee 47308.36, F&BI 105338

Dear Mr. Koltes:

Included are the results from the testing of material submitted on May 26, 2011 from the Tee 47308.36, F&BI 105338 project. There are 12 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
EPI0531R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on May 26, 2011 by Friedman & Bruya, Inc. from the Environmental Partners Tee Tee 47308.36, F&BI 105338 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Environmental Partners
105338-01	SMSS-RA2
105338-02	SMSS-D2
105338-03	SMSS-RA1
105338-04	WSSB11-1
105338-05	WSSB11-2
105338-06	WS11-AM24
105338-07	Starroad-1507
105338-08	Starroad-1705
105338-09	Starroad-1807

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 200.8

Client ID:	SMSS-RA2	Client:	Environmental Partners
Date Received:	05/26/11	Project:	Tee 47308.36, F&BI 105338
Date Extracted:	05/27/11	Lab ID:	105338-01
Date Analyzed:	05/27/11	Data File:	105338-01.018
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	95	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	13.8

Analysis For Total Metals By EPA Method 200.8

Client ID:	SMSS-D2	Client:	Environmental Partners
Date Received:	05/26/11	Project:	Tee 47308.36, F&BI 105338
Date Extracted:	05/27/11	Lab ID:	105338-02
Date Analyzed:	05/27/11	Data File:	105338-02.021
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	92	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.4

Analysis For Total Metals By EPA Method 200.8

Client ID:	SMSS-RA1	Client:	Environmental Partners
Date Received:	05/26/11	Project:	Tee 47308.36, F&BI 105338
Date Extracted:	05/27/11	Lab ID:	105338-03
Date Analyzed:	05/27/11	Data File:	105338-03.022
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	92	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	16.4

Analysis For Total Metals By EPA Method 200.8

Client ID:	WSSB11-1	Client:	Environmental Partners
Date Received:	05/26/11	Project:	Tee 47308.36, F&BI 105338
Date Extracted:	05/27/11	Lab ID:	105338-04
Date Analyzed:	05/27/11	Data File:	105338-04.023
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	91	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	1.96

Analysis For Total Metals By EPA Method 200.8

Client ID:	WSSB11-2	Client:	Environmental Partners
Date Received:	05/26/11	Project:	Tee 47308.36, F&BI 105338
Date Extracted:	05/27/11	Lab ID:	105338-05
Date Analyzed:	05/27/11	Data File:	105338-05.024
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	91	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	2.84

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Analysis For Total Metals By EPA Method 200.8

Client ID:	WS11-AM24	Client:	Environmental Partners
Date Received:	05/26/11	Project:	Tee 47308.36, F&BI 105338
Date Extracted:	05/27/11	Lab ID:	105338-06
Date Analyzed:	05/27/11	Data File:	105338-06.025
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	89	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.56

Analysis For Total Metals By EPA Method 200.8

Client ID:	Method Blank	Client:	Environmental Partners
Date Received:	Not Applicable	Project:	Tee 47308.36, F&BI 105338
Date Extracted:	05/27/11	Lab ID:	I1-371 mb
Date Analyzed:	05/27/11	Data File:	I1-371 mb.015
Matrix:	Soil	Instrument:	ICPMS1
Units:	mg/kg (ppm)	Operator:	AP

Internal Standard:	% Recovery:	Lower Limit:	Upper Limit:
Indium	89	60	125

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1

Date of Report: 05/31/11
Date Received: 05/26/11
Project: Tee 47308.36, F&BI 105338
Date Extracted: 05/27/11
Date Analyzed: 05/27/11

RESULTS FROM THE ANALYSIS OF THE SOIL SAMPLES FOR TOTAL MERCURY USING EPA METHOD 1631E

Results Reported on a Dry Weight Basis
Results Reported as mg/kg (ppm)

Sample ID Laboratory ID	Total Mercury
Starroad-1507 105338-07 1/10	13
Starroad-1705 105338-08 1/10	6.1
Starroad-1807 105338-09 1/10	3.3
Method Blank	<0.1

Date of Report: 05/31/11
Date Received: 05/26/11
Project: Tee 47308.36, F&BI 105338

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 200.8

Laboratory Code: 105338-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	13.8	110 b	103 b	44-151	7 b

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	108	80-120

Date of Report: 05/31/11
Date Received: 05/26/11
Project: Tee 47308.36, F&BI 105338

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL MERCURY USING EPA METHOD 1631E

Laboratory Code: 105338-01 1/50 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Mercury	mg/kg (ppm)	0.125	62	0 b	0 b	45-162	0 b

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Mercury	mg/kg (ppm)	0.125	129	63-144

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

A1 – More than one compound of similar molecule structure was identified with equal probability.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for this range fell outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte indicated may be due to carryover from previous sample injections.

d - The sample was diluted. Detection limits may be raised due to dilution.

ds - The sample was diluted. Detection limits are raised due to dilution and surrogate recoveries may not be meaningful.

dv - Insufficient sample was available to achieve normal reporting limits and limits are raised accordingly.

fb - Analyte present in the blank and the sample.

fc – The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. The variability is attributed to sample inhomogeneity.

ht - Analysis performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of normal control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j – The result is below normal reporting limits. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The analyte result in the laboratory control sample is out of control limits. The reported concentration should be considered an estimate.

jr - The rpd result in laboratory control sample associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the compound indicated is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc – The sample was received in a container not approved by the method. The value reported should be considered an estimate.

pr – The sample was received with incorrect preservation. The value reported should be considered an estimate.

ve - 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.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

105338

SAMPLE CHAIN OF CUSTODY ME 05/26/11 BT1

PAGE # 1 OF 1

end Report To	Eric Koltes
ompany	Environmental Partners, Inc.
ddress	295 NE Gilman Blvd.
ity, State, ZIP	Issaquah, WA 98027
hone #	(425) 395-0010 Fax # (425) 395-0011

SAMPLERS (signature)

PROJECT ID/ADDRESS: TEE

JOB #: 47308.36

SITE NAME: TEE

REMARKS: Rush (BY 5/31)

TURNAROUND TIME
- ☐ Standard
- ☒ RUSH BY 5/31
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Return samples
- ☐ Will call with instructions

Sample ID	LAB ID	Date Sampled	Time Sampled	Matrix	# of jars	ANALYSES REQUESTED: 8015 - GRO	8015 - DRO	BTEX by 8021B	BTEX by 602	VOC by 8260C	VOC by 524	Arsenic	Mercury			Notes
SMSS-RA2	01	5/26/11		S	1							X				
SMSS-D2	02			S	1							X				
SMSS-RA1	03			S	1							X				
USSB11-1	04			S	1							X				
NSSB11-2	05			S	1							X				
NS11-AM24	06			S	1							X				
TARROAD-1507	07			S	1								X			
TARROAD-1705	08			S	1								X			
TARROAD-1807	09			S	1								X			

riedman & Bruya, Inc.
012 16th Avenue West
attle, WA 98119-2029
. (206) 285-8282
ax (206) 283-5044

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:		Eric Koltes	EPI	5/26/11	1415
Received by:		Matt Langston	F+BInc	5/26/11	1415
Relinquished by:					
Received by:					

Samples received at 2 °C

Attachment D

Nautilus Environmental, LLC

Soil Toxicity Evaluation

Northwest Pipeline GP Meter Station Facilities throughout Washington State

DRAFT Report

Date: September 1, 2011

Submitted to:

Environmental Partners, Inc.
295 NE Gilman Boulevard Suite 201
Issaquah, Washington 98027

Washington Laboratory
5009 Pacific Hwy East
Suite 2
Tacoma, WA 98424

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SIGNATURE PAGE

Washington 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

Laboratory toxicity testing was conducted on soil samples collected from 7 sites near Northwest Pipeline General Partnership (NWPL GP) meter stations facilities, following site-specific terrestrial ecological evaluation (TEE) methodology under the Model Toxics Control Act (MTCA). The specific contaminants of concern for the bioassay component of the TEE were arsenic and inorganic mercury. Toxicity tests were conducted using the earthworm *Eisenia foetida*, of the family lumbricidae and the butter crunch lettuce seed *Lactuca sativa*. Two different tests were conducted with the earthworm, the 14-day survival test and a 28-day bioaccumulation test. Samples tested for bioaccumulation were then sent to TestAmerica, an analytical laboratory, for arsenic determinations. Testing was initiated June, 2011 at the Washington Laboratory of Nautilus Environmental, located in Tacoma, Washington. Test procedures followed methods published by Washington State Department of Ecology for the Toxics Cleanup Program and ASTM.

2.0 METHODS

2.1 Sample Receipt and Manipulation

Seven soil samples were collected by Environmental Partners personnel between May 3rd and 17th, 2011 into HPDE containers. Individual samples were in labeled plastic jars, transported in coolers, and were received by Nautilus on June 3rd, 2011. All samples were transported in coolers. Individual samples were in labeled plastic jars. Upon receipt in the laboratory, the coolers were opened and the contents inspected and compared with documentation provided on the chain-of-custody forms (COC), where discrepancies occurred, samples identities were confirmed with Environmental Partners. Sample temperatures were measured upon receipt and recorded on both the COC and in a bound logbook maintained in the laboratory. Samples were held in the dark at 4 ± 2°C until testing.

Large pieces of wood, debris and rocks were removed from soils prior to testing. No sieving was performed on the samples. Analysis of soil pH, conductivity, and moisture content were performed upon sample receipt.

Sample ID's with corresponding dates of collection, and test initiation dates for all three tests are provided in Table 1.

Table 1. Sample collection, receipt, expiration, and test initiation dates.

Client ID	Nautilus Log-In Number	Date Collected	Lettuce Test Initiation	14-day Earthworm Test Initiation	28-day Earthworm Test Initiation
SHSB2-3:18	S11-061	May 13, 2011	June 7, 2011	June 9, 2011	NT
WSSB6-0910	S11-055	May 17, 2011	June 7, 2011	June 9, 2011	NT
ELSS-0810	S11-057				
STARROAD 1807	S11-059	May 16, 2011	June 7, 2011	June 9, 2011	NT
SH4-W64	S11-062	May 3, 2011	June 7, 2011	NT	June 9, 2011
WS11-AM24	S11-051	May 17, 2011	June 7, 2011	NT	June 9, 2011
YFSS-D1	S11-053				

2.2 Lettuce seedling survival and biomass test methods

A lettuce seedling survival and biomass test was conducted on samples received June 3, 2011 using butter crunch lettuce seeds, *Lactuca sativa*. The organisms were obtained from Territorial Seed Company, Oregon. The tests were initiated on June 7, 2011. Tests were performed according to procedures presented by WADOE (1996) and ASTM (1994). Test procedures are summarized in Table 2.

Prior to test initiation, 300 g subsamples were collected from the negative control and each site, for use in the test, as well as for initial pH measurements. Using an Orion 230 meter, pH measurements were taken by making a slurry of de-ionized (DI) water and soil in a 1:1 ratio (i.e., 25 mL DI water: 25 g soil). Soil slurry pH was measured after allowing soil/water mixture to stir for 5 minutes. Once the measurement was taken, the slurry was allowed to settle for 30 minutes, after which the pH of the supernatant liquid was measured. Sample soils were hydrated with DI water to match control friability where necessary, and distributed into three poly flat 36-cell trays with humidity domes. Five replicates per sample, each containing 50 g of soil, were randomly distributed into trays. Sample distribution took place according to a randomization sheet and planting maps created in Excel. Trays were placed in an environmental chamber at 25°C under a 16:8 hour light:dark photoperiod.

Lighting for the test was provided by 2-bulb gro-lights placed over each planting tray. Light measurements were taken upon test initiation, day seven, and at termination using a Milwaukee SM 700 photometer. Test temperatures were measured daily from a surrogate test chamber.

Table 2. Summary of testing conditions for the lettuce survival and biomass test.

Test start date	June 7, 2011
Test end date	June 21, 2011
Test organism	*Lactuca sativa*
Test organism source	Territorial Seed Company, Cottage Grove, OR
Test duration	14 days
Test chamber	60-mL planting cell with 4 drainage holes in bottom
Test soil/replicate	50 g dry weight
Water source for hydration	De-ionized water
Control soil	70% sand, 20% kaolin clay, 10% peat moss, 0.45% $CaCO_3$
Number of organisms/replicate	12
Number of replicates/sample	5
Test temperature	20-30°C
Illumination	16:8 hr light:dark photoperiod
Test acceptance criterion	≥90% mean germination in control organisms
Positive control reference toxicant	Boric acid

The tests were terminated on day 14, June 21, 2011. At test termination, the number of seedlings in each replicate was counted and observations on seedling condition (e.g., chlorosis, wilting) were recorded. The above-soil portion of each seedling was then cut at the soil using scissors; and placed in a pre-tared weigh boat corresponding to the replicate number. A 25 g subsamble of soil from each site was collected for final pH measurements from a randomly chosen replicate.

Weigh boats containing seedlings were weighed immediately after cutting using a Mettler AE 240 scale, in order to obtain wet weights, and were subsequently placed in a Thelco 28 oven to dry for 24 hours. Seedlings were weighed at the end of the drying period in order to obtain dry weights. The endpoints calculated were the number of seedling surviving and their biomass (evaluated on the basis of dry weight divided by final count). The test acceptance criterion for the negative control was seedling survival of ≥ 90 percent. Statistics were run using Biostat software on all sites where survival or growth were less than control, using a level of significance of 0.05.

A reference toxicant test (positive control) was conducted in conjunction with the lettuce seedling survival and biomass tests using boric acid as the toxicant. Test organisms were exposed to control, 40, 80, 160, 320 and 640 mg/kg boron for the same duration as the concurrent soil test, and the results of this test were compared with historical data for the species to determine whether the sensitivity of the organisms was appropriate.

2.3 Earthworm 14- day survival test methods

An earthworm survival test was conducted on samples received June 3, 2011 using the red wiggler worm, *Eisenia foetida*. The organisms were obtained from Aquatic Research Organisms, NH. Nautilus Environmental received the organisms at the laboratory on June 2, 2011 in good condition. Tests were initiated on June 9, 2011 according to procedures presented by WADOE (1996) and ASTM (1994). Test procedures are summarized in Table 3.

Table 3. Summary of testing conditions for the earthworm survival test.

