

# **SUBSURFACE ENVIRONMENTAL SITE ASSESSMENT**



**ARCOA BUILDING  
1006 SE GRAND AVENUE  
PORTLAND, MULTNOMAH COUNTY, OREGON 97214**

*Report Prepared for and Reliance Provided to:*

**MR. VINCE HUFFSTUTTER  
15019 SW RIVERSHORE DRIVE  
VANCOUVER, WASHINGTON 98683**

**Report Date: March 12, 2013  
Chugwater Project CW130201.1**

**CHUGWATER, LLC  
environmental due diligence**

**10445 sw canyon road, suite 101  
beaverton, oregon 97005  
ph: 503.916.9254 fax: 503.352.0920**

Chugwater performed an Environmental Subsurface Investigation on the Arcoa Building, located at 1006 SE Grand Avenue, Portland, Oregon 97214 ("Property"). This investigation was performed in accordance with Chugwater's Proposal CW121215-1 authorized by Mr. Vince Huffstutter on January 31, 2013.

## **PURPOSE**

The purpose of this investigation is to assess recognized environmental conditions (RECs) identified in a Phase I Environmental Site Assessment (Project CW121116.2) prepared by Chugwater for Killian Pacific LLC in December 2012. The information provided in this report describes the work performed and provides documentation of the data and evaluation that constitutes the factual findings of the investigation. This investigation is not intended to satisfy the level of inquiry that may be necessary to support remedial solutions or determine migration pathways related to a release from the RECs.

## **BACKGROUND INFORMATION**

Chugwater performed a Phase I ESA on the Arcoa Building located at 1006 SE Grand Avenue, Portland, Oregon in general conformance with the scope and limitations of ASTM Practice E 1527-05.

The Property is located in Portland, Oregon and is currently improved with a three-story commercial building with a basement constructed in 1909; a single-story addition to the east of the main Property building constructed in 1985; and a parking lot located to the east of the Property building. According to information provided by the City of Portland, the main building square footage is 23,400 total square feet and the 1985 addition square footage is 2,100 total square feet. The Property is identified by Multnomah County as tax lots 1S1E02BC01300 and 1S1E02BC01000 and consists of approximately 0.44 acres. The Property is zoned EX-Central Employment by the City of Portland.

This assessment revealed environmental concerns in connection with the Property.

Historic use of the Property from 1909 through 1959 included the presence of a dry cleaning and dyeing plant operated as US Laundry and Allyn's. Significant features depicted in Sanborn Fire Insurance Maps of the Property dated 1924 and 1950 include a dry cleaning area located in what is now the drive south of the Property building accessing the Property off of SE Grand Avenue, two fuel oil fired boilers located in the northeast corner of the Property building, and an earth floor storage and shipping shed in the current Property parking lot.

- The presence of former dry cleaning businesses on the Property indicates the likely use of perchloroethylene as a dry cleaning solvent. Information provided by the State Coalition for the Remediation of Drycleaners indicates that contamination is routinely encountered at dry cleaning locations as a result of improper waste disposal and routine maintenance issues. Perchloroethylene is an environmental contaminant regulated by the Oregon Department of Environmental Quality.

- It is likely that fuel oil supplying the boilers formerly located in the northeast corner of the Property building basement was stored in underground storage tanks. Chugwater did not identify any permits indicating the removal of underground storage tanks from the Property.

## **SOILS, GEOLOGY & GROUNDWATER CHARACTERISTICS**

The Property is situated near the outlet of the Columbia River Gorge where it intersects with the Willamette Valley (Orr, Orr, Baldwin, 1992). Sediments collected in this area record multiple Ice Age floods that originated in Montana, poured through the Cascades via the Columbia River, and backed up in the valley before eventually draining to the Pacific Ocean. The Property is located at approximately 55 feet above mean sea level.

According to a well log search conducted on the Oregon Water Resources website, no significant shallow groundwater resources have been encountered in wells advanced in close proximity of the Property. Water bearing zones were defined between 20 and 35 feet below ground surface in wells advanced in the vicinity of the Property. The water-bearing units within the area are comprised of alluvium. No on-site water wells or springs were observed during the Property reconnaissance. Domestic water is supplied to the Property by the City of Portland and is reportedly obtained primarily from surface water.

Based on a review of the Portland Quadrangle 7.5 minute series topographic map, the inferred groundwater flow at the site is to the north northeast. The Property does not overlie a sole source aquifer.

Based on the USEPA Ground Water Handbook, Vol.1 Ground Water and Contamination, September 1990, the water table typically conforms to surface topography.

## **SCOPE OF WORK**

The purpose of the subsurface environmental investigation is to collect soil, groundwater and soil vapor samples on the Property to confirm the presence or absence of contaminants related to the past use of the Property as a dry cleaning plant and the past storage of fuel oil on the Property.

## **Areas of Potential Concern, Proposed Borings and Analysis**

Based upon the past and current configuration and use of the Property, the following areas were identified for investigation. Boring locations are depicted on the attached Boring Location Diagram.

| Area of Potential Concern                                             | Boring Locations                                  |
|-----------------------------------------------------------------------|---------------------------------------------------|
| Soil, soil vapor and groundwater In area of former dry cleaning plant | SB1, SB2, SB2B, SB7, SB8 & SB9 and SV1, SV2 & SV3 |
| Soil in the vicinity of former boiler plant                           | SB5                                               |
| Soil in the vicinity of former dirt floor storage building            | SB3, SB4, SB5 & SB6                               |

| Boring | Media | Analytical Methods                                        | Detection Limit                          |
|--------|-------|-----------------------------------------------------------|------------------------------------------|
| All    | Soil  | NWTPH-Dx, Stoddard Solvent (Gx), RCRA 8 Metals & EPA 8260 | RBCs for Leaching to Groundwater or Less |
| SB2B   | Water | NWTPH-Dx, Stoddard Solvent (Gx) & EPA 8260                | RBCs for Occupational Ingestion or less  |

### Task 1 – Project Coordination

Chugwater performed a site visit to determine specific sampling locations and confirm utility locations, develop a site specific health and safety plan for the proposed sampling activities and coordinate the efforts of subcontract services including geophysical surveys, environmental drilling and analytical laboratory services.

### Task 2 – Geophysical Investigation

Chugwater subcontracted a subsurface mapping survey of selected portions of the Property to locate features of environmental interest and clear boring locations. Ground penetrating radar and magnetometer surveys were used in this investigation and results were marked on-site.

Pacific Geophysics performed the subsurface mapping survey.

### Task 2 – Subsurface Investigation

Chugwater collected soil, groundwater and soil vapor samples as follows:

- Soil samples were collected from nine boring locations including four locations representing the area denoted on Sanborn Maps as being the location of dry cleaning equipment (SB1, SB2/2B, SB7 and SB8); one location representing the area denoted on Sanborn Maps as being the location of the Property building boiler plant (SB5); and four locations representing the area denoted on Sanborn Maps as being the location of storage building with a dirt floor (SB3, SB4, SB5 & SB6). The soil borings were advanced using a direct push probe.
- A single groundwater sample was collected from SB2B to evaluate impacts to groundwater in the area where soils impacted by suspected dry cleaning compounds and diesel fuel.
- Three soil vapor samples were collected to evaluate vapor concentrations in the area where soils impacted by suspected dry cleaning compounds and diesel fuel as well as beneath the Arcoa Building. Soil vapor sample SV1 is considered invalid as the Summa canister used in collecting this sample did not depressurize correctly in the field.

### Task 3 – Analytical Services

Soil and groundwater samples were transported to ESN Northwest for analysis by NWTPH-Dx, NWTPH-Gx, EPA Method 6020 (Metals) and EPA Method 8260 (Volatile Organic Compounds).

Soil vapor samples were transported to Air Toxics for analysis by TO-15.

### **Exceptions to the Scope of Work**

The proposed scope of work for this project was substantially completed.

Soil vapor sample SV1 is considered invalid as the Summa canister used in collecting this sample did not depressurize correctly in the field.

### **UTILITY LOCATING**

Prior to initiating the field activities, Oregon law requires that, at least 48 hours prior to the initiation of any subsurface work (drilling, backhoe operation, etc.), a utility inspection be performed at the subject property. This inspection consists of the marking of underground utility locations by authorized utility locating personnel. The utility inspection was performed prior to the drilling activities. The ticket number for the utility inspection is 12232613.

### **SAMPLING METHODOLOGY and QA/QC**

Soil borings were advanced using geoprobe macro tooling with an acetate liner. Water samples were collected using stainless steel screened geoprobe tooling. Direct push tooling was decontaminated in a water and detergent solution and rinsed in tap water between samples and boring locations. A clean pair of Nitrile gloves was worn by field personnel for the collection of each sample. Soil samples were placed in laboratory provided 4 oz. glass containers with Teflon-lined lids. Water samples were collected using a peristaltic pump and placed in laboratory provided VOA containers and amber 1-liter bottles. Upon collection, all samples were chilled. One transport blank was prepared and handled according to ODEQ Quality Assurance Policy 760.00.

Soil vapor samples were collected in Summa canisters provided by Air Toxics.

All analytical data was reviewed for quality assurance. Chain of Custody was maintained for all samples.

### **HEALTH AND SAFETY PLAN**

A written site specific Safety Plan was read by field personnel. A toolbox safety meeting was conducted at the site prior to the commencement of the field work. Topics included potential exposure to contaminants of interest, personal protective equipment (drilling and media contact), location of first aid kit and fire extinguisher, and location/directions to closest emergency medical facility.

### **GEOPHYSICAL SURVEY**

A magnetometer survey was conducted at the Property in order to detect large, underground objects that could be possible USTs. Ground penetrating radar (GPR) and handheld metal detectors were used to investigate several magnetic anomalies, and to clear the proposed boring locations.

Several magnetic anomalies were detected and investigated; however, none appeared to be caused by large metallic objects. No USTs were detected within the magnetometer survey area.

## **SUBSURFACE INVESTIGATION**

The investigation was conducted on December 15, 2012 and February 15, 2013. During the investigation, soil borings were advanced with a push probe drilling rig by ESN Northwest. The borings were advanced in locations determined by Chugwater based on the findings of the previously prepared Phase I Environmental Site Assessment, the findings of the geophysical survey and marked utility locations.

- **Boring SB1** was completed to 20 feet below ground surface (bgs) near the center of the drive south of the Arcoa Building in the area depicted on Sanborn Maps as the location of dry cleaning equipment. Native soil consisting of fine-grained alluvium from the surface to approximately 17 feet bgs and coarse-grained alluvium from 17 to 20 feet below ground surface was encountered in the boring. Soil staining and odor was encountered from 6.5 to 17 feet bgs in this boring. Soil samples were collected at depths of 8 and 17 feet bgs at this location. Groundwater was not encountered in this boring.
- **Boring SB2/2B** was completed to 32 feet bgs at the east end of the drive south of the Arcoa Building in the area depicted on Sanborn Maps as the location of dry cleaning equipment. Native soil consisting of fine-grained alluvium from the surface to approximately 17 feet bgs and coarse-grained alluvium from 17 to 20 feet below ground surface was encountered in the boring. Soil staining and odor was encountered from 6.5 to 17 feet bgs in this boring. Soil samples were collected at depths of 8, 17 and 28 feet bgs at this location. Groundwater was encountered at a depth of 28.4 feet bgs in this boring. Static groundwater was measured at a depth of 28.0 feet bgs prior to abandonment of this boring. A groundwater sample was collected in this boring.
- **Boring SB3** was completed to 20 feet bgs in the southwest corner of the parking lot located to the east of the Arcoa Building. Native soil consisting of fine-grained alluvium from the surface to approximately 17 feet bgs and coarse-grained alluvium from 17 to 20 feet below ground surface was encountered in the boring. No indications of contamination were noted in the continuous soil cores collected from this boring. Soil samples were collected at depths of 8 and 15 feet bgs at this location. Groundwater was not encountered in this boring.
- **Boring SB4** was completed to 20 feet bgs in the southeast corner of the parking lot located to the east of the Arcoa Building. Native soil consisting of fine-grained alluvium from the surface to approximately 17 feet bgs and coarse-grained alluvium from 17 to 20 feet below ground surface was encountered in the boring. No indications of contamination were noted in the continuous soil cores collected from this boring. Soil samples were collected at depths of 8 and 14 feet bgs at this location. Groundwater was not encountered in this boring.

- **Boring SB5** was completed to 20 feet bgs in the northwest corner of the parking lot located to the east of the Arcoa Building. Native soil consisting of fine-grained alluvium from the surface to approximately 17 feet bgs and coarse-grained alluvium from 17 to 20 feet below ground surface was encountered in the boring. No indications of contamination were noted in the continuous soil cores collected from this boring. Soil samples were collected at depths of 8 and 14 feet bgs at this location. Groundwater was not encountered in this boring.
- **Boring SB6** was completed to 20 feet bgs in the northeast corner of the parking lot located to the east of the Arcoa Building. Native soil consisting of fine-grained alluvium from the surface to approximately 17 feet bgs and coarse-grained alluvium from 17 to 20 feet below ground surface was encountered in the boring. No indications of contamination were noted in the continuous soil cores collected from this boring. Soil samples were collected at depths of 8 and 15 feet bgs at this location. Groundwater was not encountered in this boring.
- **Boring SB7** was completed to 8 feet bgs near the center of the drive south of the Arcoa Building in the area depicted on Sanborn Maps as the location of dry cleaning equipment. Native soil consisting of fine-grained alluvium was encountered in the boring. Soil staining and odor was encountered from 6.5 to 8 feet bgs in this boring. Soil samples were not collected at this location. Groundwater was not encountered in this boring.
- **Boring SB8** was completed to 20 feet bgs near the west end of the drive south of the Arcoa Building in the area depicted on Sanborn Maps as the location of dry cleaning equipment. Native soil consisting of fine-grained alluvium from the surface to approximately 17 feet bgs and coarse-grained alluvium from 17 to 20 feet below ground surface was encountered in the boring. Soil staining and odor was encountered from 7.0 to 13 feet bgs in this boring. A soil samples was collected at depths of 14 feet bgs at this location. Groundwater was not encountered in this boring.
- **Boring SB9/SV3** was completed to 1 foot bgs below the building floor slab in the basement communications room. Sandy fill material was encountered in the boring. No indications of contamination were noted in the continuous soil core collected from this boring. A soil sample was collected at a depth of 1.0 feet bgs at this location. A soil vapor probe was driven at this location and soil vapor sample SV3 was collected.
- **SV1** was completed to 4 feet bgs on the south side of the drive south of the Arcoa Building in a location near the south adjoining property building fronting SE 6<sup>th</sup> Avenue. A soil vapor probe was driven at this location and soil vapor sample SV1 was collected.
- **SV2** was completed to 4 feet bgs on the south side of the drive south of the Arcoa Building in a location near the south adjoining property building fronting SE Grand Avenue. A soil vapor probe was driven at this location and soil vapor sample SV2 was collected.

The boring locations are illustrated on Figure 3. Boring logs are presented in Appendix I.

### **Soil Sampling**

Soil samples were continuously collected with a four-foot long stainless-steel macro core and disposable acetate sleeves.

The soil samples collected from each boring were field screened with a photo-ionization detector (PID) for volatile organic vapors. Field screening readings, olfactory and visual indications of potential contamination are noted above and on soil boring logs found in the appendix.

### **Groundwater Sampling**

A temporary groundwater monitoring well were established and a groundwater sample collected with a peristaltic pump from boring SB2B. Static groundwater level was encountered at 28.4 feet below ground surface.

### **Soil Vapor Sampling**

Soil Vapor samples were collected in 1 liter sample canister provided Air Toxics. The sample canister, Teflon tubing, vacuum gauges and flow rate orifice apparatus were connected in the sample string. Vacuum gauges and sample canister vacuum were checked before initiating sample collection. The air volume within the collection apparatus and Teflon tubing was purged prior to sample collection. Geoprobe tooling was advanced to a depth of 4 feet bgs. A bentonite seal was applied to the point of ground and at the exit of the Teflon tubing through the Geoprobe tool string. Paper towels saturated with 2-propanol were placed around the seals and sample apparatus.

### **Laboratory Analytical Results**

Fourteen soil samples, one groundwater sample and three soil vapor samples were collected for analysis.

The soil and groundwater samples were transported under chain of custody to ESN Northwest, Inc. of Olympia, Washington, an Oregon certified laboratory. The soil vapor samples were transported to Eurofins/Air Toxics in Folsom, California.

The sample analytical results are summarized in the tables below. Only compounds regulated by the Oregon Department of Environmental Quality are reported in these tables. The laboratory analytical report and chain-of-custody forms are included as Appendix II.

| TABLE 1<br>LABORATORY ANALYTICAL RESULTS –TPH/VOCS/METALS IN SOIL (MG/KG) |           |       |               |                                             |                                                        |
|---------------------------------------------------------------------------|-----------|-------|---------------|---------------------------------------------|--------------------------------------------------------|
| Sample Number                                                             | Date      | Depth | TPHs          | Metals                                      | 8260 VOCs                                              |
| SB1-S1                                                                    | 2/15/2012 | 8.0'  | none detected | Lead – 9.4<br>Chromium – 13<br>Barium – 152 | Benzene – 0.13<br>Ethylbenzene – 0.76<br>Xylenes – 2.1 |

