January 2013 Groundwater Monitoring

Former Irondale Iron and Steel Plant Site
Irondale, Washington

for
Washington State Department of Ecology

December 5, 2014

GeoEngineers
Earth Science + Technology

January 2013 Groundwater Monitoring

Former Irondale Iron and Steel Plant Site
Irondale, Washington

for
Washington State Department of Ecology

December 5, 2014

GeoEngineers

Plaza 600 Building
600 Stewart Street, Suite 1700
Seattle, Washington 98101
206-728-2674

January 2013 Groundwater Monitoring

Former Irondale Iron and Steel Plant Site
Irondale, Washington

File No. 0504-042-02

December 5, 2014

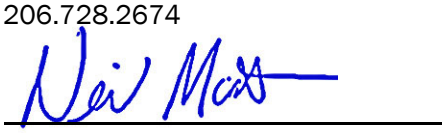
Prepared for:

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

Attention: Steve Teel

Prepared by:

GeoEngineers, Inc.
Plaza 600 Building
600 Stewart Street, Suite 1700
Seattle, Washington 98101
206.728.2674



Neil Morton
Senior Environmental Scientist and Project Lead

David A. Cook, LG, CPG
Principal and Program Manager

NFM:CB:leh

Disclaimer: Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Copyright© 2014 by GeoEngineers, Inc. All rights reserved.

GeoEngineers

Table of Contents

LIST OF TABLES

LIST OF FIGURES

APPENDICES

INTRODUCTION

This report summarizes the results of the January 2013 quarterly groundwater monitoring event (Round 1) at the Former Irondale Iron and Steel Plant Site (Site, also known as Irondale Beach Park) in Irondale, Washington. The Site is a 13-acre property located at 526 Moore Street in the town of Irondale, latitude 48°2' 38" N longitude 122° 45' 60" W, approximately 5 miles south of Port Townsend, Washington (see Vicinity Map, Figure 1). The Site is owned by Jefferson County and is currently used as an undeveloped day-use park (Irondale Beach Park). It is bounded by Port Townsend Bay to the east, residential properties to the south, southwest and northwest, and parklands to the north. The Site includes both upland and aquatic land. The general site layout is shown on the attached Groundwater Monitoring Results – Dissolved Metals, Figure 2.

From 1881 to 1919, iron and steel were produced intermittently at the Site by various owners. Steel plant operations during this time resulted in metals, carcinogenic polycyclic aromatic hydrocarbons (cPAHs) and/or petroleum contamination of soil, sediment and/or groundwater. Washington State Department of Ecology (Ecology) completed a cleanup action consisting of excavation of upland soil and marine sediment along the shoreline that contain chemicals of concern (COC) concentrations greater than Site-Specific cleanup levels, excavation of slag material outside of remedial excavations to facilitate shoreline habitat restoration, and installation of a multi-component environmental cap in two upland areas where surface soil exceeded Site-Specific cleanup levels. The cleanup action was completed in December 2012.

GeoEngineers, Inc. (GeoEngineers) has been providing site characterization, cleanup and groundwater monitoring services at the Site since 2007.

SCOPE OF SERVICES

Groundwater monitoring wells (MW-1 through MW-4) in remedial excavation areas were decommissioned in accordance with the requirements of WAC 173-160, prior to excavating soil. Monitoring well MW-5 was not decommissioned because it is outside the remedial excavation footprint. New wells (MW-6 through MW-9) were installed following completion of remedial excavation activities. The purpose of the groundwater monitoring program is to evaluate the effectiveness of the cleanup action, with respect to protection of groundwater. As outlined in the Engineering Design Report (GeoEngineers, 2012), post-construction groundwater monitoring will be performed quarterly for a minimum of one year.

Our specific scope of services is as follows:

1. Measure the depths to groundwater in each well (MW-5 through MW-9). Estimate groundwater flow direction at the site based on the groundwater depths.
2. Purge approximately three well volumes of water from the wells prior to sampling. Obtain groundwater samples using low-flow methodology in accordance with the field procedures outlined in Appendix A from the five wells for chemical analysis.
3. Submit the groundwater samples to an Ecology-certified laboratory for chemical analysis of diesel- and heavy oil-range hydrocarbons by Ecology Method NWTPH-Dx, dissolved and total carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by EPA Method SW 8270D-SIM, and dissolved metals by EPA Method

200.8. Ecology requested the additional dissolved cPAH analyses to evaluate whether particulates in groundwater adversely affect the total cPAH results.

4. Evaluate the chemical analytical results relative to Site-Specific groundwater cleanup levels consistent with MTCA requirements. Site-specific groundwater cleanup levels are presented in Table 2.