Test start date	June 9, 2011
Test end date	June 23, 2011
Test organism	*Eisenia foetida*
Test organism source	Aquatic Research Organisms, Hampton, NH
Test organism age	>90 days
Test duration	14 days
Test chamber	1-L glass jar
Test soil/replicate	200 g dry weight
Water source for hydration	De-ionized water
Control soil	70% sand, 20% kaolin clay, 10% peat moss, 0.45% $CaCO_3$
Number of organisms/replicate	10
Number of replicates/sample	3
Test temperature	22± 2°C
Illumination	Continuous lighting
Test acceptance criterion	≥90% mean survival of control organisms
Positive control reference toxicant	2-chloroacetamide

Twenty-four hours prior to testing, 25 g of soil was removed from each sample, the initial weight of soil and vessel was obtained, and samples were then placed in a Thelco 28 oven set to between 103 and 105°C to dry for 24 hours. After 24 hours, samples were removed from the oven, allowed to cool, and final weights were obtained to determine the moisture content of each sample. Samples with a moisture content of less than 35 percent were then hydrated to match control levels or control friability, as required. Moisture content upon receipt of the samples, as well as hydration requirements and amount of water added to samples is contained in Table 4.

On test initiation, pH and conductivity measurements were conducted on a slurry of de-ionized (DI) water and soil in a 1:1 ratio (i.e., 25 mL DI water:25 g soil). Soil slurry pH was measured after allowing soil/water mixture to stir for 5 minutes. Once the measurement was taken, the slurry was allowed to settle for 30 minutes, after which the pH of the supernatant liquid was

measured. Conductivity and pH measurements were conducted utilizing an Orion 130A and Orion 320 meter, respectively.

Sample soils were hydrated with DI water where necessary, and distributed into 1-L labeled glass jars prior to test initiation. Three replicates and a surrogate were used for each sample, each containing 200 g of soil. Moisture content was also determined at test initiation. Sample distribution took place according to a randomization sheet created in Excel. Organisms, greater than 90 days old, were added following sample distribution, once samples were confirmed to be within acceptable temperature range. Jars were placed in an environmental chamber at 22 ± 2°C under continuous light conditions.

Test temperatures were measured daily from surrogate test chambers. Test chambers were misted daily with DI water in order to maintain proper moisture levels.

Table 4. Pre-test hydration used for visual match of control friability.

Client ID	Nautilus Log-In	Initial Moisture Content (%)	Hydration Needed (%)	Amount of Water Added to Sample (ml)
SHSB2-3:18	S11-061	7.3	27.7	166
WSSB6-0910	S11-055	7.3	27.7	166
ELSS-0810	S11-057	8.7	26.3	158
STARROAD 1807	S11-059	12.1	22.9	137
SH4-W64	S11-062	14.2	20.8	125
WS11-AM24	S11-051	30.1	4.1	24.7
YFSS-D1	S11-053	7.3	27.7	166

The tests were terminated on day 14, June 23, 2011. At test termination, prior to counting, observations were made of each test chamber, including dead organisms on the surface or any behavior abnormalities. To count test organisms, sample replicates were transferred to a flat surface lined with moistened paper towels, animals were counted, and any behavior (e.g., lack of burrowing, coiling, "balling" together), or morphological changes (e.g., contraction, rigidity, ulceration of the integument, segmental constriction, segmental loss) were noted. The surrogate chamber was used to determine final moisture content, and final pH and conductivity measurements.

The endpoint calculated was earthworm survival. The test acceptance criterion for the negative control was earthworm survival of ≥ 90 percent. Statistics were run using Biostat software on all sites where survival were less than control, using a level of significance of 0.05.

A reference toxicant test (positive control) was conducted in conjunction with the earthworm survival tests using 2-chloroacetamide. Test organisms were exposed to control, 10, 20, 40, and 80 mg/kg 2-chloroacetamide for the same duration as the concurrent soil tests, and the results of this test were compared with historical data for the species to determine whether the sensitivity of the organisms was appropriate.

2.4 Earthworm 28- day bioaccumulation test methods

Methods for the 28-day tests with earthworms followed the same methods as the 14-day for test initiation and daily monitoring, as outlined in Section 2.3. The test was terminated on July 7, 2011 following the same procedures. Worms were then separated from the soil and were stored in clean glass jars overnight to allow for depuration. The day following termination, worms were placed in chemistry containers by site and sent to an analytical chemical laboratory for analysis. There were no statistical endpoints calculated for this test. The chemistry data is reported here and will be used by Environmental Partners to calculate a bioaccumulation factor.

3.0 RESULTS

Results of toxicity tests conducted using butter crunch lettuce starting June 7, 2011 are summarized in Tables 5 and 6. Results of toxicity tests conducted using *E. foetida* starting June 9, 2011 are summarized in Tables 7 and 8. Detailed results of the soil toxicity tests and statistical analyses are provided in Appendix A. Copies of the laboratory bench sheets, reference toxicant test results, and chain-of-custody forms are in Appendices B, C, and D.

3.1 Lettuce toxicity results

Mean survival was 91.7 percent for the artificial soil control. The mean survival in the test soils ranged from 78.3 to 91.7 percent. None of the sites exhibited significant toxic effects when compared to negative control survival results.

Mean biomass was 1.18 mg per seedling for the artificial soil control. Mean biomass in the test soils ranged from 1.00 to 2.27 mg per seedling. None of the sites were significantly different than the negative control for growth.

Table 5. Results (means ± standard deviations) for *L. sativa* survival

Site ID/ Nautilus Log-In Number	% Survival	Mean Survival (%)	% of Control	Significant Decrease from Control? (p<0.05)
Negative Control	91.7 75.0 91.7 100 100	91.7 ± 10.2	--	--
SHSB2-3:18 S11-061	91.7 91.7 100 91.7 83.3	91.7 ± 5.9	100	No
WSSB6-0910 S11-055	100 91.7 91.7 83.3 58.3	85.0 ± 16.0	92.7	No
ELSS-0810 SS11-057	58.3 91.7 83.3 100 58.3	78.3 ± 19.2	85.4	No
STARROAD 1807 S11-059	100 83.3 91.7 91.7 91.7	91.7 ± 5.9	100	No
SH4-W64 S11-062	75.0 100 91.7 91.7 100	91.7 ± 10.2	100	No
WS11-AM24 S11-051	91.7 91.7 91.7 83.3 66.7	85.0 ± 10.9	92.7	No
YFSS-D1 S11-053	100 100 58.3 91.7 83.3	86.7 ± 17.3	94.5	No

Table 6. Results (means ± standard deviations) for *L. sativa* growth

Site ID/Nautilus Log-In Number	Growth per Seedling (mg)	Mean Growth per Organism (mg)	% of Control	Significant Decrease from Control? ($p<0.05$)
Negative Control	1.56 1.39 0.62 1.34 0.99	1.18 ± 0.38	--	--
SHSB2-3:18 S11-061	1.34 1.67 1.74 0.75 1.56	1.41 ± 0.40	119	No
WSSB6-0910 S11-055	1.11 1.17 1.58 2.12 1.45	1.49 ± 0.40	126	No
ELSS-0810 SS11-057	0.98 0.94 1.27 1.07 0.77	1.01 ± 0.18	85.6	No
STARROAD 1807 S11-059	2.30 1.77 2.31 2.24 2.72	2.27 ± 0.34	192	No
SH4-W64 S11-062	1.23 1.71 1.57 1.93 2.26	1.74 ± 0.38	147	No
WS11-AM24 S11-051	1.22 2.00 0.90 1.00 1.05	1.23 ± 0.44	104	No
YFSS-D1 S11-053	0.56 1.00 0.87 1.38 1.20	1.00 ± 0.31	84.7	No

3.2 Earthworm 14-day toxicity results

Mean survival was 100 percent for the artificial soil control as well as the test sites, SHSB2-3:18 and WSSB6-0910, and STARROAD 1807. Site ELSS-0810 had 96.7 percent survival. None of the test sites were significantly different from the control.

Table 7. Results (means ± standard deviations) for *E. foetida* survival

Site ID/Nautilus Log-In Number	Survival (%)	Mean Survival (%)	% of Control	Significant Decrease from Control? ($p<0.05$)
Negative Control	100 100 100	100 ± 0.0	--	--
SHSB2-3:18 S11-061	100 100 100	100 ± 0.0	100	No
WSSB6-0910 S11-055	100 100 100	100 ± 0.0	100	No
ELSS-0810 SS11-057	100 90.0 100	96.7 ± 5.8	96.7	No
STARROAD 1807 S11-059	100 100 100	100 ± 0.0	100	No

3.3 Earthworm 28-day bioaccumulation results

Control arsenic concentrations were determined to be 3.6 mg/kg at test termination. Site concentrations ranged from 4.1 to 7.8 mg/kg.

Table 8. Analytical chemistry results after 28-days for *E. foetida*

Site ID/Nautilus Log-In Number	Arsenic Concentration (mg/kg)
Negative Control	3.6
SH4-W64 S11-062	7.8
WS11-AM24 S11-051	4.1
YFSS-D1 S11-053	7.4

3.4 Soil Chemistries

Soil chemistry data are provided in Appendix B. Lettuce test sample pH from test initiation and termination are provided in Tables 9, while pH, conductivity, and percent moisture data for the 14-day earthworm are contained in Table 10. A summary of physical and chemical characteristics measured during testing is provided in Tables 11 through 13.

For the lettuce test temperatures ranged between 21.5 and 28.0°C for the duration of the test. The temperature in the 14-day earthworm test ranged from 21.9-22.0 °C, while the 28-day test ranged from 21.3-22.0 °C for the duration of the tests.

Table 9. Initial and final pH values for 14-day lettuce tests

Sample ID	Nautilus Log-In Number	Soil Slurry pH		Soil Supernatant pH	
		Initial	Final	Initial	Final
SHSB2-3:18	S11-061	5.14	5.66	5.94	5.69
WSSB6-0910	S11-055	7.41	7.73	7.51	7.80
ELSS-0810	S11-057	6.85	7.34	7.28	7.67
STARROAD 1807	S11-059	7.50	8.10	7.52	8.13
SH4-W64	S11-062	7.05	7.58	7.50	7.55
WS11-AM24	S11-051	7.50	7.94	7.51	8.00
YFSS-D1	S11-053	7.51	7.93	7.52	7.93

Table 10. Initial and final soil chemistry values for the *E. foetida* tests

Sample ID	Nautilus Log-In Number	% Moisture		Soil Slurry pH		Soil Slurry Conductivity (µS/cm)	
		Initial	Final	Initial	Final	Initial	Final
14-day Tests							
Negative Control		51.5	38.1	7.63	7.69	285	473
SHSB2-3:18	S11-061	10.1	19.1	8.09	7.59	71	370
WSSB6-0910	S11-055	5.5	16.8	8.10	6.66	17	219
ELSS-0810	S11-057	5.5	22.0	8.28	7.55	30	335
STARROAD 1807	S11-059	14.2	28.9	7.68	6.76	46	603
28-day Tests							
Negative Control		46.2	50.6	7.54	7.08	529	607
SH4-W64	S11-062	7.76	13.1	8.23	7.50	84	43
WS11-AM24	S11-051	38.9	51.5	6.54	5.54	16	15
YFSS-D1	S11-053	9.17	14.2	7.00	6.80	34	120

Table 11. Summary of Chemical/Physical Characteristics measured during *L. sativa* testing

Parameter	Criteria	Count	Minimum	Maximum	Average	Acceptable?
Initial pH (Slurry)	>5.0	7	5.14	7.51	6.99	Yes
Initial pH (Supernatant)	>5.0	7	5.94	7.52	7.25	Yes
Temperature (°C)	20-30	15	21.4	28.0	25.1	Yes
Light Reading (Lux)	>1000	3	2146	2262	2203	Yes

Table 12. Summary of Chemical/Physical Characteristics measured during the 14-day *E. foetida* testing

Parameter	Criteria	Count	Minimum	Maximum	Average	Acceptable? Samples affected
Initial Moisture Fraction (%)	35-45	5	5.49	51.5	17.3	No[1] All three sites
Initial Slurry pH	>5.0	5	7.63	8.28	7.96	Yes
Initial Slurry Conductivity (µS/cm)	--	5	17	285	90.0	Yes
Temperature (°C)	22±2	15	21.9	22.0	22.0	Yes

[1]Deviation from protocol not expected to influence results of the test, see QA/QC for discussion

Table 13. Summary of Chemical/Physical Characteristics measured during the 28-day *E. foetida* testing

Parameter	Criteria	Count	Minimum	Maximum	Average	Acceptable? Samples affected
Initial Moisture Fraction (%)	35-45	4	7.76	51.5	26.8	No[1] SH4-W64, YFSS-D1
Initial Slurry pH	>5.0	4	6.54	8.23	7.33	Yes
Initial Slurry Conductivity (µS/cm)	--	4	16	529	166	Yes
Temperature (°C)	22±2	29	21.3	22	21.9	Yes

[1]Deviation from protocol not expected to influence results of the test, see QA/QC for discussion

4.0 QA/QC

In both the 14- and 28-day earthworm tests, due to the nature of some of the soils, (consisting mostly of rocks and little to no organic matter that could hold moisture), all samples except WS11-AM24 were hydrated to 35 percent moisture content based on calculations. However, the measured percent moisture was significantly less than 35 percent. All samples took on the same appearance and friability as the control soil and the low moisture content is not thought to have affected the results.

All three tests met the acceptability criterion for negative control performance. Temperature readings remained within parameters for the duration of the test.

Results of reference toxicant test (positive control) conducted with the test organisms are provided in Table 14. The EC50 values fell within the acceptable range of mean ± two standard deviations for historical data, indicating that the test organisms appeared to have been of an appropriate degree of sensitivity.

Table 14. Reference toxicant test results.

Species	Endpoint	Date Initiated	EC50	Historical range (mean ± 2 SD)	Coefficient of Variation (%)
Lactuca sativa	Survival	6/7/2011	174 mg/kg B	106 – 377	28.1
	Biomass	6/7/2011	123 mg/kg B	96.6 – 194	16.8
Eisenia foetida	Survival	6/9/2011	35.8 mg/kg 2-Chloroacetamide	7.0 – 80.9	42.0

5.0 REFERENCES

American Society of Testing and Materials (ASTM). 1999. Standard guide for conducting terrestrial plant toxicity tests. ASTM designation E1963-98.

American Society of Testing and Materials (ASTM). 1997. Standard guide for conducting laboratory soil toxicity or bioaccumulation tests with the lumbricid earthworm *Eisenia* fetida. ASTM designation E1676-97.

Biostat. DMMP/SMS Bioassay Statistics Program for Microsoft Windows. Developed by Corps of Engineers, Seattle District

Washington State Department of Ecology (WDOE). 1996. Earthworm bioassay protocol for soil toxicity screening. WDOE Environmental Investigations and Laboratory Services Program Publication No. 96-327.