**TABLE 1**  
**LABORATORY ANALYTICAL RESULTS –TPH/VOCs/METALS IN SOIL (MG/KG)**

| Sample Number | Date       | Depth | TPHs               | Metals                                       | 8260 VOCs                                                                                                                                                                                                                                                                                      |
|---------------|------------|-------|--------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               |            |       |                    |                                              | Isopropylbenzene – 1.5<br>1,3,5-Trimethybenzene – 8.4<br>1,2,4-Trimethybenzene - 16<br>Napthalene – 0.14                                                                                                                                                                                       |
| SB1-S2        | 12/15/2012 | 17.0' | none detected      | Chromium – 6.4<br>Barium – 75                | none detected                                                                                                                                                                                                                                                                                  |
| SB2-S1        | 12/15/2012 | 8.0'  | Diesel – 7,100     | Lead – 11<br>Chromium – 14<br>Barium – 120   | 1,1-Dichloroethene – 0.05<br>Chloroform – 2.7<br>EDC – 2.5<br>Benzene - 93<br>Trichloroethene – 1.1<br>Toluene - 40<br>Tetrachloroethene – 8.6<br>Ethylbenzene - 18<br>Xylenes - 170<br>Isopropylbenzene - 27<br>1,3,5-Trimethybenzene - 150<br>1,2,4-Trimethybenzene - 310<br>Napthalene - 12 |
| SB2B-S1       | 2/15/2013  | 28'   | Stoddard (Gx) - 65 | not analyzed                                 | Tetrachloroethene – 0.3<br>1,3,5-Trimethybenzene – 0.16<br>1,2,4-Trimethybenzene – 0.32                                                                                                                                                                                                        |
| SB3-S1        | 12/15/2012 | 8.0'  | none detected      | Lead – 8.8<br>Chromium – 8.9<br>Barium – 78  | not analyzed                                                                                                                                                                                                                                                                                   |
| SB3-S2        | 12/15/2012 | 15.0' | none detected      | Lead – 5.3<br>Chromium – 5.8<br>Barium – 120 | not analyzed                                                                                                                                                                                                                                                                                   |
| SB4-S1        | 12/15/2012 | 8.0'  | none detected      | Lead – 12<br>Chromium – 8.5<br>Barium – 120  | not analyzed                                                                                                                                                                                                                                                                                   |
| SB4-S2        | 12/15/2012 | 14.0' | none detected      | Lead – 8.2<br>Chromium – 9.6<br>Barium – 110 | not analyzed                                                                                                                                                                                                                                                                                   |
| SB5-S1        | 12/15/2012 | 8.0'  | none detected      | Lead – 11<br>Chromium – 7.8<br>Barium – 110  | not analyzed                                                                                                                                                                                                                                                                                   |
| SB5-S2        | 12/15/2012 | 14.0' | none detected      | Lead – 6.9<br>Chromium – 6.8<br>Barium – 94  | not analyzed                                                                                                                                                                                                                                                                                   |
| SB6-S1        | 12/15/2012 | 8.0'  | none detected      | Lead – 7.6<br>Chromium – 8.1<br>Barium – 98  | not analyzed                                                                                                                                                                                                                                                                                   |

| TABLE 1<br>LABORATORY ANALYTICAL RESULTS –TPH/VOCS/METALS IN SOIL (MG/KG) |            |       |                     |                                              |                                                                                                                               |
|---------------------------------------------------------------------------|------------|-------|---------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Sample Number                                                             | Date       | Depth | TPHs                | Metals                                       | 8260 VOCs                                                                                                                     |
| SB6-S2                                                                    | 12/15/2012 | 15.0' | none detected       | Lead – 8.5<br>Chromium – 9.5<br>Barium – 101 | not analyzed                                                                                                                  |
| SB8-S1                                                                    | 2/15/2013  | 14'   | Stoddard (Gx) - 310 | not analyzed                                 | Ethylbenzene – 0.16<br>Xylenes - 0.38<br>Isopropylbenzene – 0.50<br>1,3,5-Trimethybenzene – 3.5<br>1,2,4-Trimethybenzene – 12 |
| SB9-S1                                                                    | 2/15/2013  | 2'    | not analyzed        | not analyzed                                 | none detected                                                                                                                 |

| TABLE 2<br>LABORATORY ANALYTICAL RESULTS –TPH/VOCS IN GROUNDWATER (UG/L) |           |       |                             |                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------|-----------|-------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sample Number                                                            | Date      | Depth | TPH                         | 8260 VOC                                                                                                                                                                                                                                      |
| SB2B-W1                                                                  | 2/15/2013 | 28.4' | Stoddard (Gx Range) – 2,200 | cis-1,2-Dichloroethene – 1.6<br>Chloroform – 35<br>Benzene – 3.4<br>Trichloroethene – 5.1<br>Tetrachloroethene – 53<br>Xylenes – 37<br>Isopropylbenzene – 9.9<br>1,3,5-Trimethybenzene – 57<br>1,2,4-Trimethybenzene - 140<br>Napthalene - 14 |

| TABLE 3<br>LABORATORY ANALYTICAL RESULTS –VOCS IN SOIL VAPOR (UG/M <sup>3</sup> ) |           |       |                                                                                                                                                                                                                                                                                        |                                                                                                                                                       |
|-----------------------------------------------------------------------------------|-----------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sample Number                                                                     | Date      | Depth | TPH Concentrations                                                                                                                                                                                                                                                                     | TO 15 VOC Concentrations                                                                                                                              |
| SV1                                                                               | 2/15/2013 | 4.0'  | Sample SV1 was received at laboratory (Eurofins/Air Toxics) with significant vacuum remaining in canister. The residual canister vacuum resulted in elevated reporting limits as well as elevated concentrations. As such these results are not used for the evaluation of conditions. |                                                                                                                                                       |
| SV2                                                                               | 2/15/2013 | 4.0'  | NA                                                                                                                                                                                                                                                                                     | Chloroform – 36<br>Carbon Tetrachloride – 34<br>Benzene – 66<br>Trichloroethene – 62<br>Toluene – 34<br>Tetrachloroethene – 2200<br>Ethylbenzene - 24 |

| TABLE 3<br>LABORATORY ANALYTICAL RESULTS –VOCs IN SOIL VAPOR (UG/M <sup>3</sup> ) |           |       |                    |                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|-----------|-------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sample Number                                                                     | Date      | Depth | TPH Concentrations | TO 15 VOC Concentrations                                                                                                                                           |
|                                                                                   |           |       |                    | Xylenes – 300<br>1,3,5-Trimethybenzene – 1100<br>1,2,4-Trimethybenzene – 2800                                                                                      |
| SV3                                                                               | 2/15/2013 | 1.0'  | NA                 | Cis-1, 2-Dichloroethene – 84<br>Chloroform – 19000<br>Carbon Tetrachloride – 1800<br>Trichloroethene – 66<br>Tetrachloroethene – 400<br>1,2,4-Trimethybenzene – 78 |

## FINDINGS

Concentrations of compounds exceeding occupational and/or construction worker exposure scenarios are noted below in bold type.

| TABLE 4<br>OCCUPATIONAL/CONSTRUCTION WORKER RBCS |                            |                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Occupational                                     | TPHs                       | VOCs                                                                                                                                                                                                                                                                                                                  |
| Soil Ingestion, Dermal Contact & Inhalation      | Gx – 20,000<br>Dx – 14,000 | 1,1-Dichloroethene – 27,000<br>Chloroform – 25<br>EDC – 15<br><b>Benzene - 34</b><br>Trichloroethene – 46<br>Toluene – 77,000<br>Tetrachloroethene – 940<br>Ethylbenzene - 140<br>Xylenes – 25,000<br>Isopropylbenzene – 53,000<br>1,3,5-Trimethybenzene – 10,000<br>1,2,4-Trimethybenzene – 2,000<br>Napthalene - 23 |
| Soil Volatilization to Outdoor Air               | Gx – 69,000<br>Dx – 14,000 | Chloroform – 17<br>EDC – 15<br>Benzene - 50<br>Trichloroethene – 96<br>Ethylbenzene – 160<br>1,2,4-Trimethybenzene – 1,000<br>Napthalene - 1500                                                                                                                                                                       |
| Soil Vapor Intrusion to Buildings                | Gx – NA<br>Dx – NA         | 1,1-Dichloroethene – 680<br><b>Chloroform – 0.41</b><br><b>EDC – 0.59</b><br><b>Benzene – 1.2</b><br>Trichloroethene – 2.8<br>Tetrachloroethene – 36                                                                                                                                                                  |

| TABLE 4<br>OCCUPATIONAL/CONSTRUCTION WORKER RBCS |                                    |                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Occupational                                     | TPHs                               | VOCs                                                                                                                                                                                                                                                                                              |
|                                                  |                                    | <b>Ethylbenzene - 12</b><br>1,2,4-Trimethybenzene – 1,000<br>Naphthalene - 99                                                                                                                                                                                                                     |
| Soil Leaching to Groundwater                     | <b>Gx – 130</b><br>Dx – NA         | 1,1-Dichloroethene – 0.20<br><b>Chloroform – 0.017</b><br><b>EDC – 0.0077</b><br><b>Benzene – 0.053</b><br><b>Trichloroethene – 0.21</b><br><b>Tetrachloroethene – 3.7</b><br><b>Ethylbenzene – 0.90</b><br><b>Xylenes - 100</b><br><b>1,2,4-Trimethybenzene - 68</b><br><b>Napthalene – 0.44</b> |
| Groundwater Ingestion and Inhalation             | <b>Gx – 450</b><br><b>Dx – 430</b> | cis-1,2-Dichloroethene – 290<br><b>Chloroform – 0.99</b><br><b>Benzene – 2.2</b><br><b>Trichloroethene – 3.6</b><br>Tetrachloroethene – 53<br>Xylenes – 850<br>Isopropylbenzene – 0.27<br>1,3,5-Trimethybenzene – 1,500<br><b>1,2,4-Trimethybenzene - 61</b><br><b>Napthalene – 0.72</b>          |
| Groundwater Volatilization to Outdoor Air        | Gx – NA<br>Dx – NA                 | Chloroform – 5,500<br>Benzene – 14,000<br>Trichloroethene – 19,000<br>Naphthalene – 16,000                                                                                                                                                                                                        |
| Groundwater Vapor Intrusion to Buildings         | Gx – NA<br>Dx – NA                 | Chloroform – 1,200<br>Benzene – 2,800<br>Trichloroethene – 3,300<br>Tetrachloroethene – 32,000<br>Naphthalene – 10,000                                                                                                                                                                            |
| Soil Gas Vapor Intrusion to Buildings            | Gx – 1,700,000<br>Dx – 440,000     | <b>Chloroform – 530</b><br>Carbon Tetrachloride – 2000<br>Benzene – 1600<br>Trichloroethene – 2900<br>Toluene – 2.2E+07<br>Tetrachloroethene – 47000<br>Ethylbenzene - 4900<br>Xylenes – 440000<br>1,2,4-Trimethybenzene – 31000                                                                  |
| Construction Worker                              | TPHs                               | VOCs                                                                                                                                                                                                                                                                                              |
| Soil Ingestion, Dermal Contact & Inhalation      | Gx – 9,700<br><b>Dx – 4,600</b>    | 1,1-Dichloroethene – 2,900<br>Chloroform – 380<br>EDC – 180                                                                                                                                                                                                                                       |

| TABLE 4<br>OCCUPATIONAL/CONSTRUCTION WORKER RBCS |                             |                                                                                                                                                                                                                                                       |
|--------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Occupational                                     | TPHs                        | VOCs                                                                                                                                                                                                                                                  |
|                                                  |                             | Benzene - 340<br>Trichloroethene – 120<br>Toluene – 24,000<br>Tetrachloroethene – 1600<br>Ethylbenzene – 1,600<br>Xylenes – 19,000<br>Isopropylbenzene – 24,000<br>1,3,5-Trimethybenzene – 3,100<br>1,2,4-Trimethybenzene – 2,000<br>Napthalene - 500 |
| Groundwater in Excavation                        | Stoddard (Gx Range) – 2,200 | cis-1,2-Dichloroethene – 24,000<br>Chloroform – 720<br>Benzene – 1,700<br>Trichloroethene – 430<br>Tetrachloroethene – 5,400<br>Xylenes – 23,000<br>1,3,5-Trimethybenzene – 23,000<br>1,2,4-Trimethybenzene – 1,700<br>Napthalene - 500               |

Cleanup criteria for compounds noted in Table 4 are established in the manual titled *“Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites”* prepared by the Oregon Department of Environmental Quality revised June 7, 2012.

| TABLE 5<br>MAXIMUM CONCENTRATIONS DETECTED |                             |                                                                                                                                                                                                                                                                                                |
|--------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Highest Concentration Soil                 | TPHs                        | VOCs                                                                                                                                                                                                                                                                                           |
|                                            | Gx – 2,200<br>Dx – 7,100    | 1,1-Dichloroethene – 0.05<br>Chloroform – 2.7<br>EDC – 2.5<br>Benzene - 93<br>Trichloroethene – 1.1<br>Toluene - 40<br>Tetrachloroethene – 8.6<br>Ethylbenzene - 18<br>Xylenes - 170<br>Isopropylbenzene - 27<br>1,3,5-Trimethybenzene - 150<br>1,2,4-Trimethybenzene - 310<br>Napthalene - 12 |
| Highest Concentration Groundwater          | TPHs                        | VOCs                                                                                                                                                                                                                                                                                           |
|                                            | Stoddard (Gx Range) – 2,200 | cis-1,2-Dichloroethene – 1.6<br>Chloroform – 35<br>Benzene – 3.4<br>Trichloroethene – 5.1                                                                                                                                                                                                      |

| TABLE 5<br>MAXIMUM CONCENTRATIONS DETECTED |            |                                                                                                                                                                                                             |
|--------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            |            | Tetrachloroethene – 53<br>Xylenes – 37<br>Isopropylbenzene – 9.9<br>1,3,5-Trimethybenzene – 57<br>1,2,4-Trimethybenzene - 140<br>Napthalene - 14                                                            |
| Highest Concentration Soil Vapor           | TPHs       | VOCs                                                                                                                                                                                                        |
|                                            | Not Tested | Chloroform – 19000<br>Carbon Tetrachloride – 1800<br>Benzene – 66<br>Trichloroethene – 66<br>Toluene – 34<br>Tetrachloroethene – 2200<br>Ethylbenzene - 24<br>Xylenes – 300<br>1,2,4-Trimethybenzene – 2800 |

- With the exception of chloroform, maximum concentrations of volatile organic compounds have not resulted in corresponding soil gas levels exceeding the soil vapor intrusion into buildings pathway.
- Chloroform in soil was detected maximum concentration of 2.7 mg/kg. This concentration exceeds the cleanup criteria for soil vapor intrusion into buildings in an occupational setting. Chloroform in soil gas was detected at a maximum concentration of 19,000 ug/m3 which exceeds the cleanup criteria for soil vapor intrusion into buildings in an occupational setting.

## CONCLUSIONS

The following conclusions are based on the results of the Environmental Subsurface Investigation performed on Arcoa Building, located at 1006 SE Grand Avenue, Portland, Oregon 97214 (“Property”). This investigation was performed in accordance with Chugwater’s Proposal CW121215-1 authorized by Mr. Vince Huffstutter on January 31, 2013.

- Drinking water at the Property is provided from the City of Portland therefore the Tapwater Ingestion and Inhalation pathway is not complete.
- No underground storage tanks were detected as a result of the geophysical conducted as part of this investigation.
- Diesel-range hydrocarbons were detected in SB2 near the southeast corner of the original Arcoa Building. This likely represents fuel oil impact to soils. It is unlikely that the detected levels of fuel oil in soil would trigger regulatory action unless disturbed by construction/excavation activities.

- Stoddard Solvent and volatile organic compounds likely associated with the past use of dry cleaning chemicals on the Property were detected in SB1, SB2, SB2B, SB7 and SB8 in the drive to the south of the Arcoa Building. It is unlikely that the presence of Stoddard Solvent and volatile organic compounds in soil would trigger regulatory action unless disturbed by construction/excavation activities. Soil vapor levels of these compounds do not exceed the cleanup criteria for soil vapor intrusion into buildings in an occupational setting.
- Chloroform in soil was detected maximum concentration of 2.7 mg/kg. This concentration exceeds the cleanup criteria for soil vapor intrusion into buildings in an occupational setting. Chloroform in soil gas beneath the Arcoa Building was detected at a maximum concentration of 19,000 ug/m3 which exceeds the cleanup criteria for soil vapor intrusion into buildings in an occupational setting.
- Other than chloroform in the soil vapor sample collected from beneath the Arcoa Building (SV3), soil gas concentrations did not exceed the cleanup criteria for soil gas intrusion into buildings in an occupational setting.

Treating municipal and industrial water supplies consumes large amounts of chlorine. Because of these uses, excess chlorine often enters the natural environment where it mixes with organic compounds. These organic compounds then react with chlorine to form chloro-organic compounds, such as chloroform. Chloroform commonly found in City of Portland drinking water is a breakdown product of chlorine which is used by the City for drinking water disinfection. These results indicate the presence of total trihalomethanes (which includes chloroform) in drinking water provided by the City of Portland (2012 Water Quality Report) in concentrations ranging from 16 ug/L to 32 ug/L. The federal Maximum Concentration Level for trihalomethanes in drinking water is 80 ug/L.

It is possible that the presence of chloroform in soil, groundwater and soil gas is the result of leakage from water lines serving the Arcoa Building. According to Mr. Huffstutter, there have been some overly large water bills which he had attributed to sticking flush valves. Chugwater recommends that the condition of the water lines feeding the Arcoa Building be checked for leaks as this maybe the source of chloroform detected in samples.

Currently, the ODEQ has no reporting requirements for releases confirmed in the process of performing real estate due diligence investigations. Regulatory address of this release by the ODEQ would require entry into the Voluntary Cleanup Program (VCP). The VCP allows the ODEQ to provide oversight to property owners and others wishing to investigate and clean up hazardous substance sites in a voluntary, cooperative manner. The Voluntary Cleanup Program offers two options for cleaning up contaminated sites, the Independent Cleanup Pathway and the Voluntary Cleanup Pathway.

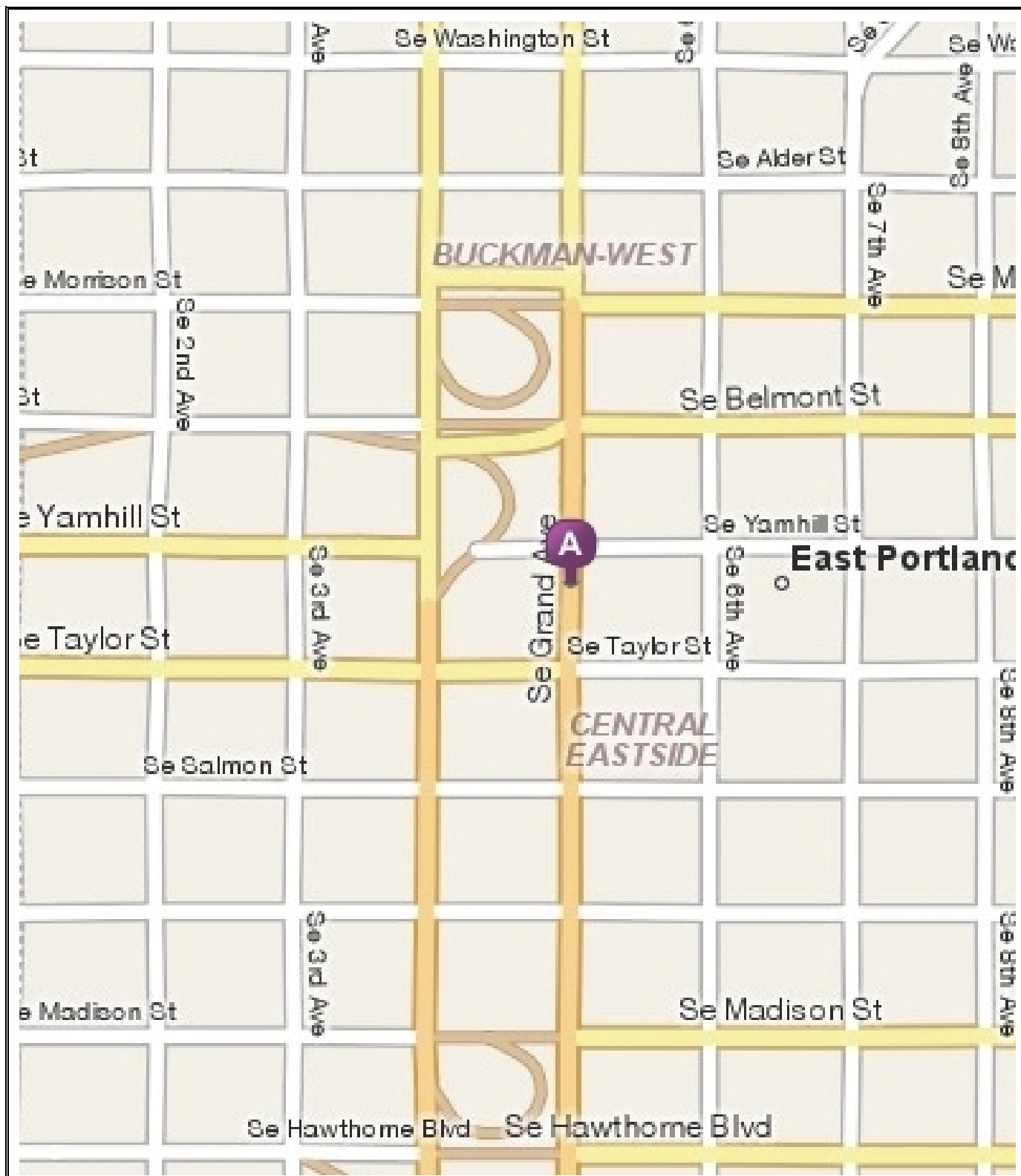
This Environmental Subsurface Investigation is intended for the exclusive use of Mr. Vince Huffstutter or entities specified by Vince Huffstutter. This report and findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor relied upon by any other party, in whole or in part without prior written consent of Chugwater.