GROUNDWATER MONITORING RESULTS

General

Monitoring wells MW-5 through MW-9 were used to evaluate groundwater flow direction and obtain groundwater samples. Monitoring well MW-5 was installed prior to the cleanup action during the site characterization phase and is located outside of the cleanup action areas. Monitoring wells MW-6 through MW-8 were installed after cleanup action activities within the limits of petroleum- and metals-contaminated soil remedial excavation areas. Monitoring well MW-9 was installed after cleanup action activities within the limits of the metals-contaminated soil remedial excavation area. The approximate locations of the monitoring wells are shown in Figure 2. Groundwater level measurement and sampling procedures are described in Appendix A. Depth to groundwater measurements are presented in Table 1. Groundwater chemical analytical data is summarized in Table 2. A copy of the laboratory report for the January 2013 groundwater analyses is presented in Appendix B.

Monitoring wells MW-5 through MW-9 were surveyed by Van Aller Surveying during February 2013 for creating the "As-Built Map of the Irondale Iron and Steel Plant Cleanup Action."

Groundwater Conditions

Groundwater conditions beneath the Site were evaluated by measuring groundwater levels and obtaining groundwater samples from MW-5 through MW-9 on January 4, 2013. Groundwater depths ranged from approximately 3 to 5 feet below ground surface (bgs) in the monitoring wells. The shallow depths to water in the monitoring wells are attributed to the proximity of Port Townsend Bay located approximately 20 to 60 feet east from the monitoring wells. Based on site topography, the ground surface is relatively flat, though the ground surface elevation is slightly higher in the southern portion of the site (near MW-6 and MW-7) compared to the ground surface in the northern portion of the site. The groundwater flow direction beneath the site based on January 2013 groundwater levels is to the east toward Port Townsend Bay (see Figure 3).

Groundwater Sampling

Groundwater samples from MW-5 through MW-9 were submitted to Analytical Resources, Inc. (ARI) an environmental laboratory in Tukwila, Washington for chemical analysis of diesel- and heavy oil-range hydrocarbons, cPAHs, and dissolved Copper and dissolved Nickel.

- Diesel- and Heavy Oil-range hydrocarbons were not detected in the samples from MW-5 through MW-9.
- cPAH constituents were detected in the samples from MW-6 through MW-8 at concentrations less than the Site-Specific MTCA cleanup levels.

- Dissolved copper was detected in the sample from MW-9 at a concentration (7 µg/L) greater than the site-specific cleanup level of 2.4 µg/L. Dissolved copper was detected in MW-5, MW-6, and MW-7 at concentrations less than the site-specific cleanup level. Dissolved copper was not detected in MW-8.
- Dissolved nickel was detected in the sample from MW-9 at a concentration (90 µg/L) greater than the site-specific cleanup level of 8.2 µg/L. Dissolved nickel was detected at concentrations less than the site-specific cleanup level in the samples from MW-5 though MW-8.

CONCLUSIONS AND RECOMMENDATIONS

Groundwater monitoring is being conducted at the former Irondale Iron and Steel Plant site to evaluate the post-construction effectiveness of the cleanup action as outlined in the Final Engineering Design Report (GeoEngineers, 2012). Groundwater samples obtained during the January 2013 sampling event were analyzed for diesel- and heavy oil-range hydrocarbons, cPAHs, and dissolved copper and dissolved nickel.

- Diesel-and heavy oil-range hydrocarbons were not detected in the five monitoring wells.
- cPAH constituents were detected at concentrations less than the site-specific groundwater cleanup levels in the five monitoring wells for both total and dissolved cPAHs. Because dissolved and total cPAH results were similar, we recommend only testing for total cPAHs in subsequent monitoring events.
- Dissolved copper and nickel were detected in the sample from MW-9 at concentrations greater than their respective site-specific cleanup levels. These metals were not detected or were detected at concentrations less than the site-specific cleanup levels in the other wells.

The January 2013 groundwater monitoring event is the first of the four planned quarterly groundwater monitoring events.

LIMITATIONS

We have prepared this report for use by the Washington State Department of Ecology. The information contained herein is not intended for use by others and it is not applicable to other sites. No other (third) party may rely on the product of our services unless we agree in advance and in writing to such reliance.

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

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

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

REFERENCES

GeoEngineers, 2009, "Revised Draft Remedial Investigation/Feasibility Study Report, Irondale Iron and Steel Plant, Irondale, Washington, Ecology Facility/Site No. 95275518." GEI File No. 0504-042-01, August 13, 2009.

GeoEngineers, 2012, "Final Engineering Design Report, Irondale Iron and Steel Plant, Irondale, Washington." GEI File No. 0504-042-02, May 1, 2012.