APPENDIX A – Summary of Results and Statistics

Appendix Table A-1: *Lactuca sativa* 14-day Survival and Growth
Northwest Pipeline GP TEE Program
Test Initiated June 7, 2011

		Survival				Growth					
Concentration	Rep	# Alive	% Survival	Mean % Survival	St. Dev.	Tare Weight (g)	Total Dry Weight (g)	Total Seedling Weight (mg)	Growth per Seedling (mg)	Mean Growth per Org (mg)	St. Dev.
Laboratory Control	1	11	91.7	91.7	10.2	1.63560	1.65274	17.14	1.56	1.18	0.38
	2	9	75.0			1.35860	1.37110	12.50	1.39		
	3	11	91.7			1.42428	1.43108	6.80	0.62		
	4	12	100.0			1.53960	1.55564	16.04	1.34		
	5	12	100.0			1.54137	1.55324	11.87	0.99		
SHSB2-3:18 S11-061	1	11	91.7	91.7	5.9	1.73975	1.75454	14.79	1.34	1.41	0.40
	2	11	91.7			1.76037	1.77874	18.37	1.67		
	3	12	100.0			1.66022	1.68107	20.85	1.74		
	4	11	91.7			1.50294	1.51123	8.29	0.75		
	5	10	83.3			1.49273	1.50835	15.62	1.56		
WSSB6-0910 S11-055	1	12	100.0	85.0	16.0	1.50121	1.51454	13.33	1.11	1.49	0.40
	2	11	91.7			1.49888	1.51179	12.91	1.17		
	3	11	91.7			1.51305	1.53038	17.33	1.58		
	4	10	83.3			1.48985	1.51108	21.23	2.12		
	5	7	58.3			1.48325	1.49343	10.18	1.45		
ELSS-0810 S11-057	1	7	58.3	78.3	19.2	1.66060	1.66749	6.89	0.98	1.01	0.18
	2	11	91.7			1.67227	1.68264	10.37	0.94		
	3	10	83.3			1.70786	1.72053	12.67	1.27		
	4	12	100.0			1.59567	1.60853	12.86	1.07		
	5	7	58.3			1.44806	1.45345	5.39	0.77		
STARROAD 1807 S11-059	1	12	100.0	91.7	5.9	1.54378	1.57139	27.61	2.30	2.27	0.34
	2	10	83.3			1.52690	1.54464	17.74	1.77		
	3	11	91.7			1.62073	1.64619	25.46	2.31		
	4	11	91.7			1.69490	1.71952	24.62	2.24		
	5	11	91.7			1.48753	1.51747	29.94	2.72		
SH4-W64 S11-062	1	9	75.0	91.7	10.2	1.52711	1.53821	11.10	1.23	1.74	0.38
	2	12	100.0			1.49895	1.51949	20.54	1.71		
	3	11	91.7			1.34947	1.36679	17.32	1.57		
	4	11	91.7			1.33579	1.35705	21.26	1.93		
	5	12	100.0			1.44537	1.47247	27.10	2.26		
WS11-AM24 S11-051	1	11	91.7	85.0	10.9	1.39530	1.40868	13.38	1.22	1.23	0.44
	2	11	91.7			1.75900	1.78095	21.95	2.00		
	3	11	91.7			1.75735	1.76722	9.87	0.90		
	4	10	83.3			1.46752	1.47747	9.95	1.00		
	5	8	66.7			1.62414	1.63251	8.37	1.05		
YFSS-D1 S11-053	1	12	100.0	86.7	17.3	1.66880	1.67552	6.72	0.56	1.00	0.31
	2	12	100.0			1.47496	1.48692	11.96	1.00		
	3	7	58.3			1.51489	1.52101	6.12	0.87		
	4	11	91.7			1.53656	1.55174	15.18	1.38		
	5	10	83.3			1.57413	1.58613	12.00	1.20		

Appendix Table A-21. *Eisenia. fetida* 14-Day Survival
Northwest Pipeline GP TEE Program
Test Initiated June 9, 2011

Site	Rep	# Alive	% Survival	Mean % Survival	St. Dev.
Laboratory Control	1	10	100	100.0	0.0
	2	10	100		
	3	10	100		
SHSB2-3:18 S11-061	1	10	100	100.0	0.0
	2	10	100		
	3	10	100		
WSSB6-0910 S11-055	1	10	100	100.0	0.0
	2	10	100		
	3	10	100		
ELSS-0810 S11-057	1	10	100	96.7	5.8
	2	9	90		
	3	10	100		
STARROAD 1807 S11-059	1	10	100	100.0	0.0
	2	10	100		
	3	10	100		

Project Name: EPI-Northwest Pipeline GP TEE Program

Sample:	x1
Samp ID:	ELSS-0810
Alias:	Lettuce Survival
Replicates:	5
Mean:	78.32
SD:	19.206
Tr Mean:	70.656
Trans SD:	26.607

Ref Samp:	x2
Ref ID:	Control
Alias:	Lettuce Survival
Replicates:	5
Mean:	91.68
SD:	10.206
Tr Mean:	87.139
Trans SD:	25.638

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	16.953
SS:	5460.982
K:	5
b:	69.424
Alpha Level:	0.05
Calculated Value:	0.8826
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	18.614
Test Residual SD:	16.578
Ref. Residual Mean:	21.962
Ref. Residual SD:	7.376
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	0.4126
Critical Value:	>= 1.860
Variances Homogeneous:	Yes

Test Results:

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

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	0.9975
Critical Value:	>= 1.860
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	58.3	49.778	91.7	73.256	20.879	13.883			-27.139
2	91.7	73.256	75	60	2.599	27.139			-20.879
3	83.3	65.879	91.7	73.256	4.777	13.883			-20.879
4	100	114.591	100	114.591	43.935	27.453			-13.883
5	58.3	49.778	100	114.591	20.879	27.453			-13.883
6									-4.777
7									2.599
8									27.453
9									27.453
10									43.935

Project Name: EPI-Northwest Pipeline GP TEE Program

Sample:	x1
Samp ID:	ELSS-0810
Alias:	Lettuce Growth
Replicates:	5
Mean:	1.006
SD:	0.183
Tr Mean:	1.173
Trans SD:	0.078

Ref Samp:	x2
Ref ID:	Control
Alias:	Lettuce Growth
Replicates:	5
Mean:	1.18
SD:	0.375
Tr Mean:	1.239
Trans SD:	0.158

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	0.081
SS:	0.124
K:	5
b:	0.343
Alpha Level:	0.05
Calculated Value:	0.9541
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	0.055
Test Residual SD:	0.047
Ref. Residual Mean:	0.125
Ref. Residual SD:	0.073
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	1.7833
Critical Value:	>= 1.860
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	Sqr Root (x + .375)

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	0.8381
Critical Value:	>= 1.860
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.98	1.164	1.56	1.391	0.009	0.152			-0.242
2	0.94	1.147	1.39	1.329	0.026	0.09			-0.103
3	1.27	1.283	0.62	0.997	0.109	0.242			-0.071
4	1.07	1.202	1.34	1.31	0.029	0.071			-0.026
5	0.77	1.07	0.99	1.168	0.103	0.071			-0.009
6									0.029
7									0.071
8									0.09
9									0.109
10									0.152

Project Name: EPI-Northwest Pipeline GP TEE Program

Sample:	x1
Samp ID:	WS11-AM24
Alias:	Lettuce Survival
Replicates:	5
Mean:	85.02
SD:	10.868
Tr Mean:	68.08
Trans SD:	8.105

Ref Samp:	x2
Ref ID:	Control
Alias:	Lettuce Survival
Replicates:	5
Mean:	91.68
SD:	10.206
Tr Mean:	87.139
Trans SD:	25.638

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	12.337
SS:	2892.022
K:	5
b:	51.573
Alpha Level:	0.05
Calculated Value:	0.9197
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	6.21
Test Residual SD:	4.18
Ref. Residual Mean:	21.962
Ref. Residual SD:	7.376
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	4.1543
Critical Value:	>= 1.860
Variances Homogeneous:	No

Test Results:

Statistic:	Approximate t
Balanced Design:	Yes
Transformation:	ArcSin

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	5
Experimental Alpha Level:	0.05
Calculated Value:	1.5849
Critical Value:	>= 2.015
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	91.7	73.256	91.7	73.256	5.175	13.883			-27.139
2	91.7	73.256	75	60	5.175	27.139			-13.883
3	91.7	73.256	91.7	73.256	5.175	13.883			-13.883
4	83.3	65.879	100	114.591	2.201	27.453			-13.325
5	66.7	54.756	100	114.591	13.325	27.453			-2.201
6									5.175
7									5.175
8									5.175
9									27.453
10									27.453

Project Name: EPI-Northwest Pipeline GP TEE Program

Sample:	x1
Samp ID:	WSSB6-0910
Alias:	Lettuce Survival
Replicates:	5
Mean:	85
SD:	16.051
Tr Mean:	85
Trans SD:	16.051

Ref Samp:	x2
Ref ID:	Control
Alias:	Lettuce Survival
Replicates:	5
Mean:	91.68
SD:	10.206
Tr Mean:	91.68
Trans SD:	10.206

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	8.728
SS:	1447.228
K:	5
b:	35.389
Alpha Level:	0.05
Calculated Value:	0.8653
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	11.36
Test Residual SD:	9.815
Ref. Residual Mean:	6.672
Ref. Residual SD:	6.966
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	0.871
Critical Value:	>= 1.860
Variances Homogeneous:	Yes

Test Results:

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

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	0.7853
Critical Value:	>= 1.860
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	100	100	91.7	91.7	15	0.02			-26.7
2	91.7	91.7	75	75	6.7	16.68			-16.68
3	91.7	91.7	91.7	91.7	6.7	0.02			-1.7
4	83.3	83.3	100	100	1.7	8.32			0.02
5	58.3	58.3	100	100	26.7	8.32			0.02
6									6.7
7									6.7
8									8.32
9									8.32
10									15

Project Name: EPI-Northwest Pipeline GP TEE Program

Sample:	x1
Samp ID:	YFSS-D1
Alias:	Lettuce Survival
Replicates:	5
Mean:	86.66
SD:	17.298
Tr Mean:	86.66
Trans SD:	17.298

Ref Samp:	x2
Ref ID:	Control
Alias:	Lettuce Survival
Replicates:	5
Mean:	91.68
SD:	10.206
Tr Mean:	91.68
Trans SD:	10.206

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	9.215
SS:	1613.56
K:	5
b:	37.528
Alpha Level:	0.05
Calculated Value:	0.8728
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	12.688
Test Residual SD:	9.899
Ref. Residual Mean:	6.672
Ref. Residual SD:	6.966
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	1.1114
Critical Value:	>= 1.860
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	No Transformation
Experimental Hypothesis	
Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	0.5589
Critical Value:	>= 1.860
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	100	100	91.7	91.7	13.34	0.02			-28.36
2	100	100	75	75	13.34	16.68			-16.68
3	58.3	58.3	91.7	91.7	28.36	0.02			-3.36
4	91.7	91.7	100	100	5.04	8.32			0.02
5	83.3	83.3	100	100	3.36	8.32			0.02
6									5.04
7									8.32
8									8.32
9									13.34
10									13.34

Project Name: EPI-Northwest Pipeline GP TEE Program

Sample:	x1
Samp ID:	YFSS-D1
Alias:	Lettuce Growth
Replicates:	5
Mean:	1.002
SD:	0.314
Tr Mean:	1.002
Trans SD:	0.314

Ref Samp:	x2
Ref ID:	Control
Alias:	Lettuce Growth
Replicates:	5
Mean:	1.18
SD:	0.375
Tr Mean:	1.18
Trans SD:	0.375

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	0.225
SS:	0.959
K:	5
b:	0.942
Alpha Level:	0.05
Calculated Value:	0.9253
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	0.23
Test Residual SD:	0.18
Ref. Residual Mean:	0.3
Ref. Residual SD:	0.169
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	0.6311
Critical Value:	>= 1.860
Variances Homogeneous:	Yes

Test Results:

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

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	0.813
Critical Value:	>= 1.860
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.56	0.56	1.56	1.56	0.442	0.38			-0.56
2	1	1	1.39	1.39	0.002	0.21			-0.442
3	0.87	0.87	0.62	0.62	0.132	0.56			-0.19
4	1.38	1.38	1.34	1.34	0.378	0.16			-0.132
5	1.2	1.2	0.99	0.99	0.198	0.19			-0.002
6									0.16
7									0.198
8									0.21
9									0.378
10									0.38

APPENDIX B – Laboratory Datasheets

14-Day Soil Toxicity Test

Soil Quality Measurements

Client: Environmental Partners, Inc. Start Date/Time: 6/7/11 1430

Species: *Lactuca sativa* (butter crunch lettuce) End Date/Time: 6/21/11 1300

Sample IDs: SH582-3:18, WESBG-0910, ELSS-0810, STHERDAD1807, SH4-W104, WS11-AM124, YESS-D1

Test #s: 1106 - T006, T007, T008, T009, T010, T011, T012

Nautilus Log-In #s: S11-001, S11-055, S11-057, S11-059, S11-062, S11-051, S11-053

Test Day	Temperature (°C)	Plants Watered (AM/PM)	Light Intensity (lux)	Tech Initials
0	21.5	-/(M)	2262	(M)
1	25.0	(M)/(M)		(M)
2	26.0	MF/MF		MF
3	29.0	MF/(M)		MF
4	23.8	MF/MF		MF
5	24.0	MF/MF		MF
6	27.0	(M)/(M)		(M)
7	28.0	MF/(M)	2146	MF
8	24.0	BP/BP		BP
9	25.5	BP/(M)		BP
10	24.8	BP/(M)		BP
11	26.0	CC/CC		CC
12	24.0	(M)/(M)		(M)
13	23.5	BP/(M)		BP
14	24.0	(M)	2200	(M)

Conc. or Sample ID	Soil Slurry pH (units)		Soil Supernatant pH (units)	
	initial	final	initial	final
S11-051	5.14	5.10	5.94	5.09
S11-053	7.41	7.73	7.51	7.80
S11-055	6.85	7.34	7.28	7.67
S11-057	7.50	8.10	7.52	8.13
S11-059	7.05	7.58	7.50	7.55
S11-062	7.50	7.94	7.51	8.00
S11-062	7.51	7.93	7.52	7.93
Tech Initials	BP	(M)	BP	(M)

Comments:

Test Chamber: Room A

Organism Source: Territorial Seed Company

QC Check: (M)

Soil Toxicity Test

Lettuce Seed Daily Germination Counts

Client: EPI

Tray#: 1

Species: *Lactuca sativa*

Start Date/Time: 10/7/11 1430

Test #s: 11010 - T0010 thru T0012

End Date/Time: 10/21/11 1300

Day 3	Row	Column 1	2	3	4	5	6
	A	9	9	11	11	8	3
	B	7	10	11	#5 10	9	2
	C	11	8	11	9	3	11
	D	8	11	3	10	12	2
	E	10	2	11	5	1	SWAP
	F	3	11	11	2	12	4
Analyst		MF					

Day 4	Row	Column 1	2	3	4	5	6
	A	9	9	12	11	8	4
	B	7	11	11	10	10	5
	C	11	9	11	11	4	11
	D	11	11	8	10	12	5
	E	11	4	11	5	2	X
	F	10	11	11	3	12	6
Analyst		MF					