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



Gil Cobb  
Registered Professional Geologist (Oregon #G1440)

## FIGURES



**FIGURE 1 - SITE LOCATION MAP**

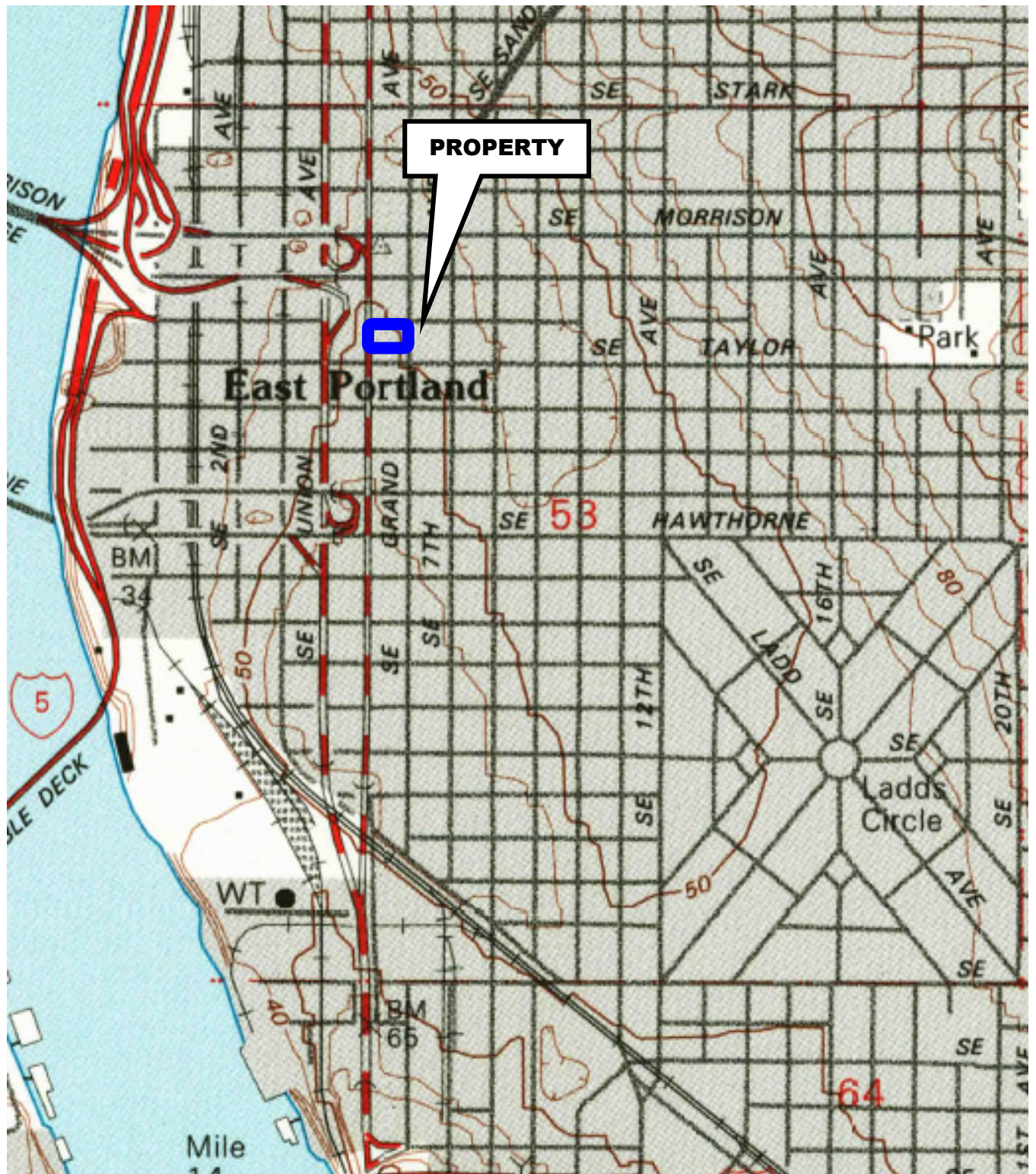
Map from Mapquest



**CHUGWATER, LLC**  
environmental due diligence

**Site Name:** Arcoa Building  
1006 SE Grand Avenue  
Portland, Oregon 97214

**Project Number:** CW130201.1



**FIGURE 2 - TOPOGRAPHIC MAP**

**DRAWING NOT TO SCALE**

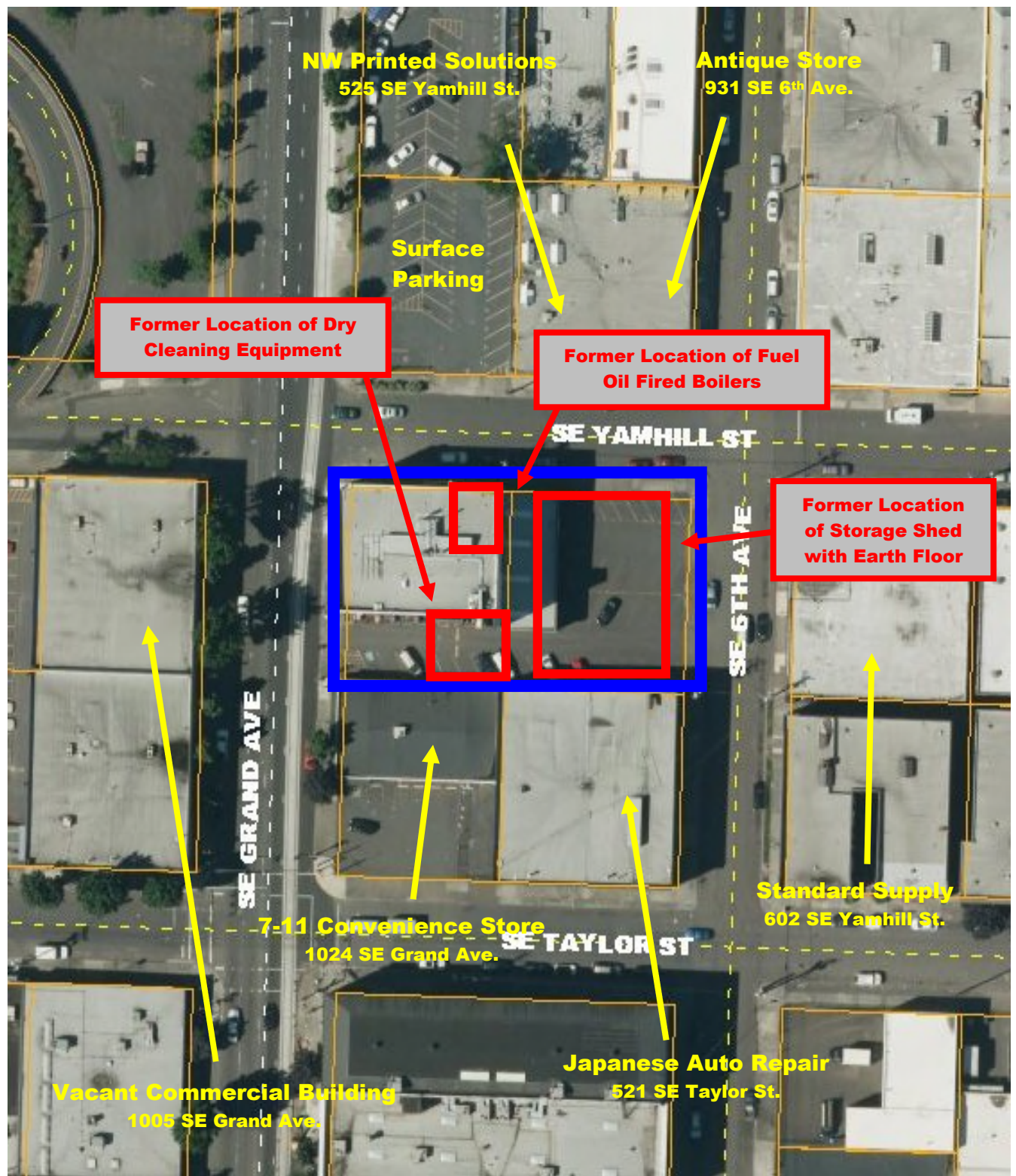
Source: USGS 7.5 Minute Topographic Map  
Portland, OR 1990

**N↑**

**CHUGWATER, LLC**  
environmental due diligence

**Site Name: Arcoa Building**  
**1006 SE Grand Avenue**  
**Portland, Oregon 97214**

**Project Number: CW130201.1**



**FIGURE 3 - SITE PLAN**

Map from PortlandMaps



**CHUGWATER, LLC**  
environmental due diligence

Site Name: Arcoa Building  
1006 SE Grand Avenue  
Portland, Oregon 97214

Project Number: CW130201.1

## LEGEND

Soil/GW Sample Location ⊕

Soil Sample Location ⊕

Soil Vapor Sample Location ●

ND – None Detected

NORL – Not Over Regulatory Limit

### **SB-8**

Impacted soils visible  
from 7.0-13.0 feet  
below ground surface

*Soil @ 14 feet*

*Stoddard (Gx) - 310*

### **SB-7**

Impacted soils visible -  
no samples collected

### **SB-5**

*Soil @ 8 feet*

*TPH - ND*

*Soil @ 14 feet*

*TPH - ND*

### **SB-6**

*Soil @ 8 feet*

*TPH - ND*

*Soil @ 15 feet*

*TPH - ND*

### **SB-4**

*Soil @ 8 feet*

*TPH - ND*

*Soil @ 14 feet*

*TPH - ND*

### **SB-3**

*Soil @ 8 feet*

*TPH - ND*

*Soil @ 15 feet*

*TPH - ND*

### **SB-1**

Impacted soils visible  
from 6.5-16.0 feet  
below ground surface

*Soil @ 8 feet*

*Dx - ND*

*Soil @ 10 feet*

*Dx - ND*

### **SB-2/2B**

Impacted soils visible  
from 6.5-16.0 feet  
below ground surface

*Soil @ 8 feet*

*Dx - 7100*

*Soil @ 17 feet*

*Dx - ND*

*Soil @ 28 feet*

*Stoddard (Gx) - 65*

*GW @ 28.4 feet*

*Stoddard (Gx) - 2,200*

**FIGURE 4 – BORING LOCATIONS**

Image From PortlandMaps 2011



**CHUGWATER, LLC**  
environmental due diligence

Site Name: Arcoa Building  
1006 SE Grand Avenue  
Portland, Oregon 97214

Project Number: CW130201.1

## APPENDICES

# **APPENDIX I**

## **SOIL BORING LOGS**

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

|                                                           |                      |                                    |                      |                 |
|-----------------------------------------------------------|----------------------|------------------------------------|----------------------|-----------------|
| <b>PROJECT:</b> Arcoa Building                            |                      | <b>DATE:</b> 2-15-13               |                      |                 |
| <b>CLIENT:</b> Vince Huffstutter                          |                      | <b>DRILLED BY:</b> ESN Northwest   |                      |                 |
| <b>LOCATION:</b> 1006 SE Grand Avenue<br>Portland, Oregon |                      | <b>BORING METHOD:</b> Push Probe   |                      |                 |
| <b>GEOLOGIST:</b> Gil Cobb                                |                      | <b>SAMPLING METHOD:</b> Continuous |                      |                 |
| <b>ELEV. GL:</b> NA                                       | <b>ELEV. TOC:</b> NA | <b>INITIAL WL:</b> NA              | <b>STATIC WL:</b> NA | <b>TD:</b> 8.0' |

[illegible]

[illegible]

|                                                           |                      |                                    |                        |                 |
|-----------------------------------------------------------|----------------------|------------------------------------|------------------------|-----------------|
| <b>PROJECT:</b> Arcoa Building                            |                      | <b>DATE:</b> 2-15-13               |                        |                 |
| <b>CLIENT:</b> Vince Huffstutter                          |                      | <b>DRILLED BY:</b> ESN Northwest   |                        |                 |
| <b>LOCATION:</b> 1006 SE Grand Avenue<br>Portland, Oregon |                      | <b>BORING METHOD:</b> Push Probe   |                        |                 |
| <b>GEOLOGIST:</b> Gil Cobb                                |                      | <b>SAMPLING METHOD:</b> Continuous |                        |                 |
| <b>ELEV. GL:</b> NA                                       | <b>ELEV. TOC:</b> NA | <b>INITIAL WL:</b> NA              | <b>STATIC WL:</b> 5.5' | <b>TD:</b> 1.0' |

[illegible]

**APPENDIX II**  
**LABORATORY ANALYTICAL REPORTS**

**December 15, 2012**  
**February 15, 2013**

# CHAIN-OF-CUSTODY RECORD

CLIENT: CHUMWATTA LLC  
 ADDRESS: 10445 SW Canyon Rd, Ste 101 Beaverton, OR  
 PHONE: 503.916.9254 FAX: 503.352.0920  
 CLIENT PROJECT #: 02121203.1 PROJECT MANAGER: G. Lopez

DATE: 12/05/12 PAGE 1 OF 1  
 PROJECT NAME: ARCOA BRON  
 LOCATION: 1000 SE Grand, POX  
 COLLECTOR: G. Lopez DATE OF COLLECTION: 12/5

| Sample Number | Depth | Time  | Sample Type | Container Type | ANALYSES |                    |      |           |              |            |                    |               |              |           | NOTES    |  | Total Number of Containers | Laboratory Note Number |
|---------------|-------|-------|-------------|----------------|----------|--------------------|------|-----------|--------------|------------|--------------------|---------------|--------------|-----------|----------|--|----------------------------|------------------------|
|               |       |       |             |                | THPACID  | THP - DIESEL & OIL | BTEX | VOC 220CL | semivol 2270 | PCB's 2270 | CL Pesticides 2081 | MTCA 5 Metals | Asbestos-PLM | DRO Suite | WQ Suite |  |                            |                        |
| 1. 5B2-51     | 8     | 8:47  | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 2. 5B2-52     | 17    | 9:31  | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 3. 5B2-51     | 8     | 10:02 | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 4. 5B2-52     | 17    | 10:32 | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 5. 5B3-51     | 8     | 10:43 | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 6. 5B3-52     | 15'   | 11:14 | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 7. 5B4-51     | 8'    | 11:31 | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 8. 5B4-52     | 14'   | 11:55 | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 9. 5B5-51     | 8'    | 12:25 | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 10. 5B5-52    | 14    | 12:40 | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 11. 5B6-51    | 6'    | 1:02  | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 12. 5B6-52    | 15'   | 1:12  | S           | 403            | X        |                    |      | X         |              |            |                    | X             |              |           |          |  | I                          | I                      |
| 13.           |       |       |             |                |          |                    |      |           |              |            |                    |               |              |           |          |  |                            |                        |
| 14.           |       |       |             |                |          |                    |      |           |              |            |                    |               |              |           |          |  |                            |                        |
| 15.           |       |       |             |                |          |                    |      |           |              |            |                    |               |              |           |          |  |                            |                        |
| 16.           |       |       |             |                |          |                    |      |           |              |            |                    |               |              |           |          |  |                            |                        |
| 17.           |       |       |             |                |          |                    |      |           |              |            |                    |               |              |           |          |  |                            |                        |
| 18.           |       |       |             |                |          |                    |      |           |              |            |                    |               |              |           |          |  |                            |                        |

|                                                                                                                     |  |               |                         |               |
|---------------------------------------------------------------------------------------------------------------------|--|---------------|-------------------------|---------------|
| RELINQUISHED BY (Signature)                                                                                         |  | DATE/TIME     | RECEIVED BY (Signature) | DATE/TIME     |
| <i>[Signature]</i>                                                                                                  |  | 12/5/12 13:30 | <i>[Signature]</i>      | 12/5/12 13:30 |
| RELINQUISHED BY (Signature)                                                                                         |  | DATE/TIME     | RECEIVED BY (Signature) | DATE/TIME     |
| <i>[Signature]</i>                                                                                                  |  |               |                         |               |
| SAMPLE DISPOSAL INSTRUCTIONS                                                                                        |  |               |                         |               |
| <input type="checkbox"/> ESN DISPOSAL @ \$2.00 each <input type="checkbox"/> Return <input type="checkbox"/> Pickup |  |               |                         |               |
| LABORATORY NOTES:                                                                                                   |  |               |                         |               |
| TOTAL NUMBER OF CONTAINERS                                                                                          |  |               |                         |               |
| CHAIN OF CUSTODY SEALS Y/N/A                                                                                        |  |               |                         |               |
| SEALS INTACT? Y/N/A                                                                                                 |  |               |                         |               |
| RECEIVED GOOD COND./COLD                                                                                            |  |               |                         |               |
| NOTES:                                                                                                              |  |               |                         |               |
| Turn Around Time: 24 HR 48 HR 5 DAY                                                                                 |  |               |                         |               |

**ESN NORTHWEST CHEMISTRY LABORATORY**

Chugwater, LLC  
ARCOA BLDG PROJECT  
Client Project #CW121203.1  
Portland, Oregon

ESN Northwest  
1210 Eastside Street SE Suite 200  
Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnnw.com

**Analysis of Diesel Range Organics & Lube Oil Range Organics in Soil**  
**by Method NWTPH-Dx/Dx Extended**

| Sample Number    | Date Prepared | Date Analyzed | Surrogate Recovery (%) | Diesel Range Organics (mg/kg) | Lube Oil Range Organics (mg/kg) |
|------------------|---------------|---------------|------------------------|-------------------------------|---------------------------------|
| Method Blank     | 12/7/2012     | 12/7/2012     | 108                    | nd                            | nd                              |
| LCS              | 12/7/2012     | 12/7/2012     | 115                    | 126%                          | ---                             |
| SB2-S1           | 12/7/2012     | 12/7/2012     | int                    | <b>7100</b>                   | nd                              |
| SB2-S2           | 12/7/2012     | 12/7/2012     | 113                    | nd                            | nd                              |
| SB1-S1           | 12/7/2012     | 12/7/2012     | 92                     | nd                            | nd                              |
| SB1-S2           | 12/7/2012     | 12/7/2012     | 105                    | nd                            | nd                              |
| SB3-S1           | 12/7/2012     | 12/7/2012     | 118                    | nd                            | nd                              |
| SB3-S2           | 12/7/2012     | 12/7/2012     | 111                    | nd                            | nd                              |
| SB4-S1           | 12/7/2012     | 12/7/2012     | 115                    | nd                            | nd                              |
| SB4-S2           | 12/7/2012     | 12/7/2012     | 111                    | nd                            | nd                              |
| SB5-S1           | 12/7/2012     | 12/8/2012     | 105                    | nd                            | nd                              |
| SB5-S2           | 12/7/2012     | 12/8/2012     | 110                    | nd                            | nd                              |
| SB5-S2 Duplicate | 12/7/2012     | 12/8/2012     | 106                    | nd                            | nd                              |
| SB6-S1           | 12/8/2012     | 12/8/2012     | 80                     | nd                            | nd                              |
| SB6-S2           | 12/8/2012     | 12/8/2012     | 104                    | nd                            | nd                              |
| SB6-S2 Duplicate | 12/8/2012     | 12/8/2012     | 104                    | nd                            | nd                              |
| Reporting Limits |               |               |                        | 50                            | 100                             |

"nd" Indicates not detected at the listed detection limits.

"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE : 50% TO 150%

# ESN NORTHWEST CHEMISTRY LABORATORY

Chugwater, LLC  
ARCOA BLDG PROJECT  
Client Project #CW121203.1  
Portland, Oregon

ESN Northwest  
1210 Eastside Street SE Suite 200  
Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnnw.com

## Analysis of Volatile Organic Compounds in Soil by Method 8260/5035

### Analytical Results

|                             | Reporting | MTH BLK  | LCS      | LCSD     | SB2-S1   | SB2-S2   | SB1-S1   | SB1-S2   |
|-----------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|
| Date extracted              | Limits    | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 |
| Date analyzed               | (mg/Kg)   | 12/11/12 | 12/12/12 | 12/12/12 | 12/11/12 | 12/11/12 | 12/11/12 | 12/12/12 |
| Dichlorodifluoromethane     | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Chloromethane               | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Vinyl chloride              | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Bromomethane                | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Chloroethane                | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Trichlorofluoromethane      | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Acetone                     | 0.25      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,1-Dichloroethene          | 0.05      | nd       | 98%      | 116%     | 0.05     | nd       | nd       | nd       |
| Methylene chloride          | 0.02      | nd       |          |          | 2.6      | nd       | nd       | nd       |
| Methyl-t-butyl ether (MTBE) | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| trans-1,2-Dichloroethene    | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,1-Dichloroethane          | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 2-Butanone (MEK)            | 0.25      | nd       |          |          | nd       | nd       | nd       | nd       |
| cis-1,2-Dichloroethene      | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 2,2-Dichloropropane         | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Chloroform                  | 0.05      | nd       | 91%      | 92%      | 2.7      | nd       | nd       | nd       |
| Bromochloromethane          | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,1,1-Trichloroethane       | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,2-Dichloroethane (EDC)    | 0.05      | nd       |          |          | 2.5      | nd       | nd       | nd       |
| 1,1-Dichloropropene         | 0.05      | nd       |          |          | 0.15     | nd       | nd       | nd       |
| Carbon tetrachloride        | 0.05      | nd       | 105%     | 113%     | nd       | nd       | nd       | nd       |
| Benzene                     | 0.02      | nd       | 94%      | 99%      | 93       | nd       | 0.13     | nd       |
| Trichloroethene (TCE)       | 0.02      | nd       | 96%      | 101%     | 1.1      | nd       | nd       | nd       |
| 1,2-Dichloropropane         | 0.05      | nd       |          |          | 1,000    | nd       | nd       | nd       |
| Dibromomethane              | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Bromodichloromethane        | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 4-Methyl-2-pentanone (MIBK) | 0.25      | nd       |          |          | nd       | nd       | nd       | nd       |
| cis-1,3-Dichloropropene     | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Toluene                     | 0.05      | nd       | 89%      | 97%      | 40       | nd       | nd       | nd       |
| trans-1,3-Dichloropropene   | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,1,2-Trichloroethane       | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 2-Hexanone                  | 0.25      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,3-Dichloropropane         | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Dibromochloromethane        | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Tetrachloroethene (PCE)     | 0.02      | nd       | 94%      | 100%     | 8.6      | nd       | nd       | nd       |
| 1,2-Dibromoethane (EDB)     | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Chlorobenzene               | 0.05      | nd       | 83%      | 87%      | nd       | nd       | nd       | nd       |
| 1,1,1,2-Tetrachloroethane   | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Ethylbenzene                | 0.05      | nd       | 84%      | 84%      | 18       | nd       | 0.76     | nd       |
| Xylenes                     | 0.15      | nd       | 83%      | 85%      | 170      | nd       | 2.1      | nd       |
| Styrene                     | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Bromoform                   | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,1,2,2-Tetrachloroethane   | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Isopropylbenzene            | 0.05      | nd       |          |          | 27       | nd       | 1.5      | nd       |
| 1,2,3-Trichloropropane      | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |

# ESN NORTHWEST CHEMISTRY LABORATORY

Chugwater, LLC  
ARCOA BLDG PROJECT  
Client Project #CW121203.1  
Portland, Oregon

ESN Northwest  
1210 Eastside Street SE Suite 200  
Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnnw.com

## Analysis of Volatile Organic Compounds in Soil by Method 8260/5035

### Analytical Results

|                             | Reporting | MTH BLK  | LCS      | LCSD     | SB2-S1   | SB2-S2   | SB1-S1   | SB1-S2   |
|-----------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|
| Date extracted              | Limits    | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 |
| Date analyzed               | (mg/Kg)   | 12/11/12 | 12/12/12 | 12/12/12 | 12/11/12 | 12/11/12 | 12/11/12 | 12/12/12 |
| Bromobenzene                | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| n-Propylbenzene             | 0.05      | nd       |          |          | 70       | nd       | 4.4      | nd       |
| 2-Chlorotoluene             | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 4-Chlorotoluene             | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,3,5-Trimethylbenzene      | 0.05      | nd       |          |          | 150      | nd       | 8.4      | nd       |
| tert-Butylbenzene           | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,2,4-Trimethylbenzene      | 0.05      | nd       |          |          | 310      | 0.06     | 16       | nd       |
| sec-Butylbenzene            | 0.05      | nd       |          |          | 56       | nd       | 4.0      | nd       |
| 1,3-Dichlorobenzene         | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,4-Dichlorobenzene         | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Isopropyltoluene            | 0.05      | nd       |          |          | 84       | nd       | 5.5      | nd       |
| 1,2-Dichlorobenzene         | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| n-Butylbenzene              | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,2-Dibromo-3-Chloropropane | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,2,4-Trichlorobenzene      | 0.05      | nd       |          |          | nd       | nd       | nd       | nd       |
| Naphthalene                 | 0.10      | nd       |          |          | 12       | nd       | 0.14     | nd       |
| Hexachloro-1,3-butadiene    | 0.10      | nd       |          |          | nd       | nd       | nd       | nd       |
| 1,2,3-Trichlorobenzene      | 0.10      | nd       |          |          | nd       | nd       | nd       | nd       |

### Surrogate recoveries

|                      |      |      |      |      |      |      |      |
|----------------------|------|------|------|------|------|------|------|
| Dibromofluoromethane | 101% | 111% | 111% | 106% | 105% | 110% | 111% |
| Toluene-d8           | 110% | 99%  | 100% | 107% | 113% | 122% | 106% |
| 4-Bromofluorobenzene | 123% | 109% | 106% | 118% | 116% | 122% | 118% |

### Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits

Acceptable Recovery limits: 65% TO 135%

Acceptable RPD limit: 35%

# ESN NORTHWEST CHEMISTRY LABORATORY

ESN Pacific  
PROJECT  
Client Project #D1212060626  
Hawaii

ESN Northwest  
1210 Eastside Street SE Suite 200  
Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnnw.com

## Analysis of Volatile Organic Compounds in Soil by Method 8260/5035

### Analytical Results

|                             | Reporting | SB3-S1   | SB3-S2   | SB4-S1   | SB4-S2   | SB5-S1   | SB5-S2   | SB6-S1   | SB6-S2   |
|-----------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Date extracted              | Limits    | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 |
| Date analyzed               | (mg/Kg)   | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 |
| Dichlorodifluoromethane     | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Chloromethane               | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Vinyl chloride              | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Bromomethane                | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Chloroethane                | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Trichlorofluoromethane      | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Acetone                     | 0.25      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,1-Dichloroethene          | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Methylene chloride          | 0.02      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Methyl-t-butyl ether (MTBE) | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| trans-1,2-Dichloroethene    | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,1-Dichloroethane          | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 2-Butanone (MEK)            | 0.25      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| cis-1,2-Dichloroethene      | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 2,2-Dichloropropane         | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Chloroform                  | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Bromochloromethane          | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,1,1-Trichloroethane       | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,2-Dichloroethane (EDC)    | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,1-Dichloropropene         | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Carbon tetrachloride        | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Benzene                     | 0.02      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Trichloroethene (TCE)       | 0.02      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,2-Dichloropropane         | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Dibromomethane              | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Bromodichloromethane        | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 4-Methyl-2-pentanone (MIBK) | 0.25      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| cis-1,3-Dichloropropene     | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Toluene                     | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| trans-1,3-Dichloropropene   | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,1,2-Trichloroethane       | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 2-Hexanone                  | 0.25      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,3-Dichloropropane         | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Dibromochloromethane        | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Tetrachloroethene (PCE)     | 0.02      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,2-Dibromoethane (EDB)     | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Chlorobenzene               | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,1,1,2-Tetrachloroethane   | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Ethylbenzene                | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Xylenes                     | 0.15      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Styrene                     | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Bromoform                   | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,1,2,2-Tetrachloroethane   | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Isopropylbenzene            | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,2,3-Trichloropropane      | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |

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ESN Pacific  
PROJECT  
Client Project #D1212060626  
Hawaii

ESN Northwest  
1210 Eastside Street SE Suite 200  
Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnnw.com

## Analysis of Volatile Organic Compounds in Soil by Method 8260/5035

### Analytical Results

|                             | Reporting | SB3-S1   | SB3-S2   | SB4-S1   | SB4-S2   | SB5-S1   | SB5-S2   | SB6-S1   | SB6-S2   |
|-----------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Date extracted              | Limits    | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 | 12/07/12 |
| Date analyzed               | (mg/Kg)   | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 | 12/12/12 |
| Bromobenzene                | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| n-Propylbenzene             | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 2-Chlorotoluene             | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 4-Chlorotoluene             | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,3,5-Trimethylbenzene      | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| tert-Butylbenzene           | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,2,4-Trimethylbenzene      | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| sec-Butylbenzene            | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,3-Dichlorobenzene         | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,4-Dichlorobenzene         | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Isopropyltoluene            | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,2-Dichlorobenzene         | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| n-Butylbenzene              | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,2-Dibromo-3-Chloropropane | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,2,4-Trichlorobenzene      | 0.05      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Naphthalene                 | 0.10      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| Hexachloro-1,3-butadiene    | 0.10      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |
| 1,2,3-Trichlorobenzene      | 0.10      | nd       | nd       | nd       | nd       | nd       | nd       | nd       | nd       |

### Surrogate recoveries

|                      |      |      |      |      |      |      |      |      |
|----------------------|------|------|------|------|------|------|------|------|
| Dibromofluoromethane | 109% | 109% | 108% | 109% | 107% | 111% | 107% | 113% |
| Toluene-d8           | 107% | 109% | 108% | 106% | 112% | 112% | 109% | 110% |
| 4-Bromofluorobenzene | 113% | 119% | 122% | 115% | 117% | 119% | 116% | 114% |

### Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits

Acceptable Recovery limits: 65% TO 135%

Acceptable RPD limit: 35%

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Chugwater, LLC  
ARCOA BLDG PROJECT  
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Portland, Oregon

ESN Northwest  
1210 Eastside Street SE Suite 200  
Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnnw.com

## Total Metals in Soil by EPA-6020 Series

| Sample Number    | Date Analyzed | Lead (Pb)<br>(mg/kg) | Cadmium (Cd)<br>(mg/kg) | Chromium (Cr)<br>(mg/kg) | Arsenic (As)<br>(mg/kg) | Silver (Ag)<br>(mg/kg) | Barium (Ba)<br>(mg/kg) | Selenium (Se)<br>(mg/kg) | Mercury (Hg)<br>(mg/kg) |
|------------------|---------------|----------------------|-------------------------|--------------------------|-------------------------|------------------------|------------------------|--------------------------|-------------------------|
| Method Blank     | 12/10/2012    | nd                   | nd                      | nd                       | nd                      | nd                     | nd                     | nd                       | nd                      |
| SB2-S1           | 12/10/2012    | 11                   | nd                      | 14                       | nd                      | nd                     | 120                    | nd                       | nd                      |
| SB2-S2           | 12/10/2012    | nd                   | nd                      | 5.3                      | nd                      | nd                     | 110                    | nd                       | nd                      |
| SB1-S1           | 12/10/2012    | 9.4                  | nd                      | 13                       | nd                      | nd                     | 152                    | nd                       | nd                      |
| SB1-2            | 12/10/2012    | nd                   | nd                      | 6.4                      | nd                      | nd                     | 75                     | nd                       | nd                      |
| SB3-S1           | 12/10/2012    | 8.8                  | nd                      | 8.9                      | nd                      | nd                     | 78                     | nd                       | nd                      |
| SB3-S1 Duplicate | 12/10/2012    | 10                   | nd                      | 9.7                      | nd                      | nd                     | 110                    | nd                       | nd                      |
| SB3-S2           | 12/10/2012    | 5.3                  | nd                      | 5.8                      | nd                      | nd                     | 120                    | nd                       | nd                      |
| SB4-S1           | 12/10/2012    | 12                   | nd                      | 8.5                      | nd                      | nd                     | 120                    | nd                       | nd                      |
| SB4-S2           | 12/10/2012    | 8.2                  | nd                      | 9.6                      | nd                      | nd                     | 110                    | nd                       | nd                      |
| SB5-S1           | 12/10/2012    | 11                   | nd                      | 7.8                      | nd                      | nd                     | 110                    | nd                       | nd                      |
| SB5-S2           | 12/10/2012    | 6.9                  | nd                      | 6.8                      | nd                      | nd                     | 94                     | nd                       | nd                      |
| SB6-S1           | 12/10/2012    | 7.6                  | nd                      | 8.1                      | nd                      | nd                     | 98                     | nd                       | nd                      |
| SB6-S1 Duplicate | 12/10/2012    | 8.5                  | nd                      | 9.5                      | nd                      | nd                     | 101                    | nd                       | nd                      |
| SB6-S2           | 12/10/2012    | 5.1                  | nd                      | nd                       | nd                      | nd                     | 92                     | nd                       | nd                      |
| Reporting Limits |               | 5.0                  | 1.0                     | 5.0                      | 5.0                     | 20                     | 50                     | 20                       | 0.5                     |

"nd" Indicates not detected at listed detection limits.

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Client Project #CW121203.1  
Portland, Oregon

ESN Northwest  
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Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnnw.com

## QA/QC Data - Total Metals EPA-6020

| Sample Number: SB3-S1 |                      |                        |                    |                        |                        |                    |     |
|-----------------------|----------------------|------------------------|--------------------|------------------------|------------------------|--------------------|-----|
|                       | Matrix Spike         |                        |                    | Matrix Spike Duplicate |                        |                    | RPD |
|                       | Spiked Conc. (mg/kg) | Measured Conc. (mg/kg) | Spike Recovery (%) | Spiked Conc. (mg/kg)   | Measured Conc. (mg/kg) | Spike Recovery (%) |     |
| Lead                  | 71.4                 | 79.1                   | 111                | 73.5                   | 85.0                   | 116                | 4.3 |
| Cadmium               | 71.4                 | 78.7                   | 110                | 73.5                   | 83.2                   | 113                | 2.7 |
| Chromium              | 71.4                 | 76.0                   | 106                | 73.5                   | 80.5                   | 109                | 2.9 |
| Arsenic               | 71.4                 | 79.7                   | 112                | 73.5                   | 84.1                   | 114                | 2.5 |
| Silver                | 71.4                 | 71.2                   | 99.7               | 73.5                   | 76.3                   | 104                | 4.0 |
| Barium                | 71.4                 | 84.7                   | 119                | 73.5                   | 93.7                   | 127M               | 7.2 |
| Selenium              | 71.4                 | 79.3                   | 111                | 73.5                   | 83.1                   | 113                | 1.8 |
| Mercury               | 7.14                 | 8.06                   | 113                | 7.35                   | 8.59                   | 117                | 3.5 |

| Laboratory Control Sample |                      |                        |                    |
|---------------------------|----------------------|------------------------|--------------------|
|                           | Spiked Conc. (mg/kg) | Measured Conc. (mg/kg) | Spike Recovery (%) |
| Lead                      | 100                  | 104                    | 104                |
| Cadmium                   | 100                  | 106                    | 106                |
| Chromium                  | 100                  | 94.8                   | 94.8               |
| Arsenic                   | 100                  | 107                    | 107                |
| Silver                    | 100                  | 98.5                   | 98.5               |
| Barium                    | 100                  | 102                    | 102                |
| Selenium                  | 100                  | 110                    | 110                |
| Mercury                   | 10                   | 10.7                   | 107                |

ACCEPTABLE RECOVERY LIMITS FOR MATRIX SPIKES: 80%-120%

ACCEPTABLE RPD IS 35%

M - Matrix Spike recovery failed due to matrix interference.

# CHAIN-OF-CUSTODY RECORD

CLIENT: CHUQUATELL  
 ADDRESS: 10445 SW CAMYON RD, STE 101 BEAVERTON 97005  
 PHONE: 503.916.9254 FAX: 503.352.0920  
 CLIENT PROJECT #: \_\_\_\_\_ PROJECT MANAGER: G. BAO

DATE: 2/15/2013 PAGE \_\_\_\_\_ OF \_\_\_\_\_  
 PROJECT NAME: ARCOA BURN  
 LOCATION: 1006 SE GRAND, PORTLAND  
 COLLECTOR: G. COBB DATE OF COLLECTION: 2/15

| Sample Number | Depth | Time  | Sample Type | Container Type | ANALYSES |        |                  |      |     |     |         |      |      |               |              |    |              |             | NOTES | Total Number of Containers | Laboratory Note Number |
|---------------|-------|-------|-------------|----------------|----------|--------|------------------|------|-----|-----|---------|------|------|---------------|--------------|----|--------------|-------------|-------|----------------------------|------------------------|
|               |       |       |             |                | TRI-ACID | TRI-CL | TRI-DIESEL & OIL | BTEX | VOC | VOC | Semivol | PAHs | PCBs | OCRA 8 Metals | PCB 5 Metals | Pb | Asbestos-PLM | DRO Sulfide |       |                            |                        |
| 1. SB2B-S1    | 28'   | 9:51  | S           | 403            | X        | X      | X                | X    | X   | X   | X       | X    | X    | X             | X            | X  | X            | X           | 1     |                            |                        |
| 2. SB2-W1     | 28'   | 11:51 | W           | VDA-DN         | X        | X      | X                | X    | X   | X   | X       | X    | X    | X             | X            | X  | X            | X           | 3     |                            |                        |
| 3. SB8-S1     | 14'   | 3:04  | S           | 403            | X        | X      | X                | X    | X   | X   | X       | X    | X    | X             | X            | X  | X            | X           | 1     |                            |                        |
| 4. SB9-S1     | 2'    | 3:29  | S           | 403            | X        | X      | X                | X    | X   | X   | X       | X    | X    | X             | X            | X  | X            | X           |       |                            |                        |
| 5.            |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 6.            |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 7.            |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 8.            |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 9.            |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 10.           |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 11.           |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 12.           |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 13.           |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 14.           |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 15.           |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 16.           |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 17.           |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |
| 18.           |       |       |             |                |          |        |                  |      |     |     |         |      |      |               |              |    |              |             |       |                            |                        |

|                             |              |                         |               |
|-----------------------------|--------------|-------------------------|---------------|
| RELINQUISHED BY (Signature) | DATE/TIME    | RECEIVED BY (Signature) | DATE/TIME     |
| <i>G. Cobb</i>              | 2/15/13 3:34 | <i>M. Tech</i>          | 2/15/13 15:28 |
| RELINQUISHED BY (Signature) | DATE/TIME    | RECEIVED BY (Signature) | DATE/TIME     |
|                             |              |                         |               |

**LABORATORY NOTES:**

|                              |  |
|------------------------------|--|
| TOTAL NUMBER OF CONTAINERS   |  |
| CHAIN OF CUSTODY SEALS Y/N/A |  |
| SEALS INTACT? Y/N/A          |  |
| RECEIVED GOOD COND./COLD     |  |
| NOTES:                       |  |

Turn Around Time: 24 HR 48 HR 5 DAY

**SAMPLE DISPOSAL INSTRUCTIONS**

☐ ESN DISPOSAL @ \$2.00 each ☐ Return ☐ Pickup

**ESN NORTHWEST CHEMISTRY LABORATORY**

Chugwater, LLC  
ARCOA BLDG PROJECT  
Portland, Oregon

ESN Northwest  
1210 Eastside Street SE Suite 200  
Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnnw.com

**Analysis of Diesel Range Organics & Lube Oil Range Organics in Soil  
by Method NWTPH-Dx Extended**

| Sample Number     | Date Prepared | Date Analyzed | Surrogate Recovery (%) | Diesel Range Organics (mg/kg) | Lube Oil Range Organics (mg/kg) |
|-------------------|---------------|---------------|------------------------|-------------------------------|---------------------------------|
| Method Blank      | 2/20/2013     | 2/20/2013     | 98                     | nd                            | nd                              |
| LCS               | 2/20/2013     | 2/20/2013     | 130                    | 116%                          | ---                             |
| SB2B-S1           | 2/20/2013     | 2/20/2013     | 92                     | nd                            | nd                              |
| SB2B-S1 Duplicate | 2/20/2013     | 2/20/2013     | 97                     | nd                            | nd                              |
| SB8-S1            | 2/20/2013     | 2/20/2013     | 66                     | nd                            | nd                              |
| Reporting Limits  |               |               |                        | 50                            | 100                             |

"nd" Indicates not detected at the listed detection limits.