Day 5	Row	Column 1	2	3	4	5	6
	A	9	10	12	11	8	6
	B	7	11	11	11	10	9
	C	11	10	11	11	6	11
	D	12	11	9	10	12	11
	E	11	8	11	6	6	X
	F	10	11	11	5	11	10
Analyst		MF					

Day 6	Row	Column 1	2	3	4	5	6
	A	9	10	12	11	8	7
	B	7	11	11	11	11	12
	C	11	10	11	11	7	11
	D	12	11	12	10	12	12
	E	11	10	11	8	7	X
	F	10	11	11	8	11	12
Analyst		MF					

Day 7	Row	Column 1	2	3	4	5	6
	A	9	10	12	11 #6	8	7
	B	7	11	11	11	11	12
	C	11	10	11	11	7	11
	D	12	11	12	16	12	12
	E	11	10	11	7	7	X
	F	10	11	11	8	11	12
Analyst		MF					

Day 8	Row	Column 1	2	3	4	5	6
	A	9	10	12	11	8	10
	B	7	11	11	11	11	12
	C	11	10	12	11	7	11
	D	12	11	12	10	12	12
	E	11	11	11	7	8	X
	F	11	11	11	8	12	12
Analyst		BP					

Day 9	Row	Column 1	2	3	4	5	6
	A	9	10	12	11	8	10
	B	7	11	11	11	11	12
	C	12 11	10	12	11	7	11
	D	12	11	12	10	12	12
	E	11	11	11	7	9	X
	F	11	11	11	8	12	12
Analyst		BP					

Day 10	Row	Column 1	2	3	4	5	6
	A	9	10	12	11	8	10
	B	7	11	11	11	11	12
	C	11	10	12	11	7	11
	D	12	11	12	10	12	12
	E	11	11	11	7	9	X
	F	11	11	11	8	12	12
Analyst		BP					

Day 11	Row	Column 1	2	3	4	5	6
	A	9	10	12	11	8	10
	B	7	11	11	11	11	12
	C	11	10	#6 12	11	7	11
	D	12	11	#6 12	10	12	12
	E	11	10	11	7	9	X
	F	10	11	11	8	12	12
Analyst		QC					

Day 12	Row	Column 1	2	3	4	5	6
	A	9	10	12	11	8	10
	B	7	11	11	11	11	12
	C	11	10	12	11	7	11
	D	12	11	12	10	12	12
	E	11	10	11	7	7	X
	F	10	11	11	8	12	12
Analyst		MF					

Day 13	Row	Column 1	2	3	4	5	6
	A	9	10	12	11	8	10
	B	7	11	11	11	11	12
	C	11	10	12	11	7	11
	D	12	11	12	10	12	12
	E	11	11	11	7	7	X
	F	11	11	11	9	12	12
Analyst		BP					

Day 14**	Row	Column 1	2	3	4	5	6
	A	9N	10N	12N	11N	8N	10N
	B	7N	11N	11N	11N	11N	12N
	C	11N	10N	12N	11N	7N	11N
	D	12N	11N	12N	10N	12N	12N
	E	11N	11N	11N	7N	7N	X
	F	11N	11N	11N	9N	12N	12N
Analyst		MF					

Comments:

QC Check: YM

** Day 14: Include sublethal observations:

N= Normal D= Desiccation M= Mottling

W= Wilting C= Chlorosis X= No germination

Soil Toxicity Test

Lettuce Seed Daily Germination Counts

Client: EPI

Tray#: 2

Species: *Lactuca sativa*

Start Date/Time: 6/7/11 1430

Test #s: 11010-T006 thru T012

End Date/Time: 6/21/11 1300

Day 3	Row	Column 1	2	3	4	5	6
	A	5					
	B	12					
	C	10					
	D	10					
	E	8					
	F	SURR					
Analyst		MF					

Day 7	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	9					
	D	10					
	E	10					
	F	X					
Analyst		MF					

Day 11	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	9					
	D	11					
	E	10					
	F	X					
Analyst		(illegible)					

Day 4	Row	Column 1	2	3	4	5	6
	A	7					
	B	12					
	C	10					
	D	MN 10					
	E	8					
	F	SURR					
Analyst		MF					

Day 8	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	9					
	D	11					
	E	10					
	F	X					
Analyst		GP					

Day 12	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	9					
	D	11					
	E	10					
	F	X					
Analyst		(illegible)					

Day 5	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	10					
	D	10					
	E	10					
	F	SURR					
Analyst		MF					

Day 9	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	9					
	D	11					
	E	10					
	F	X					
Analyst		SD					

Day 13	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	10					
	D	11					
	E	10					
	F	X					
Analyst		GP					

Day 6	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	10					
	D	11					
	E	10					
	F	SURR					
Analyst		(illegible)					

Day 10	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	9					
	D	11					
	E	10					
	F	X					
Analyst		(illegible)					

Day 14**	Row	Column 1	2	3	4	5	6
	A	11					
	B	12					
	C	10					
	D	11					
	E	10					
	F	X					
Analyst		(illegible)					

Comments:

QC Check: (illegible)

** Day 14: Include sublethal observations:

N= Normal D= Desiccation M= Mottling

W= Wilting C= Chlorosis X= No germination

Nautilus Environmental 5009 Pacific Hwy. E., Suite 2, Tacoma, WA 98424.

Nautilus Environmental
Washington Laboratory

14-Day Soil Toxicity Test
Shoot Weight Data

Client: Environmental Partners Start Date & Time: 6/7/11 1430
Species: *Lactuca sativa* Stop Date & Time: 6/21/11 1300
Test #'s: 11016 – TD06, TD07, TD08, TD09, TD10, TD11, TD12

Sample ID	Cont.	Rep.	No. Seedlings Emerged	Shoot Pan Tare Wt. (g)	Pan + Wet Shoot Wt. (g)	Pan + Dry Shoot Wt. (g)
CON	36	1	11	1.635101	2.094487	1.65274
	21	2	9	1.355260	1.600673	1.54464 1.37110
* ②	11	3	11	1.42428	1.601014	1.43108
	34	4	12	1.539160	1.716700	1.55564
	32	5	12	1.54137	1.728231	1.55324
SII-062	12	1	10 11	1.739775	2.121169	1.75454
	21	2	11	1.740037	2.049951	1.77874
* ⑤	13	3	12	1.606022	2.007733	1.66 1.58107
	5	4	11	1.502194	1.738289	1.51123
	38	5	10	1.49273	1.746017	1.50835
SII-055	30	1	12	1.50121	1.740163	1.51454
	39	2	11	1.498085	1.722253	1.51179
* ③	17	3	11	1.513055	1.763395	1.53038
	22	4	10	1.489855	1.730416	1.51108
	2	5	4	1.483255	1.613916	1.49343
SII-057	29	1	7	1.606060	1.696124 8098	1.66749
	16	2	11	1.672267	1.770254	1.68264
* ③	31	3	10	1.707860	1.757283	1.72053
	35	4	12	1.595167	1.763925	1.60853
	27	5	4	1.448016	1.747273	1.45345
SII-059	28	1	12	1.543738	2.101610	1.57139
	9	2	10	1.526090	1.980116	1.54464
* ②	14	3	11	1.602073	2.168559	1.64619
	10	4	11	1.694490	2.159132	1.71953
	33	5	11	1.487553	2.018168	1.51747
SII-062	1	1	9	1.52711	1.755354	1.53821
	37	2	12	1.499895	1.738872	1.51949
* ④	18	3	11	1.349473	1.602471	1.36679
	8	4	11	1.335539	1.607703	1.35705
	15	5	12	1.445537	1.705816	1.47247
SII-051	20	1	11	1.595130	1.759103	1.40868
	3	2	11	1.735900	1.976021	1.78095
* ①	19	3	11	1.735735	2.04110	1.76722
	7	4	10	1.467552	1.696124	1.47747
	25	5	8	1.602414	1.741093	1.63251
SII-053	16	1	12	1.696880	1.726710	1.67552
	4	2	12	1.479796	1.577018	1.48692
* ③	23	3	7	1.51489	1.566172	1.52101
	24	4	11	1.53555 1056	1.604056	1.55174
	40	5	10	1.574113	1.692237	1.58613
		1				
		2				
		3				
		4				
		5				
Tech Initials:			(M)	(M)	(M)	(M)

Comments: Initial number of seeds added to each replicate = 12
Date/Time in: 6/21/11 1500 Oven Temp (°C): 107.0
Date/Time out: 6/23/11 1530 Oven Temp (°C): 72.0
QC: (M)

* Samples rated 0–5 from least rocky ⓪ to most rocky ⑤.

Environmental Quality Results - 14-Day Soil
Nautilus Environmental

Client: Environmental Partners Start Date/Time: 6/9/11 1400 End Date/Time: 6/22/11 1300

Sample IDs: S11SB02-3:18, WSSB9-0911 Test #s: 1106-T029 to -T032
ELSS-0810, STIRCOAD 1807 Test Species: *Eisenia foetida*

Test Day	Temp (°C)	Tech Init.
0	22.0	
1	22.0	
2	21.9	
3	21.9	
4	21.9	
5	21.9	
6	22.0	
7	22.0	
8	22.0	
9	22.0	
10	22.0	
11	22.1	
12	21.9	
13	22.0	
14	22.0	

Sample ID	Rep. #	Cont. #	% Moisture initial	% Moisture final	pH (units) initial	pH (units) final	Conductivity (uhom-cm) initial	Conductivity (uhom-cm) final	Survival initial	Survival final	Sublethal Observations Day 7	Sublethal Observations Day 14
CON	1	10	7.54	38.12	7.63	7.69	285	473	10	10	N	N
	2	13	5.15						10	10	↓	↓
	3	4							10	10		
S11-061	1	12	10.1	19.1	8.09	7.59	71	370	10	10		
	2	2							10	10		
	3	8							10	10		
S11-055	1	14	5.49	16.8	8.10	6.606	17	219	10	10		
	2	11							10	10		
	3	6							10	10		
S11-057	1	5	5.49	22.0	8.28	7.55	30	335	10	10		
	2	15							10	9		
	3	1							10	10	↓	↓
S11-059	1	7	14.16	28.9	7.68	6.776	46	603	10	10	N	N
	2	3							10	10	↓	↓
	3	9							10	10		
	1								10			
	2								10			
	3								10			
	1								10			
	2								10			
	3								10			
	1								10			
	2								10			
	3								10			
	1								10			
	2								10			
	3								10			
	1								10			
	2								10			
	3								10			
	1								10			
	2								10			
	3								10			
	1								10			
	2								10			
	3								10			
	1								10			
	2								10			
	3								10			
Tech Initials												

Sublethal Observations Key:

N= Normal/burrowed
E= Exposed/on surface
B= Balled together
D= Dead
W= Segmental swelling
L= Lesions/ulcers
C= Coiling
S= Shortening/stiffening

Test Chamber: ENV.Pm.A
Organism source: ARO
QA Review: CC

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Soil Data
14-Day Soil Toxicity Test

Client: Environmental Partners Inc. Test #s: 11010-TD29 to TD32
Sample IDs: SHSB2-3:18, WSSBG-0910, ELSS-0810, Log-In#s: S11-061, 055, 057, 059
Date: 10/9/11 1400 STARTED 1807 Species: E. foetida

Soil Weights and Moisture Fraction (MF):

Site	Pre-Test Initial (wet)	Pre-Test Final (dry)	Pre-Test MF (*)	Day 0 Initial (wet)	Day 0 Final (dry)	Day 0 MF (*)	Day 14/28 Initial (wet)	Day 14/28 Final (dry)	Day 14/28 MF
S11-061	26.4	24.7	7.3	76.7	76.4	10.1	158.0	154.0	19.1
S11-055	26.6	24.9	7.3	78.9	77.6	5.49	119.2	113.3	16.8
S11-057	26.1	24.1	8.7	77.8	76.5	5.49	92.9	88.4	22.0
S11-059	26.4	23.7	12.1	78.4	75.3	14.16	140.5	134.9	28.9
14 day LON				75.4	66.9	51.5	124.7	117.8	38.12
S11-062	26.4	24.3	14.2	102.0	100.2	7.76	124.8	121.9	13.1
S11-051	26.4	20.5	30.9	73.1	86.1	38.9	139.2	130.7	24.5
S11-053	26.4	24.7	7.3	105.4	103.3	9.17	142.0	121.5	14.2
28 day LON				105.5	97.8	46.2	105.7	97.3	50.6
RT 80 mg/kg				92.6	84.3	49.7	123.4	118.2	46.9
" 40 mg/kg				70.8	62.7	47.9	105.4	96.3	57.2
" 20 mg/kg				78.1	70.2	46.2	78.5	67.10	77.3
" 10 mg/kg				82.10	74.6	47.1	143.2	135.0	48.8
" LON				102.1	94.2	46.2	145.8	130.9	55.3
Tech Initials:									

Date/Time in/Temp: 10/7/11 1400 103° 10/9/11 1330 101 10/22/11 / 1400 / 96°
Date/Time out/Temp: 10/8/11 1400 104° 10/10/11 1330 109 10/28/11 / 830 / 103°

MF= (I-F)/[A-(I-F)]*100
MF= Moisture fraction of bulk soil (in %)
I= Initial wet weight of sample + pan (g)
F=Final dry weight of sample + pan (g)
A= Initial aliquot weight (g))

(*) due to rocky texture of samples, matched % moisture on friability instead of volume

Environmental Quality Results - 28-Day Soil Bioassay
Nautilus Environmental

Client: Environmental Partners
Sample ID: SH4-W6f, YFSS-D1, WS11-A131 (BKG)
Test #: 1106-TD33, 1106-TD34, 1106-TD35
Nautilus Check-In #: S11-062, S11-051, S11-053

Start Date/Time: 6/9/11 1415
End Date/Time: 7/7/11 1500
Test Species: *Eisenia foetida*

Test Day	Temp (°C)	Tech Initials
0	22.0	
1	22.0	
2	21.9	
3	21.9	
4	21.9	
5	21.9	
6	22.0	
7	21.8	
8	22.0	
9	22.0	
10	22.0	
11	21.9	
12	21.9	
13	22.0	
14	21.9	
15	22.0	
16	22.0	
17	22.0	
18	22.0	
19	22.0	
20	21.9	
21	21.3	
22	22.0	
23	21.8	
24	22.0	
25	22.0	
26	22.0	
27	22.0	
28	22.0	

Site	% Moisture Day 0	% Moisture Day 28	pH (units) Day 0	pH (units) Day 28	Conductivity (uhom-cm Day 0	Conductivity (uhom-cm Day 28
LDW	51.5	50.6	7.54	7.08	529	607
S11-062	7.76	13.1	8.23	7.50	84	43
S11-051	38.9	51.5	6.54	5.54	16	15
S11-053	9.17	14.2	7.00	6.80	34	120
Tech Initials						