"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE : 50% TO 150%

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**Analysis of Diesel Range Organics & Lube Oil Range Organics in Water  
by Method NWTPH-Dx Extended**

| Sample Number    | Date Prepared | Date Analyzed | Surrogate Recovery (%) | Diesel Range Organics (ug/L) | Lube Oil Range Organics (ug/L) |
|------------------|---------------|---------------|------------------------|------------------------------|--------------------------------|
| Method Blank     | 2/18/2013     | 2/18/2013     | 75                     | nd                           | nd                             |
| LCS              | 2/18/2013     | 2/18/2013     | 118                    | 95%                          | ---                            |
| SB2-W1           | 2/18/2013     | 2/18/2013     | 72                     | nd                           | nd                             |
| Reporting Limits |               |               |                        | 250                          | 500                            |

"nd" Indicates not detected at the listed detection limits.

"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE : 50% TO 150%

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Portland, Oregon

ESN Northwest  
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### Analysis of Gasoline Range Organics in Soil by Method NWTPH-Gx

| Sample<br>Number | Date<br>Prepared | Date<br>Analyzed | Surrogate<br>Recovery (%) | Gasoline Range Organics<br>(mg/kg) |
|------------------|------------------|------------------|---------------------------|------------------------------------|
| Method Blank     | 2/18/2013        | 2/20/2013        | 105                       | nd                                 |
| LCS              | 2/18/2013        | 2/20/2013        | 111                       | 103%                               |
| SB8-S1           | 2/18/2013        | 2/20/2013        | 113                       | nd                                 |
| Reporting Limits |                  |                  |                           | 10                                 |

"nd" Indicates not detected at the listed detection limits.

"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE: 65% TO 135%

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Olympia, WA 98501  
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## Analysis of Chlorinated Volatile Organic Compounds in Soil by EPA Method 8260C/5035A

### Analytical Results

| Matrix                      | Reporting | MTH BLK  | LCS      | LCSD     | SB2B-S1  | SB8-S1   | SB9-S1   |
|-----------------------------|-----------|----------|----------|----------|----------|----------|----------|
|                             | Soil      | Soil     | Soil     | Soil     | Soil     | Soil     | Soil     |
| Date extracted              | Limits    | 02/18/13 | 02/18/13 | 02/18/13 | 02/18/13 | 02/18/13 | 02/18/13 |
| Date analyzed               | (mg/kg)   | 02/20/13 | 02/20/13 | 02/20/13 | 02/20/13 | 02/20/13 | 02/20/13 |
| Dichlorodifluoromethane     | 0.05      | nd       |          |          | nd       | nd       | nd       |
| Chloromethane               | 0.05      | nd       |          |          | nd       | nd       | nd       |
| Vinyl chloride              | 0.05      | nd       | 159%     | 143%     | nd       | nd       | nd       |
| Chloroethane                | 0.05      | nd       |          |          | nd       | nd       | nd       |
| Trichlorofluoromethane      | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,1-Dichloroethene          | 0.05      | nd       | 139%     | 139%     | nd       | nd       | nd       |
| Methylene chloride          | 0.02      | nd       |          |          | nd       | nd       | nd       |
| trans-1,2-Dichloroethene    | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,1-Dichloroethane          | 0.05      | nd       |          |          | nd       | nd       | nd       |
| cis-1,2-Dichloroethene      | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 2,2-Dichloropropane         | 0.05      | nd       |          |          | nd       | nd       | nd       |
| Chloroform                  | 0.05      | nd       | 127%     | 122%     | nd       | nd       | nd       |
| Bromochloromethane          | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,1,1-Trichloroethane       | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,2-Dichloroethane (EDC)    | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,1-Dichloropropene         | 0.05      | nd       |          |          | nd       | nd       | nd       |
| Carbon tetrachloride        | 0.05      | nd       |          |          | nd       | nd       | nd       |
| Trichloroethene (TCE)       | 0.02      | nd       | 132%     | 124%     | nd       | nd       | nd       |
| 1,2-Dichloropropane         | 0.05      | nd       | 115%     | 109%     | nd       | nd       | nd       |
| Bromodichloromethane        | 0.05      | nd       |          |          | nd       | nd       | nd       |
| cis-1,3-Dichloropropene     | 0.05      | nd       |          |          | nd       | nd       | nd       |
| trans-1,3-Dichloropropene   | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,1,2-Trichloroethane       | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,3-Dichloropropane         | 0.05      | nd       |          |          | nd       | nd       | nd       |
| Dibromochloromethane        | 0.05      | nd       |          |          | nd       | nd       | nd       |
| Tetrachloroethene (PCE)     | 0.02      | nd       | 110%     | 112%     | 0.03     | nd       | nd       |
| Chlorobenzene               | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,1,1,2-Tetrachloroethane   | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,1,2,2-Tetrachloroethane   | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,2,3-Trichloropropane      | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 2-Chlorotoluene             | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 4-Chlorotoluene             | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,3-Dichlorobenzene         | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,4-Dichlorobenzene         | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,2-Dichlorobenzene         | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,2-Dibromo-3-Chloropropane | 0.05      | nd       |          |          | nd       | nd       | nd       |
| 1,2,4-Trichlorobenzene      | 0.10      | nd       |          |          | nd       | nd       | nd       |
| Hexachloro-1,3-butadiene    | 0.10      | nd       |          |          | nd       | nd       | nd       |
| 1,2,3-Trichlorobenzene      | 0.10      | nd       |          |          | nd       | nd       | nd       |

### Surrogate recoveries

|                      |      |      |      |      |      |      |
|----------------------|------|------|------|------|------|------|
| Dibromofluoromethane | 98%  | 107% | 107% | 102% | 107% | 110% |
| Toluene-d8           | 106% | 96%  | 98%  | 103% | 107% | 107% |
| 4-Bromofluorobenzene | 115% | 100% | 99%  | 114% | 112% | 112% |

### Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits  
Acceptable Recovery limits: 65% TO 135%  
Acceptable RPD limit: 35%

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ARCOA BLDG PROJECT  
Portland, Oregon

ESN Northwest  
1210 Eastside Street SE Suite 200  
Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnnw.com

## Analysis of Chlorinated Volatile Organic Compounds in Water by Method 8260

### Analytical Results

| Date analyzed               | RL<br>(ug/L) | MB<br>02/20/13 | LCS<br>02/20/13 | LCSD<br>02/20/13 | SB2-W1<br>02/20/13 | TRIP BLANK<br>02/20/13 |
|-----------------------------|--------------|----------------|-----------------|------------------|--------------------|------------------------|
| Dichlorodifluoromethane     | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Chloromethane               | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Vinyl chloride              | 0.2          | nd             | 80%             | 75%              | nd                 | nd                     |
| Chloroethane                | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Trichlorofluoromethane      | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,1-Dichloroethene          | 1.0          | nd             | 115%            | 101%             | nd                 | nd                     |
| Methylene chloride          | 1.0          | nd             |                 |                  | nd                 | nd                     |
| trans-1,2-Dichloroethene    | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,1-Dichloroethane          | 1.0          | nd             |                 |                  | nd                 | nd                     |
| cis-1,2-Dichloroethene      | 1.0          | nd             |                 |                  | 1.6                | nd                     |
| 2,2-Dichloropropane         | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Chloroform                  | 1.0          | nd             | 130%            | 115%             | 35                 | nd                     |
| Bromochloromethane          | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,1,1-Trichloroethane       | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,2-Dichloroethane (EDC)    | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,1-Dichloropropene         | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Carbon tetrachloride        | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Trichloroethene (TCE)       | 1.0          | nd             | 133%            | 117%             | 5.1                | nd                     |
| 1,2-Dichloropropane         | 1.0          | nd             | 125%            | 119%             | 101                | nd                     |
| Bromodichloromethane        | 1.0          | nd             |                 |                  | nd                 | nd                     |
| cis-1,3-Dichloropropene     | 1.0          | nd             |                 |                  | nd                 | nd                     |
| trans-1,3-Dichloropropene   | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,1,2-Trichloroethane       | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,3-Dichloropropane         | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Dibromochloromethane        | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Tetrachloroethene (PCE)     | 1.0          | nd             | 122%            | 109%             | 53                 | nd                     |
| Chlorobenzene               | 1.0          | nd             | 126%            | 112%             | nd                 | nd                     |
| 1,1,1,2-Tetrachloroethane   | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,1,2,2-Tetrachloroethane   | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,2,3-Trichloropropane      | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 2-Chlorotoluene             | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 4-Chlorotoluene             | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,3-Dichlorobenzene         | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,4-Dichlorobenzene         | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,2-Dichlorobenzene         | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,2-Dibromo-3-Chloropropane | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,2,4-Trichlorobenzene      | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Hexachloro-1,3-butadiene    | 1.0          | nd             |                 |                  | nd                 | nd                     |
| 1,2,3-Trichlorobenzene      | 1.0          | nd             |                 |                  | nd                 | nd                     |
| Surrogate recoveries        |              |                |                 |                  |                    |                        |
| Dibromofluoromethane        |              | 110%           | 103%            | 104%             | 114%               | 106%                   |
| Toluene-d8                  |              | 101%           | 98%             | 97%              | 99%                | 97%                    |
| 4-Bromofluorobenzene        |              | 104%           | 103%            | 101%             | 111%               | 101%                   |

### Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits  
Acceptable Recovery limits: 65% TO 135%  
Acceptable RPD limit: 35%

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Olympia, WA 98501  
(360) 459-4670 (360) 459-3432 Fax  
lab@esnsw.com

### Analysis of Stoddard Solvent Range Organics in Soil by Method NWTPH-Gx

| Sample Number    | Date Prepared | Date Analyzed | Surrogate Recovery (%) | Stoddard Solvent Range Organics (mg/kg) |
|------------------|---------------|---------------|------------------------|-----------------------------------------|
| Method Blank     | 2/18/2013     | 2/20/2013     | 105                    | nd                                      |
| LCS              | 2/18/2013     | 2/20/2013     | 111                    | 103%                                    |
| SB2B-S1          | 2/18/2013     | 2/20/2013     | 114                    | 65                                      |
| SB8-S1           | 2/18/2013     | 2/20/2013     | 113                    | 310                                     |
| Reporting Limits |               |               |                        | 10                                      |

"nd" Indicates not detected at the listed detection limits.

"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE: 65% TO 135%

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### Analyses of Stoddard Solvent Range Organics in Water by Method NWTPH-Gx

| Sample Number    | Date Analyzed | Surrogate Recovery (%) | Stoddard Solvent Range Organics (ug/L) |
|------------------|---------------|------------------------|----------------------------------------|
| Method Blank     | 2/20/2013     | 106%                   | nd                                     |
| LCS              | 2/20/2013     | 103%                   | 89%                                    |
| SB2-W1           | 2/20/2013     | 114%                   | <b>2200</b>                            |
| Reporting Limits |               |                        | 100                                    |

"nd" Indicates not detected at the listed detection limits.

"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE: 65% TO 135%

**WORK ORDER #: 1302334**

Work Order Summary

|                        |                                                                                            |                  |                                                                                            |
|------------------------|--------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------------|
| <b>CLIENT:</b>         | Mr. Steve Loague<br>ESN Northwest<br>1210 Eastside St<br>SE Suite 200<br>Olympia, WA 98501 | <b>BILL TO:</b>  | Mr. Steve Loague<br>ESN Northwest<br>1210 Eastside St<br>SE Suite 200<br>Olympia, WA 98501 |
| <b>PHONE:</b>          | 360-459-4670                                                                               | <b>P.O. #</b>    | P13021508                                                                                  |
| <b>FAX:</b>            | 360-4595-3432                                                                              | <b>PROJECT #</b> | ARCOA BLVD                                                                                 |
| <b>DATE RECEIVED:</b>  | 02/19/2013                                                                                 | <b>CONTACT:</b>  | Kelly Buettner                                                                             |
| <b>DATE COMPLETED:</b> | 03/04/2013                                                                                 |                  |                                                                                            |

| <u>FRACTION #</u> | <u>NAME</u> | <u>TEST</u>    | <u>RECEIPT<br/>VAC./PRES.</u> | <u>FINAL<br/>PRESSURE</u> |
|-------------------|-------------|----------------|-------------------------------|---------------------------|
| 01A               | SV1-Arcoa   | Modified TO-15 | 24.0 "Hg                      | 15 psi                    |
| 02A               | SV2-Arcoa   | Modified TO-15 | 1.0 "Hg                       | 15 psi                    |
| 03A               | SV3-Arcoa   | Modified TO-15 | 4.0 "Hg                       | 15 psi                    |
| 04A               | Lab Blank   | Modified TO-15 | NA                            | NA                        |
| 05A               | CCV         | Modified TO-15 | NA                            | NA                        |
| 06A               | LCS         | Modified TO-15 | NA                            | NA                        |
| 06AA              | LCSD        | Modified TO-15 | NA                            | NA                        |

CERTIFIED BY:



Technical Director

DATE: 03/04/13

Certification numbers: AZ Licensure AZ0775, CA NELAP - 12282CA, NY NELAP - 11291,

TX NELAP - T104704434-12-5, UT NELAP CA009332012-3, WA NELAP - C935

Name of Accrediting Agency: NELAP/ORELAP (Oregon Environmental Laboratory Accreditation Program)

Accreditation number: CA300005, Effective date: 10/18/2011, Expiration date: 10/17/2012.

Eurofins Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

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180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 9563

(916) 985-1000 . (800) 985-5955 . FAX (916) 985-1020



**LABORATORY NARRATIVE**  
**EPA Method TO-15**  
**ESN Northwest**  
**Workorder# 1302334**

Three 1 Liter Summa Canister samples were received on February 19, 2013. The laboratory performed analysis via EPA Method TO-15 using GC/MS in the full scan mode.

This workorder was independently validated prior to submittal using 'USEPA National Functional Guidelines' as generally applied to the analysis of volatile organic compounds in air. A rules-based, logic driven, independent validation engine was employed to assess completeness, evaluate pass/fail of relevant project quality control requirements and verification of all quantified amounts.

**Receiving Notes**

Sample SV1-Aroclor was received with significant vacuum remaining in the canister. The residual canister vacuum resulted in elevated reporting limits.

**Analytical Notes**

Dilution was performed on all of the samples due to the presence of high level target species.

All Quality Control Limit exceedances and affected sample results are noted by flags. Each flag is defined at the bottom of this Case Narrative and on each Sample Result Summary page.

**Definition of Data Qualifying Flags**

Eight qualifiers may have been used on the data analysis sheets and indicates as follows:

B - Compound present in laboratory blank greater than reporting limit (background subtraction not performed).

J - Estimated value.

E - Exceeds instrument calibration range.

S - Saturated peak.

Q - Exceeds quality control limits.

U - Compound analyzed for but not detected above the reporting limit.

UJ- Non-detected compound associated with low bias in the CCV and/or LCS.

N - The identification is based on presumptive evidence.

File extensions may have been used on the data analysis sheets and indicates as follows:

a-File was requantified

b-File was quantified by a second column and detector

r1-File was requantified for the purpose of reissue



Air Toxics

**Summary of Detected Compounds**  
**EPA METHOD TO-15 GC/MS FULL SCAN**

Client Sample ID: SV1-Arcoa

Lab ID#: 1302334-01A

| Compound               | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv) | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
|------------------------|----------------------|------------------|-----------------------|-------------------|
| 1,3-Butadiene          | 50                   | 180              | 110                   | 400               |
| 2-Propanol             | 200                  | 360              | 500                   | 890               |
| Hexane                 | 50                   | 100              | 180                   | 370               |
| Chloroform             | 50                   | 50               | 250                   | 240               |
| Cyclohexane            | 50                   | 300              | 170                   | 1000              |
| Benzene                | 50                   | 3000             | 160                   | 9500              |
| 1,2-Dichloroethane     | 50                   | 70               | 200                   | 280               |
| Heptane                | 50                   | 390              | 210                   | 1600              |
| Trichloroethene        | 50                   | 430              | 270                   | 2300              |
| 1,2-Dichloropropane    | 50                   | 7500             | 230                   | 35000             |
| Toluene                | 50                   | 350              | 190                   | 1300              |
| Tetrachloroethene      | 50                   | 1500             | 340                   | 10000             |
| Ethyl Benzene          | 50                   | 960              | 220                   | 4200              |
| m,p-Xylene             | 50                   | 5200             | 220                   | 22000             |
| o-Xylene               | 50                   | 3500             | 220                   | 15000             |
| Cumene                 | 50                   | 1200             | 250                   | 6000              |
| Propylbenzene          | 50                   | 2200             | 250                   | 11000             |
| 4-Ethyltoluene         | 50                   | 7400             | 250                   | 36000             |
| 1,3,5-Trimethylbenzene | 50                   | 5000             | 250                   | 24000             |
| 1,2,4-Trimethylbenzene | 50                   | 11000            | 250                   | 54000             |

Client Sample ID: SV2-Arcoa

Lab ID#: 1302334-02A

| Compound             | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv) | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
|----------------------|----------------------|------------------|-----------------------|-------------------|
| 1,3-Butadiene        | 4.2                  | 9.0              | 9.2                   | 20                |
| Acetone              | 42                   | 47               | 99                    | 110               |
| Chloroform           | 4.2                  | 7.4              | 20                    | 36                |
| Cyclohexane          | 4.2                  | 7.2              | 14                    | 25                |
| Carbon Tetrachloride | 4.2                  | 5.5              | 26                    | 34                |
| Benzene              | 4.2                  | 21               | 13                    | 66                |
| Heptane              | 4.2                  | 30               | 17                    | 120               |
| Trichloroethene      | 4.2                  | 11               | 22                    | 62                |



Air Toxics

**Summary of Detected Compounds**  
**EPA METHOD TO-15 GC/MS FULL SCAN**

**Client Sample ID: SV2-Arcoa**

**Lab ID#: 1302334-02A**

|                        |     |     |    |      |
|------------------------|-----|-----|----|------|
| Toluene                | 4.2 | 9.0 | 16 | 34   |
| Tetrachloroethene      | 4.2 | 320 | 28 | 2200 |
| Ethyl Benzene          | 4.2 | 5.6 | 18 | 24   |
| m,p-Xylene             | 4.2 | 37  | 18 | 160  |
| o-Xylene               | 4.2 | 32  | 18 | 140  |
| Cumene                 | 4.2 | 20  | 20 | 98   |
| Propylbenzene          | 4.2 | 99  | 20 | 480  |
| 4-Ethyltoluene         | 4.2 | 230 | 20 | 1200 |
| 1,3,5-Trimethylbenzene | 4.2 | 230 | 20 | 1100 |
| 1,2,4-Trimethylbenzene | 4.2 | 560 | 20 | 2800 |

**Client Sample ID: SV3-Arcoa**

**Lab ID#: 1302334-03A**

| Compound               | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv) | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
|------------------------|----------------------|------------------|-----------------------|-------------------|
| Acetone                | 120                  | 130              | 280                   | 310               |
| Hexane                 | 12                   | 20               | 41                    | 71                |
| cis-1,2-Dichloroethene | 12                   | 21               | 46                    | 84                |
| Chloroform             | 12                   | 3900             | 57                    | 19000             |
| Carbon Tetrachloride   | 12                   | 280              | 73                    | 1800              |
| Trichloroethene        | 12                   | 12               | 63                    | 66                |
| Tetrachloroethene      | 12                   | 59               | 79                    | 400               |
| 1,2,4-Trimethylbenzene | 12                   | 16               | 57                    | 78                |



Air Toxics

Client Sample ID: SV1-Arcoa

Lab ID#: 1302334-01A

## EPA METHOD TO-15 GC/MS FULL SCAN

|                                  |                      |                     |                       |                   |
|----------------------------------|----------------------|---------------------|-----------------------|-------------------|
| File Name:                       | p022606              | Date of Collection: | 2/15/13 12:40:00 PM   |                   |
| Dil. Factor:                     | 101                  | Date of Analysis:   | 2/26/13 11:59 AM      |                   |
| Compound                         | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv)    | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
| Freon 12                         | 50                   | Not Detected        | 250                   | Not Detected      |
| Freon 114                        | 50                   | Not Detected        | 350                   | Not Detected      |
| Chloromethane                    | 500                  | Not Detected        | 1000                  | Not Detected      |
| Vinyl Chloride                   | 50                   | Not Detected        | 130                   | Not Detected      |
| 1,3-Butadiene                    | 50                   | 180                 | 110                   | 400               |
| Bromomethane                     | 500                  | Not Detected        | 2000                  | Not Detected      |
| Chloroethane                     | 200                  | Not Detected        | 530                   | Not Detected      |
| Freon 11                         | 50                   | Not Detected        | 280                   | Not Detected      |
| Ethanol                          | 200                  | Not Detected        | 380                   | Not Detected      |
| Freon 113                        | 50                   | Not Detected        | 390                   | Not Detected      |
| 1,1-Dichloroethene               | 50                   | Not Detected        | 200                   | Not Detected      |
| Acetone                          | 500                  | Not Detected        | 1200                  | Not Detected      |
| 2-Propanol                       | 200                  | 360                 | 500                   | 890               |
| Carbon Disulfide                 | 200                  | Not Detected        | 630                   | Not Detected      |
| 3-Chloropropene                  | 200                  | Not Detected        | 630                   | Not Detected      |
| Methylene Chloride               | 500                  | Not Detected        | 1800                  | Not Detected      |
| Methyl tert-butyl ether          | 50                   | Not Detected        | 180                   | Not Detected      |
| trans-1,2-Dichloroethene         | 50                   | Not Detected        | 200                   | Not Detected      |
| Hexane                           | 50                   | 100                 | 180                   | 370               |
| 1,1-Dichloroethane               | 50                   | Not Detected        | 200                   | Not Detected      |
| 2-Butanone (Methyl Ethyl Ketone) | 200                  | Not Detected        | 600                   | Not Detected      |
| cis-1,2-Dichloroethene           | 50                   | Not Detected        | 200                   | Not Detected      |
| Tetrahydrofuran                  | 50                   | Not Detected        | 150                   | Not Detected      |
| Chloroform                       | 50                   | 50                  | 250                   | 240               |
| 1,1,1-Trichloroethane            | 50                   | Not Detected        | 280                   | Not Detected      |
| Cyclohexane                      | 50                   | 300                 | 170                   | 1000              |
| Carbon Tetrachloride             | 50                   | Not Detected        | 320                   | Not Detected      |
| 2,2,4-Trimethylpentane           | 50                   | Not Detected        | 240                   | Not Detected      |
| Benzene                          | 50                   | 3000                | 160                   | 9500              |
| 1,2-Dichloroethane               | 50                   | 70                  | 200                   | 280               |
| Heptane                          | 50                   | 390                 | 210                   | 1600              |
| Trichloroethene                  | 50                   | 430                 | 270                   | 2300              |
| 1,2-Dichloropropane              | 50                   | 7500                | 230                   | 35000             |
| 1,4-Dioxane                      | 200                  | Not Detected        | 730                   | Not Detected      |
| Bromodichloromethane             | 50                   | Not Detected        | 340                   | Not Detected      |
| cis-1,3-Dichloropropene          | 50                   | Not Detected        | 230                   | Not Detected      |
| 4-Methyl-2-pentanone             | 50                   | Not Detected        | 210                   | Not Detected      |
| Toluene                          | 50                   | 350                 | 190                   | 1300              |
| trans-1,3-Dichloropropene        | 50                   | Not Detected        | 230                   | Not Detected      |
| 1,1,2-Trichloroethane            | 50                   | Not Detected        | 280                   | Not Detected      |
| Tetrachloroethene                | 50                   | 1500                | 340                   | 10000             |
| 2-Hexanone                       | 200                  | Not Detected        | 830                   | Not Detected      |



## Air Toxics

Client Sample ID: SV1-Arcoa

Lab ID#: 1302334-01A

### EPA METHOD TO-15 GC/MS FULL SCAN

|              |         |                     |                     |
|--------------|---------|---------------------|---------------------|
| File Name:   | p022606 | Date of Collection: | 2/15/13 12:40:00 PM |
| Dil. Factor: | 101     | Date of Analysis:   | 2/26/13 11:59 AM    |

| Compound                  | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv) | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
|---------------------------|----------------------|------------------|-----------------------|-------------------|
| Dibromochloromethane      | 50                   | Not Detected     | 430                   | Not Detected      |
| 1,2-Dibromoethane (EDB)   | 50                   | Not Detected     | 390                   | Not Detected      |
| Chlorobenzene             | 50                   | Not Detected     | 230                   | Not Detected      |
| Ethyl Benzene             | 50                   | 960              | 220                   | 4200              |
| m,p-Xylene                | 50                   | 5200             | 220                   | 22000             |
| o-Xylene                  | 50                   | 3500             | 220                   | 15000             |
| Styrene                   | 50                   | Not Detected     | 220                   | Not Detected      |
| Bromoform                 | 50                   | Not Detected     | 520                   | Not Detected      |
| Cumene                    | 50                   | 1200             | 250                   | 6000              |
| 1,1,2,2-Tetrachloroethane | 50                   | Not Detected     | 350                   | Not Detected      |
| Propylbenzene             | 50                   | 2200             | 250                   | 11000             |
| 4-Ethyltoluene            | 50                   | 7400             | 250                   | 36000             |
| 1,3,5-Trimethylbenzene    | 50                   | 5000             | 250                   | 24000             |
| 1,2,4-Trimethylbenzene    | 50                   | 11000            | 250                   | 54000             |
| 1,3-Dichlorobenzene       | 50                   | Not Detected     | 300                   | Not Detected      |
| 1,4-Dichlorobenzene       | 50                   | Not Detected     | 300                   | Not Detected      |
| alpha-Chlorotoluene       | 50                   | Not Detected     | 260                   | Not Detected      |
| 1,2-Dichlorobenzene       | 50                   | Not Detected     | 300                   | Not Detected      |
| 1,2,4-Trichlorobenzene    | 200                  | Not Detected     | 1500                  | Not Detected      |
| Hexachlorobutadiene       | 200                  | Not Detected     | 2200                  | Not Detected      |

Container Type: 1 Liter Summa Canister

| Surrogates            | %Recovery | Method<br>Limits |
|-----------------------|-----------|------------------|
| Toluene-d8            | 89        | 70-130           |
| 1,2-Dichloroethane-d4 | 106       | 70-130           |
| 4-Bromofluorobenzene  | 104       | 70-130           |



Air Toxics

Client Sample ID: SV2-Arcoa

Lab ID#: 1302334-02A

## EPA METHOD TO-15 GC/MS FULL SCAN

| File Name:                       | p022607              | Date of Collection: 2/15/13 1:36:00 PM |                       |                   |
|----------------------------------|----------------------|----------------------------------------|-----------------------|-------------------|
| Dil. Factor:                     | 8.36                 | Date of Analysis: 2/26/13 12:31 PM     |                       |                   |
| Compound                         | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv)                       | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
| Freon 12                         | 4.2                  | Not Detected                           | 21                    | Not Detected      |
| Freon 114                        | 4.2                  | Not Detected                           | 29                    | Not Detected      |
| Chloromethane                    | 42                   | Not Detected                           | 86                    | Not Detected      |
| Vinyl Chloride                   | 4.2                  | Not Detected                           | 11                    | Not Detected      |
| 1,3-Butadiene                    | 4.2                  | 9.0                                    | 9.2                   | 20                |
| Bromomethane                     | 42                   | Not Detected                           | 160                   | Not Detected      |
| Chloroethane                     | 17                   | Not Detected                           | 44                    | Not Detected      |
| Freon 11                         | 4.2                  | Not Detected                           | 23                    | Not Detected      |
| Ethanol                          | 17                   | Not Detected                           | 32                    | Not Detected      |
| Freon 113                        | 4.2                  | Not Detected                           | 32                    | Not Detected      |
| 1,1-Dichloroethene               | 4.2                  | Not Detected                           | 16                    | Not Detected      |
| Acetone                          | 42                   | 47                                     | 99                    | 110               |
| 2-Propanol                       | 17                   | Not Detected                           | 41                    | Not Detected      |
| Carbon Disulfide                 | 17                   | Not Detected                           | 52                    | Not Detected      |
| 3-Chloropropene                  | 17                   | Not Detected                           | 52                    | Not Detected      |
| Methylene Chloride               | 42                   | Not Detected                           | 140                   | Not Detected      |
| Methyl tert-butyl ether          | 4.2                  | Not Detected                           | 15                    | Not Detected      |
| trans-1,2-Dichloroethene         | 4.2                  | Not Detected                           | 16                    | Not Detected      |
| Hexane                           | 4.2                  | Not Detected                           | 15                    | Not Detected      |
| 1,1-Dichloroethane               | 4.2                  | Not Detected                           | 17                    | Not Detected      |
| 2-Butanone (Methyl Ethyl Ketone) | 17                   | Not Detected                           | 49                    | Not Detected      |
| cis-1,2-Dichloroethene           | 4.2                  | Not Detected                           | 16                    | Not Detected      |
| Tetrahydrofuran                  | 4.2                  | Not Detected                           | 12                    | Not Detected      |
| Chloroform                       | 4.2                  | 7.4                                    | 20                    | 36                |
| 1,1,1-Trichloroethane            | 4.2                  | Not Detected                           | 23                    | Not Detected      |
| Cyclohexane                      | 4.2                  | 7.2                                    | 14                    | 25                |
| Carbon Tetrachloride             | 4.2                  | 5.5                                    | 26                    | 34                |
| 2,2,4-Trimethylpentane           | 4.2                  | Not Detected                           | 20                    | Not Detected      |
| Benzene                          | 4.2                  | 21                                     | 13                    | 66                |
| 1,2-Dichloroethane               | 4.2                  | Not Detected                           | 17                    | Not Detected      |
| Heptane                          | 4.2                  | 30                                     | 17                    | 120               |
| Trichloroethene                  | 4.2                  | 11                                     | 22                    | 62                |
| 1,2-Dichloropropane              | 4.2                  | Not Detected                           | 19                    | Not Detected      |
| 1,4-Dioxane                      | 17                   | Not Detected                           | 60                    | Not Detected      |
| Bromodichloromethane             | 4.2                  | Not Detected                           | 28                    | Not Detected      |
| cis-1,3-Dichloropropene          | 4.2                  | Not Detected                           | 19                    | Not Detected      |
| 4-Methyl-2-pentanone             | 4.2                  | Not Detected                           | 17                    | Not Detected      |
| Toluene                          | 4.2                  | 9.0                                    | 16                    | 34                |
| trans-1,3-Dichloropropene        | 4.2                  | Not Detected                           | 19                    | Not Detected      |
| 1,1,2-Trichloroethane            | 4.2                  | Not Detected                           | 23                    | Not Detected      |
| Tetrachloroethene                | 4.2                  | 320                                    | 28                    | 2200              |
| 2-Hexanone                       | 17                   | Not Detected                           | 68                    | Not Detected      |



Air Toxics

Client Sample ID: SV2-Arcoa

Lab ID#: 1302334-02A

## EPA METHOD TO-15 GC/MS FULL SCAN

|              |         |                     |                    |
|--------------|---------|---------------------|--------------------|
| File Name:   | p022607 | Date of Collection: | 2/15/13 1:36:00 PM |
| Dil. Factor: | 8.36    | Date of Analysis:   | 2/26/13 12:31 PM   |

| Compound                  | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv) | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
|---------------------------|----------------------|------------------|-----------------------|-------------------|
| Dibromochloromethane      | 4.2                  | Not Detected     | 36                    | Not Detected      |
| 1,2-Dibromoethane (EDB)   | 4.2                  | Not Detected     | 32                    | Not Detected      |
| Chlorobenzene             | 4.2                  | Not Detected     | 19                    | Not Detected      |
| Ethyl Benzene             | 4.2                  | 5.6              | 18                    | 24                |
| m,p-Xylene                | 4.2                  | 37               | 18                    | 160               |
| o-Xylene                  | 4.2                  | 32               | 18                    | 140               |
| Styrene                   | 4.2                  | Not Detected     | 18                    | Not Detected      |
| Bromoform                 | 4.2                  | Not Detected     | 43                    | Not Detected      |
| Cumene                    | 4.2                  | 20               | 20                    | 98                |
| 1,1,2,2-Tetrachloroethane | 4.2                  | Not Detected     | 29                    | Not Detected      |
| Propylbenzene             | 4.2                  | 99               | 20                    | 480               |
| 4-Ethyltoluene            | 4.2                  | 230              | 20                    | 1200              |
| 1,3,5-Trimethylbenzene    | 4.2                  | 230              | 20                    | 1100              |
| 1,2,4-Trimethylbenzene    | 4.2                  | 560              | 20                    | 2800              |
| 1,3-Dichlorobenzene       | 4.2                  | Not Detected     | 25                    | Not Detected      |
| 1,4-Dichlorobenzene       | 4.2                  | Not Detected     | 25                    | Not Detected      |
| alpha-Chlorotoluene       | 4.2                  | Not Detected     | 22                    | Not Detected      |
| 1,2-Dichlorobenzene       | 4.2                  | Not Detected     | 25                    | Not Detected      |
| 1,2,4-Trichlorobenzene    | 17                   | Not Detected     | 120                   | Not Detected      |
| Hexachlorobutadiene       | 17                   | Not Detected     | 180                   | Not Detected      |

Container Type: 1 Liter Summa Canister

| Surrogates            | %Recovery | Method<br>Limits |
|-----------------------|-----------|------------------|
| Toluene-d8            | 116       | 70-130           |
| 1,2-Dichloroethane-d4 | 95        | 70-130           |
| 4-Bromofluorobenzene  | 106       | 70-130           |



Air Toxics

Client Sample ID: SV3-Arcoa

Lab ID#: 1302334-03A

## EPA METHOD TO-15 GC/MS FULL SCAN

|                                  |                      |                                        |                       |                   |
|----------------------------------|----------------------|----------------------------------------|-----------------------|-------------------|
| File Name:                       | p022608              | Date of Collection: 2/15/13 2:48:00 PM |                       |                   |
| Dil. Factor:                     | 23.3                 | Date of Analysis: 2/26/13 01:12 PM     |                       |                   |
| Compound                         | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv)                       | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
| Freon 12                         | 12                   | Not Detected                           | 58                    | Not Detected      |
| Freon 114                        | 12                   | Not Detected                           | 81                    | Not Detected      |
| Chloromethane                    | 120                  | Not Detected                           | 240                   | Not Detected      |
| Vinyl Chloride                   | 12                   | Not Detected                           | 30                    | Not Detected      |
| 1,3-Butadiene                    | 12                   | Not Detected                           | 26                    | Not Detected      |
| Bromomethane                     | 120                  | Not Detected                           | 450                   | Not Detected      |
| Chloroethane                     | 47                   | Not Detected                           | 120                   | Not Detected      |
| Freon 11                         | 12                   | Not Detected                           | 65                    | Not Detected      |
| Ethanol                          | 47                   | Not Detected                           | 88                    | Not Detected      |
| Freon 113                        | 12                   | Not Detected                           | 89                    | Not Detected      |
| 1,1-Dichloroethene               | 12                   | Not Detected                           | 46                    | Not Detected      |
| Acetone                          | 120                  | 130                                    | 280                   | 310               |
| 2-Propanol                       | 47                   | Not Detected                           | 110                   | Not Detected      |
| Carbon Disulfide                 | 47                   | Not Detected                           | 140                   | Not Detected      |
| 3-Chloropropene                  | 47                   | Not Detected                           | 140                   | Not Detected      |
| Methylene Chloride               | 120                  | Not Detected                           | 400                   | Not Detected      |
| Methyl tert-butyl ether          | 12                   | Not Detected                           | 42                    | Not Detected      |
| trans-1,2-Dichloroethene         | 12                   | Not Detected                           | 46                    | Not Detected      |
| Hexane                           | 12                   | 20                                     | 41                    | 71                |
| 1,1-Dichloroethane               | 12                   | Not Detected                           | 47                    | Not Detected      |
| 2-Butanone (Methyl Ethyl Ketone) | 47                   | Not Detected                           | 140                   | Not Detected      |
| cis-1,2-Dichloroethene           | 12                   | 21                                     | 46                    | 84                |
| Tetrahydrofuran                  | 12                   | Not Detected                           | 34                    | Not Detected      |
| Chloroform                       | 12                   | 3900                                   | 57                    | 19000             |
| 1,1,1-Trichloroethane            | 12                   | Not Detected                           | 64                    | Not Detected      |
| Cyclohexane                      | 12                   | Not Detected                           | 40                    | Not Detected      |
| Carbon Tetrachloride             | 12                   | 280                                    | 73                    | 1800              |
| 2,2,4-Trimethylpentane           | 12                   | Not Detected                           | 54                    | Not Detected      |
| Benzene                          | 12                   | Not Detected                           | 37                    | Not Detected      |
| 1,2-Dichloroethane               | 12                   | Not Detected                           | 47                    | Not Detected      |
| Heptane                          | 12                   | Not Detected                           | 48                    | Not Detected      |
| Trichloroethene                  | 12                   | 12                                     | 63                    | 66                |
| 1,2-Dichloropropane              | 12                   | Not Detected                           | 54                    | Not Detected      |
| 1,4-Dioxane                      | 47                   | Not Detected                           | 170                   | Not Detected      |
| Bromodichloromethane             | 12                   | Not Detected                           | 78                    | Not Detected      |
| cis-1,3-Dichloropropene          | 12                   | Not Detected                           | 53                    | Not Detected      |
| 4-Methyl-2-pentanone             | 12                   | Not Detected                           | 48                    | Not Detected      |
| Toluene                          | 12                   | Not Detected                           | 44                    | Not Detected      |
| trans-1,3-Dichloropropene        | 12                   | Not Detected                           | 53                    | Not Detected      |
| 1,1,2-Trichloroethane            | 12                   | Not Detected                           | 64                    | Not Detected      |
| Tetrachloroethene                | 12                   | 59                                     | 79                    | 400               |
| 2-Hexanone                       | 47                   | Not Detected                           | 190                   | Not Detected      |