QA Review/Date: / 9/1/11
Test Chamber: Env. Chm. A

Eisenia fetida 28-Day Bioassay

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Client/Project ID: Environmental Partners
Test No.: 1106-T033, 1106-T034, 1106-T035

Start Date/Time: 6/9/11 14:15
End Date/Time: 7/7/11 1500

Sample ID	Cont. #	Rep. #	Initial Org. wt. (gm)	Initial No. Worms	Initial Avg. per Organism (gm)	Final Org. wt. (gm)	Final No. Worms	Initial Avg. per Organism (gm)
CON	6	1	4.49028	10		3.42983	10	
	10	2	4.39417	10		2.74904	10	
	1	3	4.42805	10		2.75244	10	
		4						
		5						
S11-002	7	1	4.26905	10		2.53335	10	
	5	2	3.39532	10		6.05209	10	
	4	3	4.15407	10		2.0551	9	
		4						
		5						
S11-005	8	1	3.81916	10		1.86036	10	
	12	2	4.01945	10		2.10131	10	
	9	3	4.44998	10		2.50674	10	
		4						
		5						
S11-053	3	1	3.88745	10		2.50888	10	
	11	2	4.08257	10		4.43401	10	
	2	3	3.98070	10		2.55261	10	
		4						
		5						
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						
	Tech Initials							

QA

28-Day Soil Survival Results
Nautilus Environmental

Client: Environmental Partners
Test No.: 1106-1033 to 1035
Test Date: 6/9/11
Test Organism: *Eisenia foetida*

Sample ID	Container #	Rep. #	Initial Number	Final Number	Sublethal Observations	Tech Initials
COW	6	1	10	10	N	
	10	2	10	10	N	
	1	3	10	10	N	
		4				
		5				
S11-062	7	1	10	10	N	
	5	2	10	10	N	
	4	3	10	9	N	
		4				
		5				
S11-051	8	1	10	10	N	
	12	2	10	10	N	
	9	3	10	10	N	
		4				
		5				
S11-053	3	1	10	10	N	
	11	2	10	10	N	
	2	3	10	10	N	
		4				
		5				
		1				
		2				
		3				
		4				
		5				
		1				
		2				
		3				
		4				
		5				
		1				
		2				
		3				
		4				
		5				

Washington Laboratory - 5009 Pacific Hwy. E., Suite 2. Tacoma, WA 98424

QA Check: (initials)

Comments:

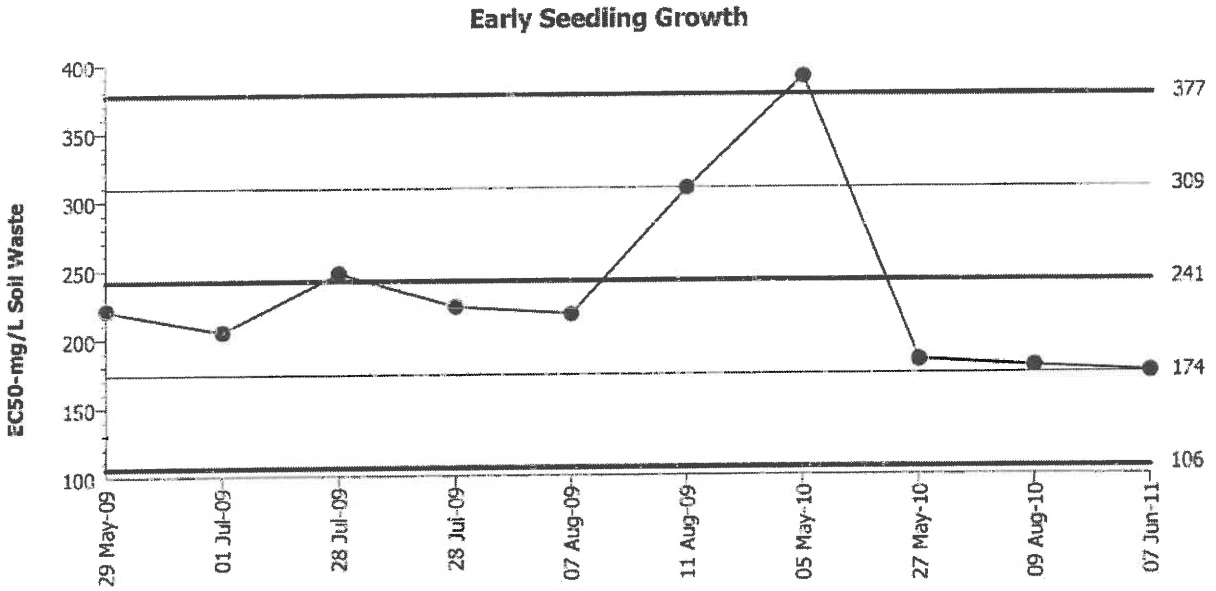
Sublethal Observations Key:
N= Normal/burrowed
E= Exposed on surface
B= Balled together
D= Dead
W= Segmental swelling
L= Lesions/ulcers
C= Coiling
S= Shortening/stiffening

APPENDIX C – Reference Toxicant Test Results

CETIS QC Plot

Early Seedling Growth — **Nautilus Environmental WA**

Test Type:	Survival-Growth	**Organism:**	Lactuca sativa (Lettuce)	**Material:**	Soil Waste
Protocol:	WDOE 96-324	**Endpoint:**	Survival Rate	**Source:**	Reference Toxicant-REF



Mean:	241.4	**Count:**	9	**-1s Warning Limit:**	173.6	**-2s Action Limit:**	105.8
Sigma:	67.79	**CV:**	28.10%	**+1s Warning Limit:**	309.2	**+2s Action Limit:**	377

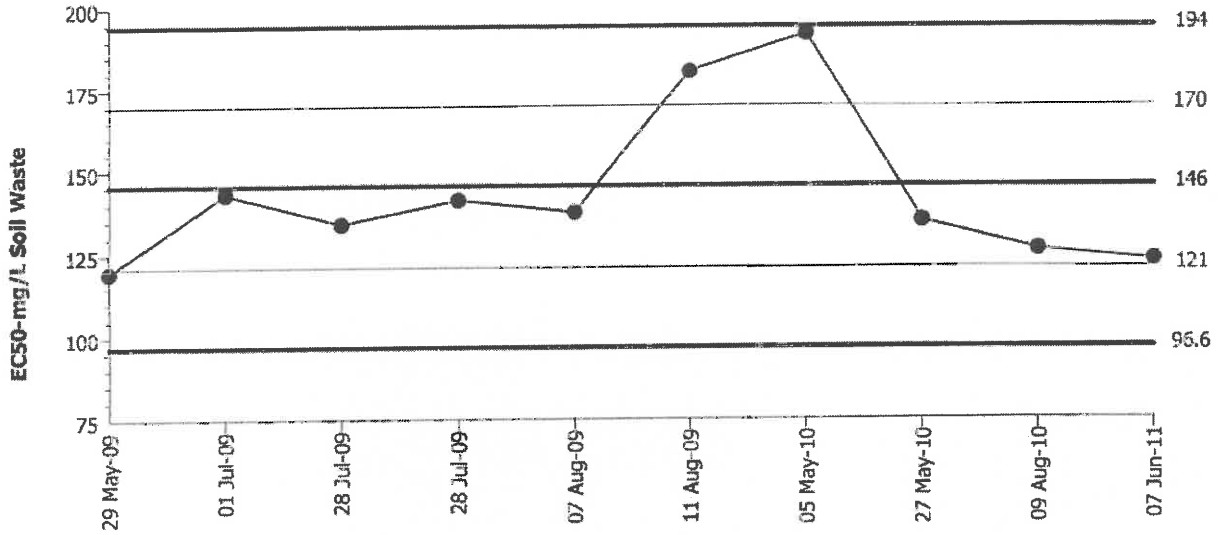
Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2009	May	29	220.6	-20.79	-0.3067			09-0219-1410	13-2075-5309
2		Jul	1	204.7	-36.73	-0.5415			11-7520-9930	03-2799-1846
3			28	247.1	5.725	0.08445			11-1163-7315	08-7410-7616
4			28	222.6	-18.81	-0.2774			18-2758-4943	00-2970-8628
5		Aug	7	217.2	-24.18	-0.3567			15-7179-2232	06-8206-1666
6			11	308.6	67.19	0.9912			11-5703-1897	11-2523-5381
7	2010	May	5	390.1	148.7	2.194	(+)	(+)	18-1256-6303	03-7353-3083
8			27	183	-58.44	-0.8621			07-5797-7609	02-8368-1573
9		Aug	9	178.5	-62.87	-0.9274			12-0568-9729	00-4825-3515
10	2011	Jun	7	174.4	-67.04	-0.9889			14-4891-1513	00-5788-6680

Early Seedling Growth — Nautilus Environmental WA

Test Type:	Survival-Growth	Organism:	Lactuca sativa (Lettuce)	Material:	Soil Waste
Protocol:	WDOE 96-324	Endpoint:	Mean Dry Biomass-mg	Source:	Reference Toxicant-REF

Early Seedling Growth



Mean:	145.5	Count:	9	-1s Warning Limit:	121.1	-2s Action Limit:	96.62
Sigma:	24.44	CV:	16.80%	+1s Warning Limit:	169.9	+2s Action Limit:	194.4

Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2009	May	29	119.5	-25.98	-1.063	(-)		09-0219-1410	17-6385-6463
2		Jul	1	143.2	-2.338	-0.09565			11-7520-9930	03-2381-2203
3			28	134	-11.49	-0.47			11-1163-7315	02-6860-1115
4			28	141.2	-4.285	-0.1753			18-2758-4943	06-5912-1272
5		Aug	7	137.6	-7.927	-0.3244			15-7179-2232	09-0615-4224
6			11	180.6	35.06	1.435	(+)		11-5703-1897	06-6373-5558
7	2010	May	5	192.1	46.62	1.908	(+)		18-1256-6303	11-1099-1174
8			27	135	-10.5	-0.4295			07-5797-7609	00-1486-3034
9		Aug	9	126.2	-19.28	-0.7888			12-0568-9729	16-9445-1694
10	2011	Jun	7	123.1	-22.38	-0.9158			14-4891-1513	14-6511-7777

CETIS Summary Report

Early Seedling Growth — **Nautilus Environmental WA**

Batch ID:	18-2865-3267	**Test Type:**	Survival-Growth	**Analyst:**	Meghan Feuk
Start Date:	07 Jun-11 14:30	**Protocol:**	WDOE 96-324	**Diluent:**	Not Applicable
Ending Date:	21 Jun-11 13:00	**Species:**	Lactuca sativa	**Brine:**	
Duration:	13d 22h	**Source:**	Territorial Seed Company	**Age:**	

Sample ID:	02-9240-0634	**Code:**	RT060711LS	**Client:**	Reference Toxicant Test
Sample Date:	07 Jun-11 14:30	**Material:**	Soil Waste	**Project:**	
Receive Date:	07 Jun-11 14:30	**Source:**	Reference Toxicant		
Sample Age:	N/A	**Station:**			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
16-6058-4487	Mean Dry Biomass-mg	80	160	113.1	36.9%		Steel Many-One Rank Test
13-0090-5880	Survival Rate	80	160	113.1	15.0%		Dunnett's Multiple Comparison Test

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/kg	95% LCL	95% UCL	TU	Method
14-6511-7777	Mean Dry Biomass-mg	IC25	96.96	69.77	107.2		Linear Interpolation (ICPIN)
		IC50	123.1	103	141.1		
00-5786-6680	Survival Rate	EC50	174.4	156.8	193.9		Trimmed Spearman-Kärber

Mean Dry Biomass-mg Summary

Conc-mg/kg	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Background Soil	5	1.025	0.8562	1.193	0.3375	1.398	0.2003	0.448	43.68%	0.0%
40		5	1.345	1.234	1.456	0.9925	1.786	0.1329	0.2972	22.1%	-31.13%
80		5	1.127	1.035	1.219	0.9242	1.502	0.11	0.246	21.82%	-9.93%
160		5	0.2675	0.2004	0.3346	0.01	0.5108	0.08033	0.1796	67.15%	73.91%
320		5	0.027	0.005819	0.04818	0	0.1283	0.02537	0.05672	210.1%	97.37%
640		5	0.013	0.002146	0.02386	0	0.065	0.013	0.02907	223.6%	98.73%

Survival Rate Summary

Conc-mg/kg	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Background Soil	5	0.95	0.933	0.967	0.9167	1	0.02041	0.04564	4.81%	0.0%
40		5	0.9667	0.9388	0.9945	0.8333	1	0.03333	0.07454	7.71%	-1.75%
80		5	0.9333	0.9194	0.9472	0.9167	1	0.01667	0.03727	3.99%	1.75%
160		5	0.55	0.4577	0.6423	0.25	0.9167	0.1106	0.2472	44.95%	42.11%
320		5	0.06667	0.03258	0.1008	0	0.1667	0.04082	0.09129	136.9%	92.98%
640		5	0.01667	0.002751	0.03058	0	0.08333	0.01667	0.03727	223.6%	98.25%

Mean Dry Biomass-mg Detail

Conc-mg/kg	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	Background Soil	1.398	1.232	0.3375	0.8133	1.347
40		0.9925	1.169	1.393	1.786	1.383
80		0.9242	0.9342	1.502	1.246	1.031
160		0.3042	0.225	0.01	0.5108	0.2875
320		0	0.006663	0	0.1283	0
640		0	0	0	0	0.065

Survival Rate Detail

Conc-mg/kg	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	Background Soil	1	1	0.9167	0.9167	0.9167
40		1	1	1	0.8333	1
80		0.9167	0.9167	0.9167	0.9167	1
160		0.5833	0.4167	0.25	0.9167	0.5833
320		0	0.1667	0	0.1667	0
640		0	0	0	0	0.08333

14-Day Soil Toxicity Test

Soil Quality Measurements

Client: Reference Toxicant

Sample ID: 640mg/Kg BHSO3

Test ID: RT060711LS

Test Species: *Lactuca sativa* (butter crunch lettuce)

Start Date/Time: 6/7/11 1430

End Date/Time: 6/21/11 1300

Test Day	Temperature (°C)	Light Intensity (Lux)	Tech Initials
0	21.5	2197	(M)
1	24.0		(M)
2	27.0		MF
3	25.0		MF
4	23.8		MF
5	24.0		MF
6	23.0		(M)
7	23.8	2162	MF
8	24.0		BP
9	25.5		BP
10	24.8		BP
11	26.0		CC
12	26.0		(M)
13	23.5		BP
14	24.0	2198	(M)