Air Toxics

Client Sample ID: SV3-Arcoa

Lab ID#: 1302334-03A

## EPA METHOD TO-15 GC/MS FULL SCAN

|              |         |                     |                    |
|--------------|---------|---------------------|--------------------|
| File Name:   | p022608 | Date of Collection: | 2/15/13 2:48:00 PM |
| Dil. Factor: | 23.3    | Date of Analysis:   | 2/26/13 01:12 PM   |

| Compound                  | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv) | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
|---------------------------|----------------------|------------------|-----------------------|-------------------|
| Dibromochloromethane      | 12                   | Not Detected     | 99                    | Not Detected      |
| 1,2-Dibromoethane (EDB)   | 12                   | Not Detected     | 90                    | Not Detected      |
| Chlorobenzene             | 12                   | Not Detected     | 54                    | Not Detected      |
| Ethyl Benzene             | 12                   | Not Detected     | 50                    | Not Detected      |
| m,p-Xylene                | 12                   | Not Detected     | 50                    | Not Detected      |
| o-Xylene                  | 12                   | Not Detected     | 50                    | Not Detected      |
| Styrene                   | 12                   | Not Detected     | 50                    | Not Detected      |
| Bromoform                 | 12                   | Not Detected     | 120                   | Not Detected      |
| Cumene                    | 12                   | Not Detected     | 57                    | Not Detected      |
| 1,1,2,2-Tetrachloroethane | 12                   | Not Detected     | 80                    | Not Detected      |
| Propylbenzene             | 12                   | Not Detected     | 57                    | Not Detected      |
| 4-Ethyltoluene            | 12                   | Not Detected     | 57                    | Not Detected      |
| 1,3,5-Trimethylbenzene    | 12                   | Not Detected     | 57                    | Not Detected      |
| 1,2,4-Trimethylbenzene    | 12                   | 16               | 57                    | 78                |
| 1,3-Dichlorobenzene       | 12                   | Not Detected     | 70                    | Not Detected      |
| 1,4-Dichlorobenzene       | 12                   | Not Detected     | 70                    | Not Detected      |
| alpha-Chlorotoluene       | 12                   | Not Detected     | 60                    | Not Detected      |
| 1,2-Dichlorobenzene       | 12                   | Not Detected     | 70                    | Not Detected      |
| 1,2,4-Trichlorobenzene    | 47                   | Not Detected     | 340                   | Not Detected      |
| Hexachlorobutadiene       | 47                   | Not Detected     | 500                   | Not Detected      |

Container Type: 1 Liter Summa Canister

| Surrogates            | %Recovery | Method<br>Limits |
|-----------------------|-----------|------------------|
| Toluene-d8            | 97        | 70-130           |
| 1,2-Dichloroethane-d4 | 92        | 70-130           |
| 4-Bromofluorobenzene  | 101       | 70-130           |



Air Toxics

Client Sample ID: Lab Blank

Lab ID#: 1302334-04A

## EPA METHOD TO-15 GC/MS FULL SCAN

|                                  |                      |                     |                       |                   |
|----------------------------------|----------------------|---------------------|-----------------------|-------------------|
| File Name:                       | p022605              | Date of Collection: | NA                    |                   |
| Dil. Factor:                     | 1.00                 | Date of Analysis:   | 2/26/13 11:22 AM      |                   |
| Compound                         | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv)    | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
| Freon 12                         | 0.50                 | Not Detected        | 2.5                   | Not Detected      |
| Freon 114                        | 0.50                 | Not Detected        | 3.5                   | Not Detected      |
| Chloromethane                    | 5.0                  | Not Detected        | 10                    | Not Detected      |
| Vinyl Chloride                   | 0.50                 | Not Detected        | 1.3                   | Not Detected      |
| 1,3-Butadiene                    | 0.50                 | Not Detected        | 1.1                   | Not Detected      |
| Bromomethane                     | 5.0                  | Not Detected        | 19                    | Not Detected      |
| Chloroethane                     | 2.0                  | Not Detected        | 5.3                   | Not Detected      |
| Freon 11                         | 0.50                 | Not Detected        | 2.8                   | Not Detected      |
| Ethanol                          | 2.0                  | Not Detected        | 3.8                   | Not Detected      |
| Freon 113                        | 0.50                 | Not Detected        | 3.8                   | Not Detected      |
| 1,1-Dichloroethene               | 0.50                 | Not Detected        | 2.0                   | Not Detected      |
| Acetone                          | 5.0                  | Not Detected        | 12                    | Not Detected      |
| 2-Propanol                       | 2.0                  | Not Detected        | 4.9                   | Not Detected      |
| Carbon Disulfide                 | 2.0                  | Not Detected        | 6.2                   | Not Detected      |
| 3-Chloropropene                  | 2.0                  | Not Detected        | 6.3                   | Not Detected      |
| Methylene Chloride               | 5.0                  | Not Detected        | 17                    | Not Detected      |
| Methyl tert-butyl ether          | 0.50                 | Not Detected        | 1.8                   | Not Detected      |
| trans-1,2-Dichloroethene         | 0.50                 | Not Detected        | 2.0                   | Not Detected      |
| Hexane                           | 0.50                 | Not Detected        | 1.8                   | Not Detected      |
| 1,1-Dichloroethane               | 0.50                 | Not Detected        | 2.0                   | Not Detected      |
| 2-Butanone (Methyl Ethyl Ketone) | 2.0                  | Not Detected        | 5.9                   | Not Detected      |
| cis-1,2-Dichloroethene           | 0.50                 | Not Detected        | 2.0                   | Not Detected      |
| Tetrahydrofuran                  | 0.50                 | Not Detected        | 1.5                   | Not Detected      |
| Chloroform                       | 0.50                 | Not Detected        | 2.4                   | Not Detected      |
| 1,1,1-Trichloroethane            | 0.50                 | Not Detected        | 2.7                   | Not Detected      |
| Cyclohexane                      | 0.50                 | Not Detected        | 1.7                   | Not Detected      |
| Carbon Tetrachloride             | 0.50                 | Not Detected        | 3.1                   | Not Detected      |
| 2,2,4-Trimethylpentane           | 0.50                 | Not Detected        | 2.3                   | Not Detected      |
| Benzene                          | 0.50                 | Not Detected        | 1.6                   | Not Detected      |
| 1,2-Dichloroethane               | 0.50                 | Not Detected        | 2.0                   | Not Detected      |
| Heptane                          | 0.50                 | Not Detected        | 2.0                   | Not Detected      |
| Trichloroethene                  | 0.50                 | Not Detected        | 2.7                   | Not Detected      |
| 1,2-Dichloropropane              | 0.50                 | Not Detected        | 2.3                   | Not Detected      |
| 1,4-Dioxane                      | 2.0                  | Not Detected        | 7.2                   | Not Detected      |
| Bromodichloromethane             | 0.50                 | Not Detected        | 3.4                   | Not Detected      |
| cis-1,3-Dichloropropene          | 0.50                 | Not Detected        | 2.3                   | Not Detected      |
| 4-Methyl-2-pentanone             | 0.50                 | Not Detected        | 2.0                   | Not Detected      |
| Toluene                          | 0.50                 | Not Detected        | 1.9                   | Not Detected      |
| trans-1,3-Dichloropropene        | 0.50                 | Not Detected        | 2.3                   | Not Detected      |
| 1,1,2-Trichloroethane            | 0.50                 | Not Detected        | 2.7                   | Not Detected      |
| Tetrachloroethene                | 0.50                 | Not Detected        | 3.4                   | Not Detected      |
| 2-Hexanone                       | 2.0                  | Not Detected        | 8.2                   | Not Detected      |



Air Toxics

Client Sample ID: Lab Blank

Lab ID#: 1302334-04A

## EPA METHOD TO-15 GC/MS FULL SCAN

|              |         |                                    |
|--------------|---------|------------------------------------|
| File Name:   | p022605 | Date of Collection: NA             |
| Dil. Factor: | 1.00    | Date of Analysis: 2/26/13 11:22 AM |

| Compound                  | Rpt. Limit<br>(ppbv) | Amount<br>(ppbv) | Rpt. Limit<br>(ug/m3) | Amount<br>(ug/m3) |
|---------------------------|----------------------|------------------|-----------------------|-------------------|
| Dibromochloromethane      | 0.50                 | Not Detected     | 4.2                   | Not Detected      |
| 1,2-Dibromoethane (EDB)   | 0.50                 | Not Detected     | 3.8                   | Not Detected      |
| Chlorobenzene             | 0.50                 | Not Detected     | 2.3                   | Not Detected      |
| Ethyl Benzene             | 0.50                 | Not Detected     | 2.2                   | Not Detected      |
| m,p-Xylene                | 0.50                 | Not Detected     | 2.2                   | Not Detected      |
| o-Xylene                  | 0.50                 | Not Detected     | 2.2                   | Not Detected      |
| Styrene                   | 0.50                 | Not Detected     | 2.1                   | Not Detected      |
| Bromoform                 | 0.50                 | Not Detected     | 5.2                   | Not Detected      |
| Cumene                    | 0.50                 | Not Detected     | 2.4                   | Not Detected      |
| 1,1,2,2-Tetrachloroethane | 0.50                 | Not Detected     | 3.4                   | Not Detected      |
| Propylbenzene             | 0.50                 | Not Detected     | 2.4                   | Not Detected      |
| 4-Ethyltoluene            | 0.50                 | Not Detected     | 2.4                   | Not Detected      |
| 1,3,5-Trimethylbenzene    | 0.50                 | Not Detected     | 2.4                   | Not Detected      |
| 1,2,4-Trimethylbenzene    | 0.50                 | Not Detected     | 2.4                   | Not Detected      |
| 1,3-Dichlorobenzene       | 0.50                 | Not Detected     | 3.0                   | Not Detected      |
| 1,4-Dichlorobenzene       | 0.50                 | Not Detected     | 3.0                   | Not Detected      |
| alpha-Chlorotoluene       | 0.50                 | Not Detected     | 2.6                   | Not Detected      |
| 1,2-Dichlorobenzene       | 0.50                 | Not Detected     | 3.0                   | Not Detected      |
| 1,2,4-Trichlorobenzene    | 2.0                  | Not Detected     | 15                    | Not Detected      |
| Hexachlorobutadiene       | 2.0                  | Not Detected     | 21                    | Not Detected      |

Container Type: NA - Not Applicable

| Surrogates            | %Recovery | Method<br>Limits |
|-----------------------|-----------|------------------|
| Toluene-d8            | 85        | 70-130           |
| 1,2-Dichloroethane-d4 | 94        | 70-130           |
| 4-Bromofluorobenzene  | 87        | 70-130           |



Air Toxics

Client Sample ID: CCV

Lab ID#: 1302334-05A

## EPA METHOD TO-15 GC/MS FULL SCAN

|              |         |                                    |
|--------------|---------|------------------------------------|
| File Name:   | p022602 | Date of Collection: NA             |
| Dil. Factor: | 1.00    | Date of Analysis: 2/26/13 09:58 AM |

| Compound                         | %Recovery |
|----------------------------------|-----------|
| Freon 12                         | 99        |
| Freon 114                        | 96        |
| Chloromethane                    | 90        |
| Vinyl Chloride                   | 101       |
| 1,3-Butadiene                    | 92        |
| Bromomethane                     | 95        |
| Chloroethane                     | 91        |
| Freon 11                         | 95        |
| Ethanol                          | 88        |
| Freon 113                        | 95        |
| 1,1-Dichloroethene               | 96        |
| Acetone                          | 91        |
| 2-Propanol                       | 90        |
| Carbon Disulfide                 | 90        |
| 3-Chloropropene                  | 93        |
| Methylene Chloride               | 90        |
| Methyl tert-butyl ether          | 104       |
| trans-1,2-Dichloroethene         | 98        |
| Hexane                           | 96        |
| 1,1-Dichloroethane               | 91        |
| 2-Butanone (Methyl Ethyl Ketone) | 99        |
| cis-1,2-Dichloroethene           | 109       |
| Tetrahydrofuran                  | 98        |
| Chloroform                       | 95        |
| 1,1,1-Trichloroethane            | 98        |
| Cyclohexane                      | 105       |
| Carbon Tetrachloride             | 97        |
| 2,2,4-Trimethylpentane           | 100       |
| Benzene                          | 101       |
| 1,2-Dichloroethane               | 100       |
| Heptane                          | 111       |
| Trichloroethene                  | 93        |
| 1,2-Dichloropropane              | 107       |
| 1,4-Dioxane                      | 128       |
| Bromodichloromethane             | 103       |
| cis-1,3-Dichloropropene          | 102       |
| 4-Methyl-2-pentanone             | 115       |
| Toluene                          | 101       |
| trans-1,3-Dichloropropene        | 94        |
| 1,1,2-Trichloroethane            | 90        |
| Tetrachloroethene                | 89        |
| 2-Hexanone                       | 92        |



Air Toxics

Client Sample ID: CCV

Lab ID#: 1302334-05A

**EPA METHOD TO-15 GC/MS FULL SCAN**

|                     |                |                                           |
|---------------------|----------------|-------------------------------------------|
| <b>File Name:</b>   | <b>p022602</b> | <b>Date of Collection:</b> NA             |
| <b>Dil. Factor:</b> | <b>1.00</b>    | <b>Date of Analysis:</b> 2/26/13 09:58 AM |

| Compound                  | %Recovery |
|---------------------------|-----------|
| Dibromochloromethane      | 95        |
| 1,2-Dibromoethane (EDB)   | 90        |
| Chlorobenzene             | 94        |
| Ethyl Benzene             | 107       |
| m,p-Xylene                | 97        |
| o-Xylene                  | 100       |
| Styrene                   | 105       |
| Bromoform                 | 95        |
| Cumene                    | 102       |
| 1,1,2,2-Tetrachloroethane | 117       |
| Propylbenzene             | 109       |
| 4-Ethyltoluene            | 116       |
| 1,3,5-Trimethylbenzene    | 121       |
| 1,2,4-Trimethylbenzene    | 114       |
| 1,3-Dichlorobenzene       | 94        |
| 1,4-Dichlorobenzene       | 94        |
| alpha-Chlorotoluene       | 100       |
| 1,2-Dichlorobenzene       | 95        |
| 1,2,4-Trichlorobenzene    | 93        |
| Hexachlorobutadiene       | 93        |

Container Type: NA - Not Applicable

| Surrogates            | %Recovery | Method Limits |
|-----------------------|-----------|---------------|
| Toluene-d8            | 103       | 70-130        |
| 1,2-Dichloroethane-d4 | 96        | 70-130        |
| 4-Bromofluorobenzene  | 94        | 70-130        |



Air Toxics

Client Sample ID: LCS

Lab ID#: 1302334-06A

## EPA METHOD TO-15 GC/MS FULL SCAN

|              |         |                                    |
|--------------|---------|------------------------------------|
| File Name:   | p022603 | Date of Collection: NA             |
| Dil. Factor: | 1.00    | Date of Analysis: 2/26/13 10:28 AM |

| Compound                         | %Recovery |
|----------------------------------|-----------|
| Freon 12                         | 102       |
| Freon 114                        | 101       |
| Chloromethane                    | 107       |
| Vinyl Chloride                   | 108       |
| 1,3-Butadiene                    | 98        |
| Bromomethane                     | 99        |
| Chloroethane                     | 96        |
| Freon 11                         | 98        |
| Ethanol                          | 68 Q      |
| Freon 113                        | 98        |
| 1,1-Dichloroethene               | 106       |
| Acetone                          | 100       |
| 2-Propanol                       | 92        |
| Carbon Disulfide                 | 117       |
| 3-Chloropropene                  | 107       |
| Methylene Chloride               | 93        |
| Methyl tert-butyl ether          | 103       |
| trans-1,2-Dichloroethene         | 114       |
| Hexane                           | 114       |
| 1,1-Dichloroethane               | 94        |
| 2-Butanone (Methyl Ethyl Ketone) | 96        |
| cis-1,2-Dichloroethene           | 100       |
| Tetrahydrofuran                  | 95        |
| Chloroform                       | 97        |
| 1,1,1-Trichloroethane            | 100       |
| Cyclohexane                      | 110       |
| Carbon Tetrachloride             | 108       |
| 2,2,4-Trimethylpentane           | 102       |
| Benzene                          | 106       |
| 1,2-Dichloroethane               | 97        |
| Heptane                          | 106       |
| Trichloroethene                  | 84        |
| 1,2-Dichloropropane              | 99        |
| 1,4-Dioxane                      | 117       |
| Bromodichloromethane             | 106       |
| cis-1,3-Dichloropropene          | 104       |
| 4-Methyl-2-pentanone             | 104       |
| Toluene                          | 98        |
| trans-1,3-Dichloropropene        | 86        |
| 1,1,2-Trichloroethane            | 82        |
| Tetrachloroethene                | 82        |
| 2-Hexanone                       | 86        |



Air Toxics

Client Sample ID: LCS

Lab ID#: 1302334-06A

EPA METHOD TO-15 GC/MS FULL SCAN

|              |         |                                    |
|--------------|---------|------------------------------------|
| File Name:   | p022603 | Date of Collection: NA             |
| Dil. Factor: | 1.00    | Date of Analysis: 2/26/13 10:28 AM |

| Compound                  | %Recovery |
|---------------------------|-----------|
| Dibromochloromethane      | 102       |
| 1,2-Dibromoethane (EDB)   | 98        |
| Chlorobenzene             | 93        |
| Ethyl Benzene             | 100       |
| m,p-Xylene                | 94        |
| o-Xylene                  | 92        |
| Styrene                   | 95        |
| Bromoform                 | 87        |
| Cumene                    | 94        |
| 1,1,2,2-Tetrachloroethane | 93        |
| Propylbenzene             | 89        |
| 4-Ethyltoluene            | 88        |
| 1,3,5-Trimethylbenzene    | 94        |
| 1,2,4-Trimethylbenzene    | 91        |
| 1,3-Dichlorobenzene       | 88        |
| 1,4-Dichlorobenzene       | 87        |
| alpha-Chlorotoluene       | 89        |
| 1,2-Dichlorobenzene       | 102       |
| 1,2,4-Trichlorobenzene    | 95        |
| Hexachlorobutadiene       | 91        |

Q = Exceeds Quality Control limits.