Conc. (ppm)	Soil slurry pH (units)		Soil supernatant pH (units)	
	initial	final	initial	final
Lab Control	7.27	7.81	7.37	7.70
40	7.15	7.669	7.13	7.71
80	7.10	7.59	7.07	7.605
160	7.07	7.60	7.09	7.63
320	7.05	7.48	7.11	7.51
640	6.93	7.40	7.07	7.46
Tech Initials	BP	(M)	BP	(M)

Test Chamber: RoomA

Comments:

QC Check: (M)

Nautilus Environmental

Washington Laboratory

5009 Pacific Hwy. E. Suite 2

Tacoma, WA 98424

(253) 922-4296

Soil Toxicity Test

Lettuce Seed Daily Germination Counts

Client/Sample ID: Reference Toxicant **Test No:** RTDD7111LS **Start Date/Time:** 6/7/11 1430

Tray #: RT **Test Species:** *Lactuca sativa* (buttercrunch lettuce) **End Date/Time:** 6/21/11 1300

Day 3

Row	1	2	3	4	5	6
A	–	–	–	1	1	
B	6	–	–	3	–	
C	2	–	–	–	–	
D	–	–	–	1	–	
E	–	–	–	2	–	
F	–	–	–	–	3	
Analyst	MF					

Day 4

Row	1	2	3	4	5	6
A	1	–	2	5	7	
B	13	2	–	8	7	
C	10	–	–	–	–	
D	–	–	–	3	–	
E	–	–	–	8	–	
F	10	–	–	2	9	
Analyst	ME					

Day 5

Row	1	2	3	4	5	6
A	10	1	6	10	9	
B	13	9	–	9	9	
C	10	6	–	1	–	
D	–	–	2	7	–	
E	–	–	–	10	–	
F	10	–	–	6	11	
Analyst	MF					

Day 6

Row	1	2	3	4	5	6
A	10	10	9	11	11	
B	13	9	–	10	11	
C	11	10	–	1	1	
D	–	–	3	11	–	
E	–	1	–	10	–	
F	11	–	–	11	12	
Analyst	(N)					

Day 7

Row	1	2	3	4	5	6
A	10	8	10	12	11	
B	13	9	–	11	12	
C	11	11	–	3	1	
D	1	–	3	13	–	
E	–	2	–	11	–	
F	11	–	–	11	12	
Analyst						

Day 8

Row	1	2	3	4	5	6
A	11	11	11	12	11	
B	13	10	–	11	12	
C	11	11	1	3	4	
D	2	–	4	12	–	
E	1	4	–	10	–	
F	11	–	–	11	12	
Analyst	BP					

Day 9

Row	1	2	3	4	5	6
A	11	11	11	12	11	
B	13	10	–	11	12	
C	11	11	1	4	4	
D	2	–	4	12	–	
E	1	5	–	11	–	
F	11	–	–	11	DH 12	
Analyst	DS					

Day 10

Row	1	2	3	4	5	6
A	11	11	11	12	11	
B	13	10	–	11	12	
C	11	11	1	4	4	
D	2	–	4	12	–	
E	1	5	–	11	–	
F	11	–	–	11	12	
Analyst	BP					

Day 11

Row	1	2	3	4	5	6
A	11	11	11	12	11	
B	13	10	–	11	12	
C	11	11	1	4	4	
D	2	–	4	12	–	
E	1	6	–	11	–	
F	11	–	–	11	12	
Analyst	BP					

Day 12

Row	1	2	3	4	5	6
A	11	11	11	12	11	
B	13	10	–	11	12	
C	11	11	1	4	4	
D	2	–	4	12	–	
E	1	5	–	11	–	
F	11	–	–	11	12	
Analyst	(N)					

Day 13

Row	1	2	3	4	5	6
A	11	11	11	12	11	
B	13	10	–	11	12	
C	11	11	1	4	5	
D	2	–	7	12	–	
E	2	7	–	11	–	
F	11	–	–	11	12	
Analyst	BP					

Day 14

Row	1	2	3	4	5	6
A	11	11	11	12	12	
B	13	10	X	11	12	
C	12	11	1	3	5	
D	2	X	7	12	X	
E	2	7	X	11	X	
F	11	X	X	11	12	
Analyst	(N)					

Comments:

QC Check: (N)

Nautilus Environmental
Washington Laboratory

14-Day Soil Toxicity Test
Shoot Weight Data

Client: EPA Reference Toxicant — Start Date & Time: 6/7/11 1430
Species: *Lactuca sativa* — Stop Date & Time: 6/21/11 1300
Test #'s: ~~1106 - 1010 thru 1012~~ RT060711LS

Sample ID	Cont.	Rep.	No. Seedlings Emerged	Shoot Pan Tare Wt. (g)	Pan + Wet Shoot Wt. (g)	Pan + Dry Shoot Wt. (g)
CON	30	1	12	1.627685	1.954249	1.622652
	2	2	13	1.58772	1.98134	1.60374
	6	3	11	1.52754	1.881000	1.53159
	23	4	11	1.52307	1.83107	1.531683
	20	5	11	1.561825	1.89805	1.556950
40	25	1	12	1.55613	1.93357	1.51680
	3	2	12	1.60471	1.901020	1.61874
	19	3	12	1.67584	2.05702	1.69256
	8	4	10	1.73943	1.93591	1.76086
	26	5	12	1.76734	2.01103	1.78393
80	9	1	11	1.60258	1.32514	1.61367
	24	2	11	1.60842	1.53918	1.61963
	1	3	11	1.75529	2.04068	1.77331
	13	4	11	1.67500	1.91820	1.68995
	22	5	12	1.71965	1.94503	1.73202
160	11	1	7	1.73111	1.802093 1.77749	1.73476
	27	2	5	1.73726	1.96364	1.73996
	21	3	3	1.55054	1.76756	1.55066
	7	4	11	1.54128	1.76273	1.54741
	16	5	7	1.52393	1.58073	1.52738
320	18	1	0	1.57399		
	4	2	2	1.52993	1.54589	1.53001
	14	3	0	1.52811		
	5	4	2	1.816674	1.822095	1.81628
	17	5	0	1.607167		
640	28	1	0	1.547838		
	29	2	0	1.52280		
	10	3	0	1.50600		
	12	4	0	1.49046		
	15	5	1	1.683974	1.681042	1.68168
		1				
		2				
		3				
		4				
		5				
		1				
		2				
		3				
		4				
		5				
		1				
		2				
		3				
		4				
		5				
Tech Initials:			NV	NV	NV	

Comments: Initial number of seeds added to each replicate = 12
Date/Time in: 6/21/11
Date/Time out: 7/6/11 1500
Oven Temp (°C): 107.0
Oven Temp (°C): 102.0
QC: NV

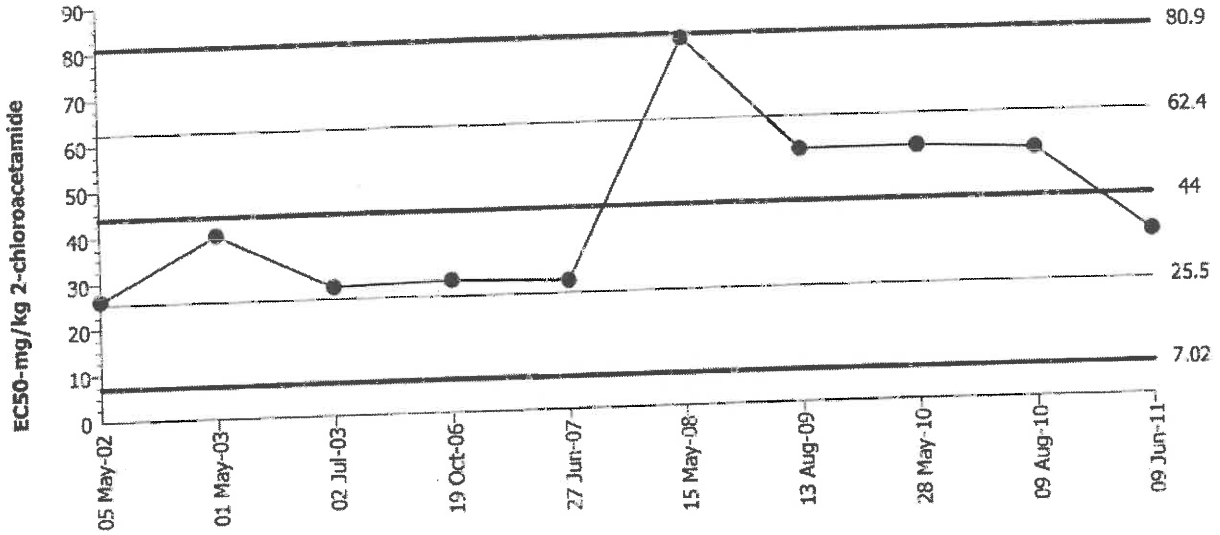
CETIS QC Plot

Nautilus Environmental WA

Eisenia 14-d Survival Soil Test

Test Type:	Survival	**Organism:** Eisenia fetida (Red worm)	**Material:** 2-chloroacetamide
Protocol:	WDOE 96-327	**Endpoint:** Survival Rate	**Source:** Reference Toxicant-REF

Eisenia 14-d Survival Soil Test



Mean:	43.96	**Count:**	9	**-1s Warning Limit:**	25.49	**-2s Action Limit:**	7.02
Sigma:	18.47	**CV:**	42.00%	**+1s Warning Limit:**	62.43	**+2s Action Limit:**	80.9

Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2002	May	5	26.17	-17.79	-0.9631			16-0112-7495	03-6581-6762
2	2003		1	39.91	-4.055	-0.2195			18-0678-2428	10-9716-6177
3		Jul	2	28.07	-15.89	-0.8602			02-9873-1034	00-3454-9068
4	2006	Oct	19	28.75	-15.21	-0.8232			02-3082-1435	00-0149-2749
5	2007	Jun	27	28.01	-15.95	-0.8634			19-0311-5351	13-6127-6576
6	2008	May	15	80	36.04	1.951	(+)		20-3102-3790	16-3060-0026
7	2009	Aug	13	55.16	11.2	0.6061			20-6120-4139	00-4183-4608
8	2010	May	28	55.28	11.32	0.6127			13-2033-4602	20-4300-2078
9		Aug	9	54.28	10.32	0.5589			18-7475-1619	02-4525-0355
10	2011	Jun	9	35.82	-8.136	-0.4405			14-4766-0393	16-5490-4261

CETIS Summary Report

Eisenia 14-d Survival Soil Test — Nautilus Environmental WA

Batch ID:	20-0867-4021	Test Type:	Survival	Analyst:	Meghan Feuk
Start Date:	09 Jun-11 14:00	Protocol:	WDOE 96-327	Diluent:	
Ending Date:	23 Jun-11 14:00	Species:	Eisenia fetida	Brine:	
Duration:	14d 0h	Source:	Aquatic Research Organisms, NH	Age:	

Sample ID:	06-4903-5718	Code:	RT060911EF	Client:	Reference Toxicant Test
Sample Date:	09 Jun-11 14:00	Material:	2-chloroacetamide	Project:	
Receive Date:	23 Jun-11 14:00	Source:	Reference Toxicant		
Sample Age:	N/A	Station:			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
14-8257-9163	Survival Rate	20	40	28.28	6.59%		Dunnett's Multiple Comparison Test

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/kg	95% LCL	95% UCL	TU	Method
16-5490-4261	Survival Rate	EC50	35.82	31.36	40.89		Trimmed Spearman-Karber

Survival Rate Summary

Conc-mg/kg	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Control Sed	3	1	1	1	1	1	0	0	0.0%	0.0%
10		3	0.9333	0.9118	0.9549	0.9	1	0.03333	0.05774	6.19%	6.67%
20		3	1	1	1	1	1	0	0	0.0%	0.0%
40		3	0.3667	0.3451	0.3882	0.3	0.4	0.03333	0.05774	15.75%	63.33%
80		3	0	0	0	0	0	0	0		100.0%

Survival Rate Detail

Conc-mg/kg	Control Type	Rep 1	Rep 2	Rep 3
0	Control Sed	1	1	1
10		1	0.9	0.9
20		1	1	1
40		0.4	0.3	0.4
80		0	0	0

Environmental Quality Results - 14-Day Soil
Nautilus Environmental

Client: Reference Toxicant
Sample ID: 80 ug/L 2-Chloroacetamide
Test #: RTOL-R09-11-EF

Start Date/Time: 6/9/11 1400
End Date/Time: 6/23/11 1400
Test Species: *Eisenia foetida*

Test Day	Temp (°C)	Tech Initials
0	22.0	JS
1	22.0	MF
2	21.9	MF
3	21.9	MF
4	21.9	MN
5	22.0	JS
6	21.9	BP
7	22.0	RH
8	22.0	CC
9	22.0	MN
10	22.0	RH
11	21.8	BP
12	21.9	RH
13	22.0	JS
14	22.0	MN

Conc. ug/L	Rep. #	Cont. #	% Moisture initial	% Moisture final	pH (units) initial	pH (units) final	Conductivity (uhom-cm) initial	Conductivity (uhom-cm) final	Survival initial	Survival final
Con	1	10	46.2	55.3	7.28	7.63	528	615	10	10
	2	5							10	10
	3	12							10	10
10	1	4	47.1	48.8	7.25	7.55	580	683	10	10
	2	11							10	9
	3	7							10	9
20	1	8	46.2	713	7.35	7.30	516	650	10	10
	2	6							10	10
	3	14							10	10
40	1	15	47.9	572	7.27	7.70	515	674	10	4
	2	2							10	3
	3	3							10	4
80	1	1	49.7	68.9	7.29	7.80	524	751	10	0
	2	9							10	0
	3	13							10	0
		Tech Initials	JS	JS	JS	MN	JS	MN	JS/RH	MN

Washington Laboratory - 5009 Pacific Hwy. E., Suite 2. Tacoma, WA 98424

Test Chamber: Rm A

QA Review/Date: MN 6/29/11
Organism Source: AQD

APPENDIX D – Chain-of-Custody Forms

Nautilus Environmental

Chain of Custody

TESTING LOCATION (Please Check Box)

☐ **California**
5550 Morehouse Drive, Suite 150
San Diego, CA 92121
Phone 858.587.7333
Fax 858.587.3961

☐ **Washington**
5009 Pacific Highway East, Suite 2
Tacoma, WA 98424
Phone 253.922.4296
Fax 253.922.5814

☐ **British Columbia**
8664 Commerce Court
Burnaby, British Columbia, Canada V5A 4N3
Phone 604.420.8773
Fax 604.357.1361

Date 6/3/11 Page 1 of 1

Sample Collection By: _____

Report to:
Company: ENVIRONMENTAL PARTNERS INC.
Address: 495 NE GILMAN BLVD #201
City/State/Zip: ISSAQUAH WA 98027
Contact: 425 395 0014
Phone: ERIC KOLTES
Email: eric.k@epi-wa.com

Invoice To:
Company: SAME
Address:
City/State/Zip:
Contact:
Phone:
Email:

ANALYSES REQUIRED

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	BAF AS	BIOASSAY - LETTUCE	BIOASSAY - WORM							Receipt Temperature (°C)
1 SHSB2-3:18	5/13/11		SOIL		1			X	X	S11-061						2.2
2 WSSB6-09.0	5/17/11		SOIL		1			X	X	S11-055						
3 ELSS-0810	5/17/11		SOIL		1			X	X	S11-057						
4 STARROAD 1807	5/16/11		SOIL		1			X	X	S11-059						
5 SH4-W64	5/3/11		SOIL		2		X	X		S11-062						1.8
6 WS11-AM24	5/17/11		SOIL		1		X	X		S11-051						
7 YFSS-01	5/17/11		SOIL		1		X	X		S11-053						
8 WS11-A131(BKG)	5/17/11		SOIL		1			HOLD		S11-052						
9 WS6-AW36(BKG)	5/17/11		SOIL		1			HOLD		S11-056						
10 SESS-B6 YFSS-B6	5/16/11 5/17/11		SOIL SOIL		1			HOLD HOLD		S11-060 S11-054						

PROJECT INFORMATION

Client:	
PO No.:	
Shipped Via:	

SAMPLE RECEIPT

Total No. of Containers	
Received Good Condition?	
Matches Test Schedule?	