Container Type: NA - Not Applicable

| Surrogates            | %Recovery | Method Limits |
|-----------------------|-----------|---------------|
| Toluene-d8            | 103       | 70-130        |
| 1,2-Dichloroethane-d4 | 97        | 70-130        |
| 4-Bromofluorobenzene  | 88        | 70-130        |



Air Toxics

Client Sample ID: LCSD

Lab ID#: 1302334-06AA

## EPA METHOD TO-15 GC/MS FULL SCAN

|              |         |                                    |
|--------------|---------|------------------------------------|
| File Name:   | p022604 | Date of Collection: NA             |
| Dil. Factor: | 1.00    | Date of Analysis: 2/26/13 10:47 AM |

| Compound                         | %Recovery |
|----------------------------------|-----------|
| Freon 12                         | 94        |
| Freon 114                        | 95        |
| Chloromethane                    | 95        |
| Vinyl Chloride                   | 98        |
| 1,3-Butadiene                    | 91        |
| Bromomethane                     | 90        |
| Chloroethane                     | 90        |
| Freon 11                         | 88        |
| Ethanol                          | 62 Q      |
| Freon 113                        | 91        |
| 1,1-Dichloroethene               | 96        |
| Acetone                          | 95        |
| 2-Propanol                       | 86        |
| Carbon Disulfide                 | 106       |
| 3-Chloropropene                  | 108       |
| Methylene Chloride               | 86        |
| Methyl tert-butyl ether          | 95        |
| trans-1,2-Dichloroethene         | 104       |
| Hexane                           | 92        |
| 1,1-Dichloroethane               | 87        |
| 2-Butanone (Methyl Ethyl Ketone) | 88        |
| cis-1,2-Dichloroethene           | 98        |
| Tetrahydrofuran                  | 101       |
| Chloroform                       | 98        |
| 1,1,1-Trichloroethane            | 93        |
| Cyclohexane                      | 102       |
| Carbon Tetrachloride             | 92        |
| 2,2,4-Trimethylpentane           | 96        |
| Benzene                          | 100       |
| 1,2-Dichloroethane               | 95        |
| Heptane                          | 108       |
| Trichloroethene                  | 97        |
| 1,2-Dichloropropane              | 110       |
| 1,4-Dioxane                      | 103       |
| Bromodichloromethane             | 97        |
| cis-1,3-Dichloropropene          | 102       |
| 4-Methyl-2-pentanone             | 106       |
| Toluene                          | 99        |
| trans-1,3-Dichloropropene        | 103       |
| 1,1,2-Trichloroethane            | 102       |
| Tetrachloroethene                | 98        |
| 2-Hexanone                       | 92        |



Air Toxics

Client Sample ID: LCSD

Lab ID#: 1302334-06AA

**EPA METHOD TO-15 GC/MS FULL SCAN**

|              |         |                                    |
|--------------|---------|------------------------------------|
| File Name:   | p022604 | Date of Collection: NA             |
| Dil. Factor: | 1.00    | Date of Analysis: 2/26/13 10:47 AM |

| Compound                  | %Recovery |
|---------------------------|-----------|
| Dibromochloromethane      | 104       |
| 1,2-Dibromoethane (EDB)   | 101       |
| Chlorobenzene             | 96        |
| Ethyl Benzene             | 105       |
| m,p-Xylene                | 111       |
| o-Xylene                  | 112       |
| Styrene                   | 113       |
| Bromoform                 | 103       |
| Cumene                    | 114       |
| 1,1,2,2-Tetrachloroethane | 112       |
| Propylbenzene             | 108       |
| 4-Ethyltoluene            | 109       |
| 1,3,5-Trimethylbenzene    | 113       |
| 1,2,4-Trimethylbenzene    | 110       |
| 1,3-Dichlorobenzene       | 107       |
| 1,4-Dichlorobenzene       | 105       |
| alpha-Chlorotoluene       | 104       |
| 1,2-Dichlorobenzene       | 109       |
| 1,2,4-Trichlorobenzene    | 115       |
| Hexachlorobutadiene       | 110       |

Q = Exceeds Quality Control limits.

Container Type: NA - Not Applicable

| Surrogates            | %Recovery | Method Limits |
|-----------------------|-----------|---------------|
| Toluene-d8            | 103       | 70-130        |
| 1,2-Dichloroethane-d4 | 89        | 70-130        |
| 4-Bromofluorobenzene  | 103       | 70-130        |

## **APPENDIX III**

# **GEOPHYSICAL REPORT**



## GEOPHYSICAL SURVEY LETTER REPORT

Chugwater LLC  
10445 SW Canyon Rd, Suite 101  
Beaverton, OR 97005

December 4, 2012  
Project Number: 121117

### Geophysical Survey Arcoa Building 1006 SE Grand Avenue Portland, Oregon

This letter report briefly describes a geophysical survey conducted at the above address for the purpose of detecting a possible underground storage tank (UST) adjacent to an addition east of the original building. The building had been occupied by a dry cleaning business in the past. Also, six proposed sampling locations were to be "cleared" of underground obstructions.

A Geometrics G-858 Cesium magnetometer was used to scan the subsurface for buried ferrous objects that could be possible USTs. Data were collected along the SE Yamhill Street sidewalk and across the asphalt-covered parking lot east of the new addition. Reportedly the basement of the original building (west of the survey area) extended under the Yamhill Street sidewalk. No evidence of a UST was seen during the fieldwork.

Figure 1 shows a colored magnetic contour map of the data collected during the survey. The sides of the "new" addition were constructed of corrugated metal and produced significant magnetic interference. Part of the sidewalk was reinforced, and contributed to the interference.

A Schonstedt Magnetic Gradiometer and an Aqua-Tronics A6 Tracer metal detector were used to investigate several large magnetic "highs" (shown as red contours). No three-dimensional objects were detected. All of the anomalies appeared to be related to the metal-sided building and/or the sidewalk. No USTs were detected.

A GSSI SIR2000 ground penetrating radar (GPR) system coupled to a 400 MHz radar antenna, the 2 above mentioned hand-held metal detectors, and a Radio Detection RD8000 PDL were used to clear six proposed borehole locations south and east of the building.

Figure 2 accurately shows the locations of the cleared borings east of the building. Cars parked atop two additional cleared sampling locations in the south driveway before their coordinates were accurately measured. The locations shown in the figure for those points are estimates.

Jeff Mann and Nikos Tzetos of Pacific Geophysics conducted the survey for Mr. Gil Cobb of Chugwater on December 4, 2012. This report was written by Jeff Mann, reviewed by Nikos Tzetos, and sent to Mr. Cobb on December 7, 2012.

Additional information regarding geophysical surveys is included as an Appendix at the end of this report.

## Limitations

The conclusions presented in this report were based upon widely-accepted geophysical principles, methods and equipment. This survey was conducted with limited knowledge of the site, the site history and the subsurface conditions.

The goal of near-surface geophysics is to provide a rapid means of characterizing the subsurface using non-intrusive methods. Conclusions based upon these methods are generally reliable; however, due to the inherent ambiguity of the methods, no single interpretation of the data can be made. As an example, rocks and roots produce radar reflections that may appear the same as pipes and tanks.

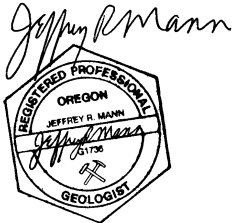
Under reasonable site conditions, geophysical surveys are good at detecting changes in the subsurface caused by manmade objects or changes in subsurface conditions, but they are poor at identifying those objects or subsurface conditions.

Objects of interest are not always detectable due to surface and subsurface conditions. The deeper an object is buried, the more difficult it is to detect, and the less accurately it can be located.

The only way to see an object is to physically expose it.

Jeff Mann  
Pacific Geophysics

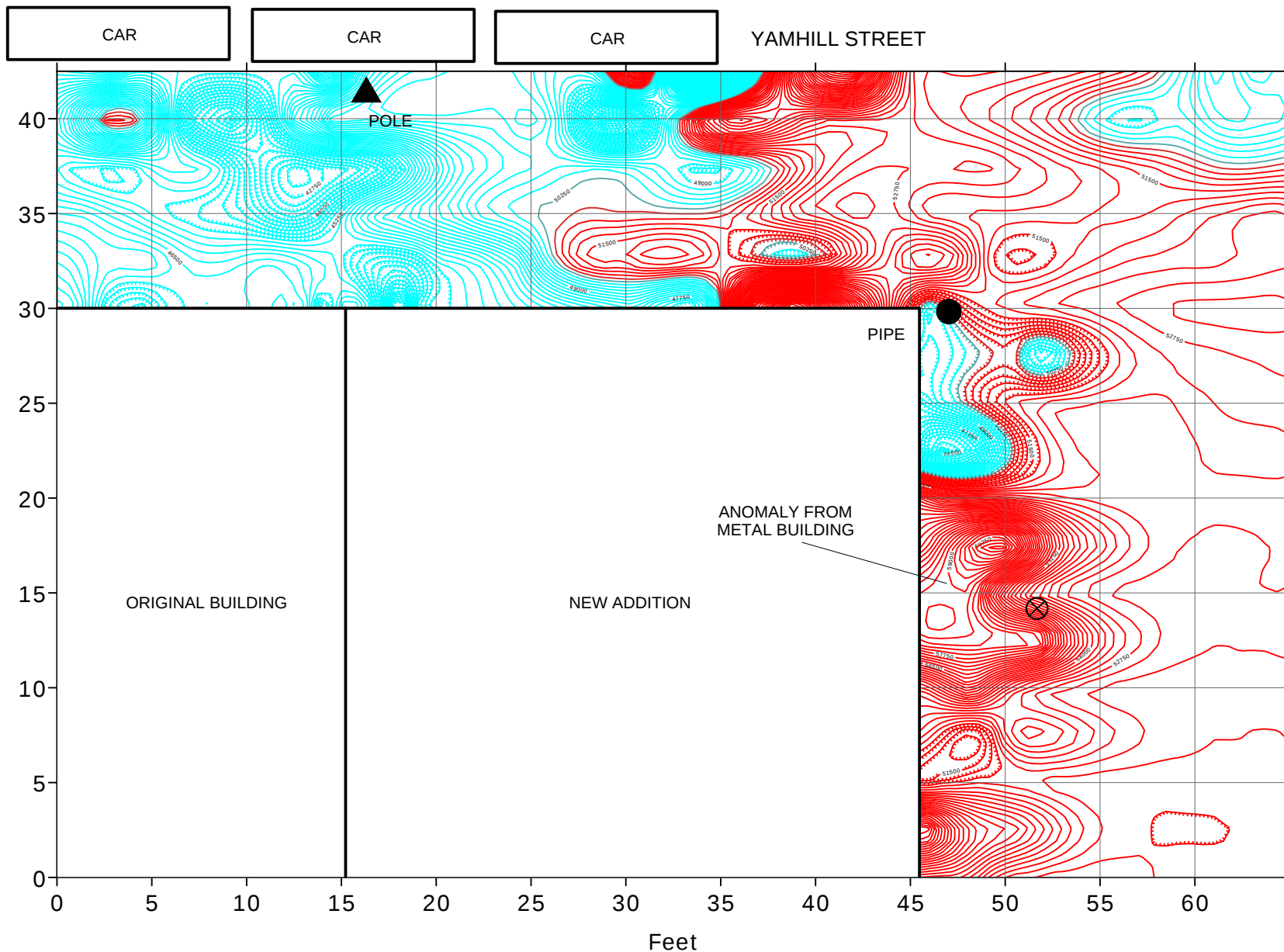
December 4, 2012

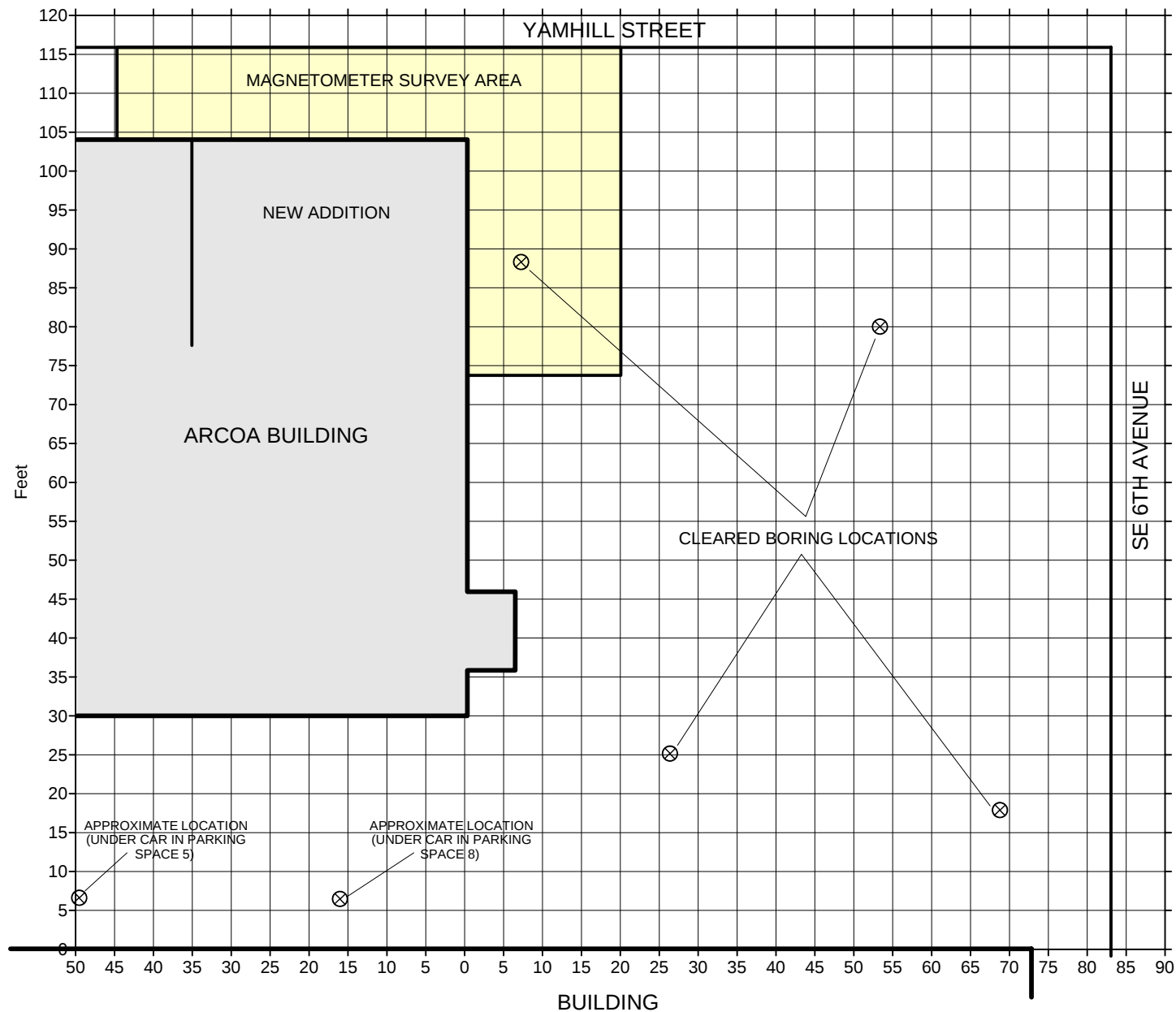


Nikos Tzetos  
Pacific Geophysics

December 4, 2012

A handwritten signature of Nikos Tzetos.





## Appendix A. Geophysical Survey Methods

### Magnetometer Surveys

Small disturbances in the Earth's local magnetic field are called "magnetic anomalies". These may be caused by naturally occurring features such as metallic mineral ore bodies, or from manmade features such as metal buildings, vehicles, fences, and underground storage tanks. The magnetometer only detects changes produced by **ferrous** objects. Aluminum and brass are non-ferrous metals and cannot be detected using a magnetometer.

A magnetometer is an electronic instrument designed to detect small changes in the Earth's local magnetic field. Over the years different technologies have been used in magnetometers. The Geometrics G-858 Portable Cesium Magnetometer used to collect magnetic data for Pacific Geophysics uses one of the most recent methods to detect magnetic anomalies. A detailed discussion describing the method this unit uses is available at [Geometrics.com](http://Geometrics.com).

This magnetometer enables the operator to collect data rapidly and continuously rather than the older instruments that collected data at discrete points only. The G-858 is carried by hand across the site. The sensor is carried at waist level. Typically individual data points collected at normal walking speed are about 6" apart along survey lines usually 5 feet apart, depending on the dimensions of the target objects.

It is critical to know the exact location of each data point so that if an anomaly is detected it can be accurately plotted on a magnetic contour map. At most small sites, data are collected along straight, parallel survey lines set up on the site before the data collection stage begins. For very large, complex sites, the G-858 can be connected to a Global Positioning System (GPS) antenna which allows the operator to collect accurately-located data without establishing a survey grid. With GPS, data are collected and positioned wherever the operator walks. A limitation using GPS is that the GPS antenna must have line of sight with the GPS satellites. Data can be mislocated if the GPS antenna is under trees or near tall buildings.

Data are stored in the unit's memory for later downloading and processing. A magnetic contour map of the data is plotted in the field. Geographical features are plotted on the map. Magnetic anomalies appearing to be caused by objects of interest are then investigated on the site using several small hand-held metal detectors. If an object appears to be a possible object of interest, it may be investigated with GPR.

Magnetic contour maps may be printed in color in order to highlight anomalies caused by ferrous objects located under the magnetic sensor. Usually, ferrous objects situated below the sensor produce magnetic "highs" and anomalies located above the sensor produce magnetic "lows". Magnetic highs are of interest to the operator since most objects of interest are located underground.

Depending on the orientation, shape and mass of a metallic object, a high/low pair of magnetic anomalies may be present. In the northern hemisphere the magnetic low is located north of the object and the magnetic high toward the south. The object producing the anomaly is located part way between the high and the low anomalies.

Magnetometer surveys have limitations. Magnetometers only detect objects made of ferrous (iron-containing) metal. Large ferrous objects (buildings, cars, fences, etc.) within several feet of the magnetometer create interference that may hide the anomaly produced by a nearby object of interest.

### **Ground Penetrating Radar**

A Geophysical Survey Systems, Inc. (GSSI) SIR-2000 GPR system coupled to a 270-, 400-, or 900-MHz GSSI antenna is used to obtain the radar data for our surveys.

GPR antennas both transmit and receive electromagnetic energy. EM energy is transmitted into the material the antenna passes over. A portion of that energy is reflected back to the antenna and amplified. Reflections are displayed in real-time in a continuous cross section. Reflections are produced where there is a sufficient electrical contrast between two materials. Changes in the electrical properties (namely the dielectric constant) that produce radar reflections include the moisture content, porosity, mineralogy, and texture of the material. Metallic objects of interest exhibit a strong electrical contrast with the surrounding material and thus produce relatively strong reflections. Non-metallic objects of interest (septic tanks, cesspools, dry wells, PVC and clay tile pipes) are not always good reflectors.

Radar data are ambiguous. It can be difficult to distinguish the reflection produced by an object of interest from the reflection caused by some natural feature. Rocks or tree roots have reflections that appear similar to reflections from pipes. In concrete investigations reflections produced by metal rebar look exactly like those from electrical conduit or post-tension cables. Objects with too small an electrical contrast may produce no reflections at all and may be missed.

In addition to interpreting ambiguous data, radar has several limitations that cannot be controlled by the operator. The radar signal is severely attenuated by electrically conductive material, including wet, clay-rich soil and reinforced concrete. The quality of the data is affected by the surface conditions over which the antenna is pulled. Ideally the antenna should rest firmly on a smooth surface. Rough terrain and tall grass reduce the quality of radar data.

It is the job of an experienced interpreter to examine the GPR profiles and deduce if reflections are from objects of interest. A GPR interpreter cannot see underground, but can only interpret reflections based on experience.

The only way to truly identify an object is to excavate.

### **Hand-held Metal detectors**

Two small, non recording metal detectors are used to locate suspect magnetic anomalies detected using the G-858 Magnetometer in order to determine the likely cause of the anomaly. First, the magnetic contour map and a Schonstedt Magnetic Gradiometer are used to locate the center of the magnetic anomalies.

Once the anomaly is located an Aqua-Tronics Tracer is used to determine if the object producing the anomaly is a possible object of interest. Most anomalies are at least in part produced by features observed on the ground surface.

*Schonstedt Magnetic Gradiometer:* This magnetometer has two magnetic sensors separated vertically by 10". The magnetic field surrounding a ferrous object is strongest near the object and decreases rapidly as the distance increases. If the magnitude measured by the sensor located in the tip of the Schonstedt is very high, and the magnetic field measured by the sensor located farther up the shaft of the Schonstedt is low, there is a large vertical magnetic gradient and the instrument responds with a loud whistle indicating the object is near the surface. If there is a small difference in the magnitudes measured by the two sensors, the object is deeper. The instrument responds with a softer tone. A discussion of this instrument is available at [Schonstedt.com](http://Schonstedt.com).

*Aqua-Tronics A-6 Tracer:* The Aqua-Tronics A-6 Tracer uses a different method of detecting metallic objects. This instrument measures the electrical conductivity of a metal object. It is capable of detecting any electrically conductive metal, including non-ferrous aluminum and brass. The Tracer is capable of detecting three-dimensional objects as well as pipes.

The Tracer consists of a transmitter coil and a receiver coil. In the absence of any electrically conductive material in the vicinity of the Tracer, the electromagnetic field around each coil is balanced.

Basically the electromagnetic field produced by the transmitter induces an electric current into the area surrounding the instrument. Nearby conductive objects distort the EM field. The balance between the two coils is disturbed and the instrument produces an audible tone and meter indication.