SPECIAL INSTRUCTIONS/COMMENTS:
ELSS-B6 S11-058 Lettuce & Earthworm (HOLD)

RELINQUISHED BY (CLIENT)
(Signature) (Time) 16:10
(Printed Name) ERIC KOLTES (Date) 6/3/11
(Company) ENVIRONMENTAL PARTNERS INC.

RECEIVED BY (COURIER)
(Signature) (Time)
(Printed Name) (Date)
(Company)

RELINQUISHED BY (COURIER)
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)
(Signature) Barbara Parsons (Time) 16:15
(Printed Name) Barbara Parsons (Date) 6/3/11
(Company) Nautilus

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

DISTRIBUTION: WHITE - Nautilus Environmental, COLOR - Originator

Table 1
Summary of Soil Sample Analytical Results for
Diesel and Oil Range Total Petroleum Hydrocarbons (in mg/kg)
Remedial Action Excavation
Seattle, WA

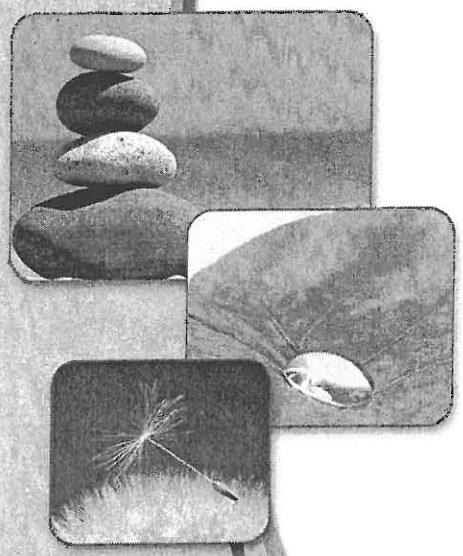
Sample ID	Sample Depth (feet bgs)	Final Performance Sample	Diesel-Range TPH[a]	Oil-Range TPH[a]
LP-B-1:13'	13	No	7,800	310
LP-B-1:16'	16	Yes	<50	<250
LP-B-10:16'	16	No	<50	<250
LP-B-11:16'	16	Yes	<50	<250
LP-B-15:20'	20	No	3,800	<250
LP-B-22:13.5'	13.5	Yes	140	<250
LP-B-23:13.5'	13.5	Yes	<50	<250
LP-B-24:12.5'	12.5	Yes	<50	<250
LP-B-3:13'	13	Yes	<50	<250
LP-B-31:14'	14	Yes	2,000	<250
LP-B-31:15.5'	15.5	Yes	890	<250
LP-B-32:14'	14	No	2,200	<250
LP-B-32:21'	21	Yes	<50	<250
LP-B-34:12'	12	Yes	470	<250
LP-B-35:16'	16	Yes	<50	<250
LP-B-36:16'	16	Yes	<50	<250
LP-B-37:14'	14		<50	<250
LP-B-43:13	13		<50	<250
LP-B-45:14	14	Yes	<50	<250
LP-B-46:14	14		<50	<250
LP-B-50:15'	15	No	3,900	<250
LP-B-50:17'	17	Yes	<50	<250
LP-B-53:15'	15	Yes	<50	<250
LP-B-54:15'	15	Yes	<50	<250
LP-B-55:17'	17	Yes	1,700	<250
LP-B-56:15'	15	Yes	<50	<250
LP-B-61:13'	13	Yes	<50	<250
LP-B-62:13'	13	Yes	1,900	<250
LP-B-63:12.5'	12.5	Yes	<50	<250
LP-B-65:13'	13	Yes	1,700	<250
LP-B-66:13'	13	Yes	<50	<250
DLP-B-66:13'	13	Yes	<50	<250
LP-B-67:12.5'	12.5		<50	<250
LP-B-67:12.5'	12.5	Yes	1,400	<250
LP-B-68:13.5'	13.5	Yes	<50	<250
LP-B-70:15'	15	No	2,900	<250
LP-B-70:23.5'	23.5	No	3,500	<250
LP-B-75:24	24	Yes	<50	<250
LP-B-76:24	24	Yes	<50	<250
LP-B-8:13'	13	Yes	<50	<250
LP-B-80:12.5	12.5	Yes	<50	<250
DLP-B-80:12.5	12.5	Yes	<50	<250
LP-B-81:25	25	Yes	<50	<250
LP-B-83:14	14	Yes	<50	<250
LP-B-85:29	29	Yes	<50	<250
DLP-B-85:29	29	Yes	<50	<250
LP-B-9:13'	13	Yes	<50	<250
LP-B-82:17	17	Yes	<50	<250
LP-ESW-2:10'	10	No	6,200	<250
LP-ESW-42:11	11	Yes	<50	<250
LP-ESW-47:12.5'	12.5	Yes	<50	<250
LP-ESW-69:11'	11	Yes	9,200	<250
LP-ESW-69:8.5'	8.5	Yes	<50	<250
LP-ESW-71:13'	13	Yes	2,400	<250
LP-ESW-72:10'	10	Yes	7,800	<250
LP-ESW-73:11.5'	11.5	Yes	1,400	<250
LP-ESW-73:18'	18	Yes	110	<250
LP-ESW-73:9'	9	Yes	12,000	370
LP-ESW-74:14	14	Yes	6,600	<250
LP-ESW-74:22	22	Yes	4,300	<250
LP-ESW-74:9'	9	Yes	<50	<250
LP-NSW-18:10'	10	Yes	<50	<250
LP-NSW-17:11'	11	Yes	<50	<250
LP-NSW-18:11.5'	11.5	Yes	<50	<250
LP-NSW-30:10'	10		<50	<250
LP-NSW-4:11'	11	No	7,700	360
LP-NSW-4R-11'	11	Yes	<50	<250
LP-NSW-7:10.5'	10.5	No	3,600	370
LP-NSW-7R:10.5'	10.5	Yes	230	<250
LP-S-35:8.5'	8.5		610	<250
LP-SSW-29:11'	11	No	12,000	<250
LP-SSW-30:11'	11	Yes	2,200	<250
LP-SSW-37:12'	12	No	13,000	360
LP-SSW-38:13'	13	No	5,600	<250
LP-SSW-40:14	14	No	7,200	<250
LP-SSW-40:19	19	No	12,900	280
LP-SSW-40:25	25	Yes	720	<250
LP-SSW-40:9	9	Yes	<50	<250
LP-SSW-40R:14'	14	Yes	3,400	<250
LP-SSW-40R:19'	19	Yes	<50	<250
LP-SSW-44:11	11	No	3,400	<250
LP-SSW-44:13	13	Yes	690	<250
LP-SSW-44:9.5	9.5	Yes	<50	<250
LP-SSW-44R:11'	11	Yes	4,900	<250
LP-SSW-48:14'	14	Yes	570	<250
LP-SSW-49:14'	14	Yes	6,300	<250
LP-SSW-49:19'	19	Yes	1,400	<250
LP-SWS-13:12'	12	Yes	<50	<250
LP-SWS-14:11'	11	Yes	<50	<250
LP-WSW-19:12'	12	Yes	<50	<250
LP-WSW-20:10.5'	10.5	Yes	2,000	<250
LP-WSW-21:11'	11	No	17,000	430
LP-WSW-21R:11'	11	Yes	<50	<250
LP-WSW-39:11'	11	No	2,900	<250
LP-WSW-39R:11'	11	Yes	<50	<250
LP-WSW-5:11'	11	No	5,000	380
LP-WSW-5R:11'	11	Yes	<50	<250
LP-WSW-51:12'	12	No	10,000	<250
LP-WSW-51:15'	15	Yes	<50	<250
LP-WSW-51:9.5'	9.5	Yes	<50	<250
LP-WSW-51RR-12	12	Yes	1,500	<250
LP-WSW-52:12'	12	No	2,300	<250
LP-WSW-52:9.5'	9.5	Yes	430	<250
LP-WSW-57:11.5	11.5	Yes	<50	<250
LP-WSW-58:10'	10	Yes	<50	<250
LP-WSW-59:11'	11	Yes	<50	<250
LP-WSW-6:11.5'	11.5	No	7,200	350
LP-WSW-6R:11.5'	11.5	No	2,800	<250
LP-WSW-6RR:11.5'	11.5	Yes	<50	<250
LP-WSW-60:12'	12	Yes	<50	<250
MTCA Method A Soil Cleanup Level for Unrestricted Land Use			2,000	2,000

B-64:12.57

Notes:
(a) Analyzed for diesel-range total petroleum hydrocarbons (DRPH) using Ecology Method NWTPH-Dx
(b) Analyzed for oil-range total petroleum hydrocarbons (ORPH) using Ecology Method NWTPH-Dx
B = bottom of excavation soil sample
bgs - Below ground surface
Soil sample analysis performed by Friedman & Bruya, Inc.
mg/kg = milligrams per kilogram
NA = not applicable
Bold = Concentration detected, but below MTCA Method A Soil Cleanup Levels for Unrestricted Land Use
Bold and Shaded = Concentration above MTCA Method A Soil Cleanup Level for Unrestricted Land Use
DLP = Duplicate sample

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING



ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-28213-1
Client Project/Site: EPI-As

For:
Nautilus Environmental
5009 Pacific Hwy. East
Suite 2
Tacoma, Washington 98424

Attn: Cat Curran

Kristine D. Allen

Authorized for release by:
09/02/2011 02:20:11 PM
Kristine Allen
Project Manager I
kristine.allen@testamericainc.com

Designee for

Melissa Armstrong
Project Manager I
melissa.armstrong@testamericainc.com

LINKS

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Job ID: 580-28213-1

Laboratory: TestAmerica Seattle

Narrative

Receipt

The following samples were received at the laboratory outside the required temperature criteria: Control (580-28213-1), SMSS-0810 (580-28213-3), SMSS-BG (580-28213-2) at 6.8c.

Sample collection dates and times were not recorded on the sample containers. The samples were logged-in and labeled according to the sample dates and times reported on the Chain of Custody (COC).

Metals

No analytical or quality issues were noted.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight **basis**
%R	Percent Recovery
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit (Dioxin)
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or method detection limit if shown)
PQL	Practical Quantitation Limit
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client: Nautilus Environmental
Project/Site: EPI-As

TestAmerica Job ID: 580-28213-1

Client Sample ID: Control
Date Collected: 08/22/11 10:00
Date Received: 08/23/11 15:25

Lab Sample ID: 580-28213-1
Matrix: Tissue

5

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		3.0		mg/Kg		09/01/11 14:39	09/01/11 23:57	1

Client: Nautilus Environmental
Project/Site: EPI-As

TestAmerica Job ID: 580-28213-1

Client Sample ID: SMSS-BG
Date Collected: 08/22/11 10:00
Date Received: 08/23/11 15:25

Lab Sample ID: 580-28213-2
Matrix: Tissue

5

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.3		mg/Kg		09/01/11 14:39	09/02/11 00:04	1

Client: Nautilus Environmental
Project/Site: EPI-As

TestAmerica Job ID: 580-28213-1

Client Sample ID: SMSS-0810
Date Collected: 08/22/11 10:00
Date Received: 08/23/11 15:25

Lab Sample ID: 580-28213-3
Matrix: Tissue

5

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.1		mg/Kg		09/01/11 14:39	09/02/11 00:11	1

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 580-94336/4-A
Matrix: Tissue
Analysis Batch: 94381

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 94336

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		3.0		mg/Kg		09/01/11 14:39	09/01/11 23:38	1

Lab Sample ID: LCS 580-94336/5-A
Matrix: Tissue
Analysis Batch: 94381

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 94336

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Arsenic	200	190		mg/Kg		95	80 - 120

Lab Sample ID: LCSD 580-94336/6-A
Matrix: Tissue
Analysis Batch: 94381

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 94336

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Arsenic	200	190		mg/Kg		95	80 - 120	0	20

Lab Chronicle

Client: Nautilus Environmental
Project/Site: EPI-As

TestAmerica Job ID: 580-28213-1

Client Sample ID: Control

Lab Sample ID: 580-28213-1
Matrix: Tissue

Date Collected: 08/22/11 10:00
Date Received: 08/23/11 15:25

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			94336	09/01/11 14:39	PAB	TAL SEA
Total/NA	Analysis	6010B		1	94381	09/01/11 23:57	SP	TAL SEA

Client Sample ID: SMSS-BG

Lab Sample ID: 580-28213-2
Matrix: Tissue

Date Collected: 08/22/11 10:00
Date Received: 08/23/11 15:25

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			94336	09/01/11 14:39	PAB	TAL SEA
Total/NA	Analysis	6010B		1	94381	09/02/11 00:04	SP	TAL SEA

Client Sample ID: SMSS-0810

Lab Sample ID: 580-28213-3
Matrix: Tissue

Date Collected: 08/22/11 10:00
Date Received: 08/23/11 15:25

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			94336	09/01/11 14:39	PAB	TAL SEA
Total/NA	Analysis	6010B		1	94381	09/02/11 00:11	SP	TAL SEA

Laboratory References:
TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Certification Summary

Client: Nautilus Environmental
Project/Site: EPI-As

TestAmerica Job ID: 580-28213-1

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Seattle	Alaska	Alaska UST	10	UST-022
TestAmerica Seattle	Alaska	TA-Port Heiden Mobile Lab	10	UST-093
TestAmerica Seattle	California	NELAC	9	1115CA
TestAmerica Seattle	Florida	NELAC	4	E871074
TestAmerica Seattle	L-A-B	DoD ELAP		L2236
TestAmerica Seattle	L-A-B	ISO/IEC 17025		L2236
TestAmerica Seattle	Louisiana	NELAC	6	05016
TestAmerica Seattle	Montana	MT DEQ UST	8	N/A
TestAmerica Seattle	Oregon	NELAC	10	WA100007
TestAmerica Seattle	USDA	USDA		P330-11-00222
TestAmerica Seattle	Washington	State Program	10	C553

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

Sample Summary

Client: Nautilus Environmental
Project/Site: EPI-As

TestAmerica Job ID: 580-28213-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-28213-1	Control	Tissue	08/22/11 10:00	08/23/11 15:25
580-28213-2	SMSS-BG	Tissue	08/22/11 10:00	08/23/11 15:25
580-28213-3	SMSS-0810	Tissue	08/22/11 10:00	08/23/11 15:25

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.testamericainc.com

☐ Rush
☐ Short Hold

Chain of Custody Record

Client: Nautilus Envir.	Client Contact: Cat Curran	Date: 8-23-11	Chain of Custody Number: 12259
Address: 5009 Pacific Hwy E Ste 2	Telephone Number (Area Code)/Fax Number: 253-922-4296	Lab Number: 28213	Page 1 of 1
City: Fife / State: WA / Zip Code: 98424	Sampler: SD	Lab Contact: Melissa A	
Project Name and Location (State): EPI-As	Billing Contact: Vicki Mansouri		
Contract/Purchase Order/Quote No.			

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Water	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): Arsenic	Special Instructions/ Conditions of Receipt
CONTROL	8-22-11	10am					X	X						X	
SMSS-BG	8-22-11	10am					X	X						X	
SMSS-0810	8-22-11	10am					X	X						X	
															IRL=6.0/6.8 Mea.R/W Wet ice/other w/o CS

Cooler: ☐ Yes ☐ No Cooler Temp:_____

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

(A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☒ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By Sign/Print: Cat Curran Cat Curran	8-23-11	1525	1. Received By Sign/Print: Samantha J. Kalicki	8/23/11	1525
2. Relinquished By Sign/Print:			2. Received By Sign/Print:		
3. Relinquished By Sign/Print:			3. Received By Sign/Print:		

Comments

DISTRIBUTION: WHITE – Stays with the Samples; CANARY – Returned to Client with Report; PINK – Field Copy

Login Sample Receipt Checklist

Client: Nautilus Environmental

Job Number: 580-28213-1

Login Number: 28213
List Number: 1
Creator: Kalicki, Samantha

List Source: TestAmerica Seattle

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	N/A	Not present
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	False	Cooler temperature outside required temperature criteria.
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	False	Refer to Job Narrative for details.
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	Not needed on tissue.
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	N/A	No VOA rec'd.
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	No analysis requiring residual chlorine check assigned.

Attachment E

Cleanup Levels for Potential TEE Receptors
Northwest Pipeline GP, Washington State Meter Station Facilities
Northwest Washington Representation Area
ARSENIC

Cleanup Level for Avian Predator (Robin)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T robin}}{\text{(FIR robin X Psb robin X BAF worm) + (SIR robin X RGAF robin)}}$$

CUL	Units
58	**mg/kg**

Variable	Unit	Value
Psb robin	Unitless	0.52
FIR robin	kg dry food / kg body weight - day	0.207
SIR robin	kg dry soil / kg body weight - day	0.0215
RGAF robin	Unitless (Table 749-5)	1
T robin	mg/kg - day (Table 749-5 footnote a)	2.24
Home Range	Acres	0.6
BAF worm	mg/kg worm / mg/kg soil (Table 749-5 footnote a)	0.16

Notes:
Psb Proportion of contaminated food in diet
FIR Food ingestion rate
SIR Soil ingestion rate
RGAF Gut Absorbsion Factor
T Toxicity Reference Value from Ecological Screening Levels for Arsenic, US EPA, March 2005
BAF Site Specific Bioaccumulation Factor

Cleanup Level for Mammalian Predator (Shrew)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T shrew}}{\text{(FIR shrew X Psb shrew X BAF worm) + (SIR shrew X RGAF shrew)}}$$

CUL	Units
47	**mg/kg**

Variable	Unit	Value
T shrew	mg/kg - day	1.89
FIR shrew	kg dry food / kg body weight - day	0.45
Psb shrew	unitless	0.5
BAF worm	mg/kg worm / mg/kg soil (Table 749-5 footnote a)	0.16
SIR shrew	kg dry soil / kg body weight - day	0.0045
RGAF shrew	Unitless (chemical specific-As)	1

Notes:
T Toxicity Reference Value
FIR Food ingestion rate
P Proportion of contaminated food in diet
BAF Bioaccumulation factor
SIR Soil ingestion rate
RGAF Gut Absorbsion Factor
BAF Site Specific Bioaccumulation Factor

Cleanup Level for Mammalian Herbivore (Vole)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T vole}}{\text{(FIR vole X P plant, vole X K plant) + (SIR vole X RGAF vole)}}$$

CUL	Units
43	**mg/kg**

Variable	Unit	Value
T vole	mg/kg - day	1.15
FIR vole	kg dry food / kg body weight - day	0.315
P plant, vole	unitless	1
K plant	mg/kg worm / mg/kg soil	0.06
SIR vole	kg dry soil / kg body weight - day	0.0079
RGAF vole	Unitless (chemical specific-As)	1

Notes:
T Toxicity Reference Value
FIR Food ingestion rate
P Proportion of contaminated food in diet
K Plant uptake coefficient
SIR Soil ingestion rate
RGAF Gut Absorbsion Factor

TEE Book Value CUL Protective of Plants
Table 749-3

CUL	Units
10	**mg/kg**

TEE Book Value CUL Protective of Soil Biota
Table 749-3

CUL	Units
60	**mg/kg**

Cleanup Levels for Potential TEE Receptors
Northwest Pipeline GP, Washington State Meter Station Facilities
Southwest Washington/Columbia River Representation Area
ARSENIC

Cleanup Level for Avian Predator (Robin)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T robin}}{\text{(FIR robin X Psb robin X BAF worm) + (SIR robin X RGAF robin)}}$$

CUL	Units
45	**mg/kg**

Variable	Unit	Value
Psb robin	Unitless	0.52
FIR robin	kg dry food / kg body weight - day	0.207
SIR robin	kg dry soil / kg body weight - day	0.0215
RGAF robin	Unitless (Table 749-5)	1
T robin	mg/kg - day (Table 749-5 footnote a)	2.24
Home Range	Acres	0.6
BAF worm	mg/kg worm / mg/kg soil (Table 749-5 footnote a)	0.26

Notes:

Psb	Proportion of contaminated food in diet
FIR	Food ingestion rate
SIR	Soil ingestion rate
RGAF	Gut Absorbsion Factor
T	Toxicity Reference Value from Ecological Screening Levels for Arsenic, US EPA, March 2005
BAF	Site Specific Bioaccumulation Factor

Cleanup Level for Mammalian Predator (Shrew)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T shrew}}{\text{(FIR shrew X Psb shrew X BAF worm) + (SIR shrew X RGAF shrew)}}$$

CUL	Units
30	**mg/kg**

Variable	Unit	Value
T shrew	mg/kg - day	1.89
FIR shrew	kg dry food / kg body weight - day	0.45
Psb shrew	unitless	0.5
BAF worm	mg/kg worm / mg/kg soil (Table 749-5 footnote a)	0.26
SIR shrew	kg dry soil / kg body weight - day	0.0045
RGAF shrew	Unitless (chemical specific-As)	1

Notes:

T	Toxicity Reference Value
FIR	Food ingestion rate
P	Proportion of contaminated food in diet
BAF	Bioaccumulation factor
SIR	Soil ingestion rate
RGAF	Gut Absorbsion Factor
BAF	Site Specific Bioaccumulation Factor

Cleanup Level for Mammalian Herbivore (Vole)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T vole}}{\text{(FIR vole X P plant, vole X K plant) + (SIR vole X RGAF vole)}}$$

CUL	Units
43	**mg/kg**

Variable	Unit	Value
T vole	mg/kg - day	1.15
FIR vole	kg dry food / kg body weight - day	0.315
P plant, vole	unitless	1
K plant	mg/kg worm / mg/kg soil	0.06
SIR vole	kg dry soil / kg body weight - day	0.0079
RGAF vole	Unitless (chemical specific-As)	1

Notes:

T	Toxicity Reference Value
FIR	Food ingestion rate
P	Proportion of contaminated food in diet
K	Plant uptake coefficient
SIR	Soil ingestion rate
RGAF	Gut Absorbsion Factor

TEE Book Value CUL Protective of Plants
Table 749-3

CUL	Units
10	**mg/kg**

TEE Book Value CUL Protective of Soil Biota
Table 749-3

CUL	Units
60	**mg/kg**

Cleanup Levels for Potential TEE Receptors
Northwest Pipeline GP, Washington State Meter Station Facilities
Central Washington Representation Area
ARSENIC

Cleanup Level for Avian Predator (Robin)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T robin}}{\text{(FIR robin X Psb robin X BAF worm) + (SIR robin X RGAF robin)}}$$

CUL	Units
29	**mg/kg**

Variable	Unit	Value
Psb robin	Unitless	0.52
FIR robin	kg dry food / kg body weight - day	0.207
SIR robin	kg dry soil / kg body weight - day	0.0215
RGAF robin	Unitless (Table 749-5)	1
T robin	mg/kg - day (Table 749-5 footnote a)	2.24
Home Range	Acres	0.6
BAF worm	mg/kg worm / mg/kg soil (Table 749-5 footnote a)	0.53

Notes:

Psb	Proportion of contaminated food in diet
FIR	Food ingestion rate
SIR	Soil ingestion rate
RGAF	Gut Absorbsion Factor
T	Toxicity Reference Value from Ecological Screening Levels for Arsenic, US EPA, March 2005
BAF	Site Specific Bioaccumulation Factor

Cleanup Level for Mammalian Predator (Shrew)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T shrew}}{\text{(FIR shrew X Psb shrew X BAF worm) + (SIR shrew X RGAF shrew)}}$$

CUL	Units
15	**mg/kg**

Variable	Unit	Value
T shrew	mg/kg - day (Table 749-5)	1.89
FIR shrew	kg dry food / kg body weight - day	0.45
Psb shrew	unitless	0.5
BAF worm	mg/kg worm / mg/kg soil (Table 749-5 footnote a)	0.53
SIR shrew	kg dry soil / kg body weight - day	0.0045
RGAF shrew	Unitless (chemical specific-As)	1

Notes:

T	Toxicity Reference Value
FIR	Food ingestion rate
P	Proportion of contaminated food in diet
BAF	Bioaccumulation factor
SIR	Soil ingestion rate
RGAF	Gut Absorbsion Factor
BAF	Site Specific Bioaccumulation Factor

Cleanup Level for Mammalian Herbivore (Vole)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T vole}}{\text{(FIR vole X P plant, vole X K plant) + (SIR vole X RGAF vole)}}$$

CUL	Units
43	**mg/kg**

Variable	Unit	Value
T vole	mg/kg - day	1.15
FIR vole	kg dry food / kg body weight - day	0.315
P plant, vole	unitless	1
K plant	mg/kg worm / mg/kg soil	0.06
SIR vole	kg dry soil / kg body weight - day	0.0079
RGAF vole	Unitless (chemical specific-As)	1

Notes:

T	Toxicity Reference Value
FIR	Food ingestion rate
P	Proportion of contaminated food in diet
K	Plant uptake coefficient
SIR	Soil ingestion rate
RGAF	Gut Absorbsion Factor

TEE Book Value CUL Protective of Plants
Table 749-3

CUL	Units
10	**mg/kg**

TEE Book Value CUL Protective of Soil Biota
Table 749-3

CUL	Units
60	**mg/kg**

Cleanup Levels for Potential TEE Receptors
Northwest Pipeline GP, Washington State Meter Station Facilities
Eastern Washington Representation Area
ARSENIC

Cleanup Level for Avian Predator (Robin)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T robin}}{\text{(FIR robin X Psb robin X BAF worm) + (SIR robin X RGAF robin)}}$$

CUL	Units
63	**mg/kg**

Variable	Unit	Value
Psb robin	Unitless	0.52
FIR robin	kg dry food / kg body weight - day	0.207
SIR robin	kg dry soil / kg body weight - day	0.0215
RGAF robin	Unitless (Table 749-5)	1
T robin	mg/kg - day (Table 749-5 footnote a)	2.24
Home Range	Acres	0.6
BAF worm	mg/kg worm / mg/kg soil (Table 749-5 footnote a)	0.13

Notes:

Psb	Proportion of contaminated food in diet
FIR	Food ingestion rate
SIR	Soil ingestion rate
RGAF	Gut Absorbsion Factor
T	Toxicity Reference Value from Ecological Screening Levels for Arsenic, US EPA, March 2005
BAF	Site Specific Bioaccumulation Factor

Cleanup Level for Mammalian Predator (Shrew)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T shrew}}{\text{(FIR shrew X Psb shrew X BAF worm) + (SIR shrew X RGAF shrew)}}$$

CUL	Units
56	**mg/kg**

Variable	Unit	Value
T shrew	mg/kg - day (Table 749-5)	1.89
FIR shrew	kg dry food / kg body weight - day	0.45
Psb shrew	unitless	0.5
BAF worm	mg/kg worm / mg/kg soil (Table 749-5 footnote a)	0.13
SIR shrew	kg dry soil / kg body weight - day	0.0045
RGAF shrew	Unitless (chemical specific-As)	1

Notes:

T	Toxicity Reference Value
FIR	Food ingestion rate
P	Proportion of contaminated food in diet
BAF	Bioaccumulation factor
SIR	Soil ingestion rate
RGAF	Gut Absorbsion Factor
BAF	Site Specific Bioaccumulation Factor

Cleanup Level for Mammalian Herbivore (Vole)
Equation in Table 749-4

$$\text{Soil CUL} = \frac{\text{T vole}}{\text{(FIR vole X P plant, vole X K plant) + (SIR vole X RGAF vole)}}$$

CUL	Units
43	**mg/kg**

Variable	Unit	Value
T vole	mg/kg - day	1.15
FIR vole	kg dry food / kg body weight - day	0.315
P plant, vole	unitless	1
K plant	mg/kg worm / mg/kg soil	0.06
SIR vole	kg dry soil / kg body weight - day	0.0079
RGAF vole	Unitless (chemical specific-As)	1

Notes:

T	Toxicity Reference Value
FIR	Food ingestion rate
P	Proportion of contaminated food in diet
K	Plant uptake coefficient
SIR	Soil ingestion rate
RGAF	Gut Absorbsion Factor

TEE Book Value CUL Protective of Plants
Table 749-3

CUL	Units
10	**mg/kg**

TEE Book Value CUL Protective of Soil Biota
Table 749-3

CUL	Units
60	**mg/kg**