TABLES

GeoEngineers

Table 1

Summary of Groundwater Level Measurements

Former Irondale Iron and Steel Plant Site

Irondale, Washington

Groundwater Monitoring Well[1]	Quarterly Groundwater Monitoring Event	Date Measured	Top of Casing Elevation[2] (feet)	Depth to Water from Top of Casing (feet)	Groundwater Elevation[2] (feet)
MW-5	Round 1	1/4/2013	13.97	5.01	8.96
MW-6	Round 1	1/4/2013	17.04	3.23	13.81
MW-7	Round 1	1/4/2013	15.98	5.08	10.90
MW-8	Round 1	1/4/2013	11.93	4.00	7.93
MW-9	Round 1	1/4/2013	11.77	4.83	6.94

Notes:

[1]Monitoring well locations are shown on Figure 2.

[2]Elevation is referenced to Mean Lower Low Water (MLLW). Elevation measurements were obtained from "ASBUILT MAP" provided by Van Aller Surveying to Anderson Environmental Contracting, LLC dated February 2013. Top of casing elevations were estimated by subtracting the distance between the top of the monument and the top of the casing at each well.

Table 2

Summary of Groundwater Chemical Analytical Data - Petroleum Hydrocarbons, cPAHs and Dissolved Metals[1]

Former Irondale Iron and Steel Plant Site

Irondale, Washington

Groundwater Sample Identification[2]	Quarterly Groundwater Monitoring Event	Sample Date	Petroleum Hydrocarbons[3]		Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)[4]									Dissolved Metals[5]	
			Diesel-Range	Heavy Oil-Range	Total or Dissolved cPAH	Benzo[a]anthracene	Chrysene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Indeno(1,2,3-c,d)pyrene	Dibenz[a,h]anthracene	Total cPAH - TEQ[4]	Copper	Nickel
MW-5-130104	Round 1	1/4/2013	100 U	200 U	–	–	–	–	–	–	–	–	–	**1.3**	**5.6**
MW-6-130104[6] (includes total cPAHs)	Round 1	1/4/2013	100 U	200 U	Total	0.010 U	**0.0066 J**	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	**0.00757 J**	**0.8**	**5.8**
	Round 1	1/4/2013	–	–	Dissolved	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	**–**	**–**
MW-7-130104 (includes total cPAHs)	Round 1	1/4/2013	100 U	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	**0.8**	**4.4**
	Round 1	1/4/2013	–	–	Dissolved	0.010 U	**0.0072 J**	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	**0.00757 J**	**–**	**–**
MW-8-130104 (includes total cPAHs)	Round 1	1/4/2013	100 U	200 U	Total	**0.0075 J**	**0.0094 J**	**0.0063 J**	0.010 U	**0.0078 J**	0.010 U	0.010 U	**0.0108 J**	0.5 U	**5**
	Round 1	1/4/2013	–	–	Dissolved	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	**–**	**–**
MW-9-130104[6]	Round 1	1/4/2013	100 U	200 U	–	–	–	–	–	–	–	–	–	**7**	**90**
Site-Specific Groundwater Cleanup Level[7]			500	500	–	see TEQ	see TEQ	see TEQ	see TEQ	see TEQ	see TEQ	see TEQ	0.018	2.4	8.2

Notes:

[1]Reported results are in micrograms per liter (µg/L).

[2]Groundwater monitoring well locations are shown in Figure 2.

[3]Petroleum Hydrocarbons analyzed using NWTPH-Dx.

[4]cPAHs analyzed using EPA method 8270D-SIM. Total carcinogenic PAHs (cPAHs) calculated using toxic equivalent (TEQ) methodology relative to benzo(a)pyrene. cPAHs that were not detected were assigned a value of one half of the reporting limit for these calculations. Samples analyed for dissolved cPAHs were laboratory filtered using a 0.7 µm borosilicate glass, binder free filter.

[5]Dissolved Metals analyzed using EPA method 200.8 (field filtered).

[6]A field duplicate groundwater sample was obtained from this monitoring well (diesel- and heavy oil-range and cPAHs for MW-6 and metals for MW-9). Higher of the two detected concentrations (parent and field duplicate) is reported for each of the analyte.

[7]Site-specific groundwater cleanup level is referenced from Table 1 of the Final Enigneering Design Report (GeoEngineers, 2012).

MTCA = Model Toxics Control Act

– = not analyzed. Monitoring wells are located in the area remediated due to metals contamination.

U = Laboratory qualifier indicating analyte not detected at level above listed reporting limit.

Bold indicates analyte was detected.

Chemical analyses performed by Analytical Resources. Inc., in Tukwila, Washington.

Shaded values represent concentrations greater than the Site-Specific cleanup level.

FIGURES

GeoEngineers

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps, Street Maps 2005

Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

Vicinity Map

Irondale Iron and Steel Plant
Irondale, Washington

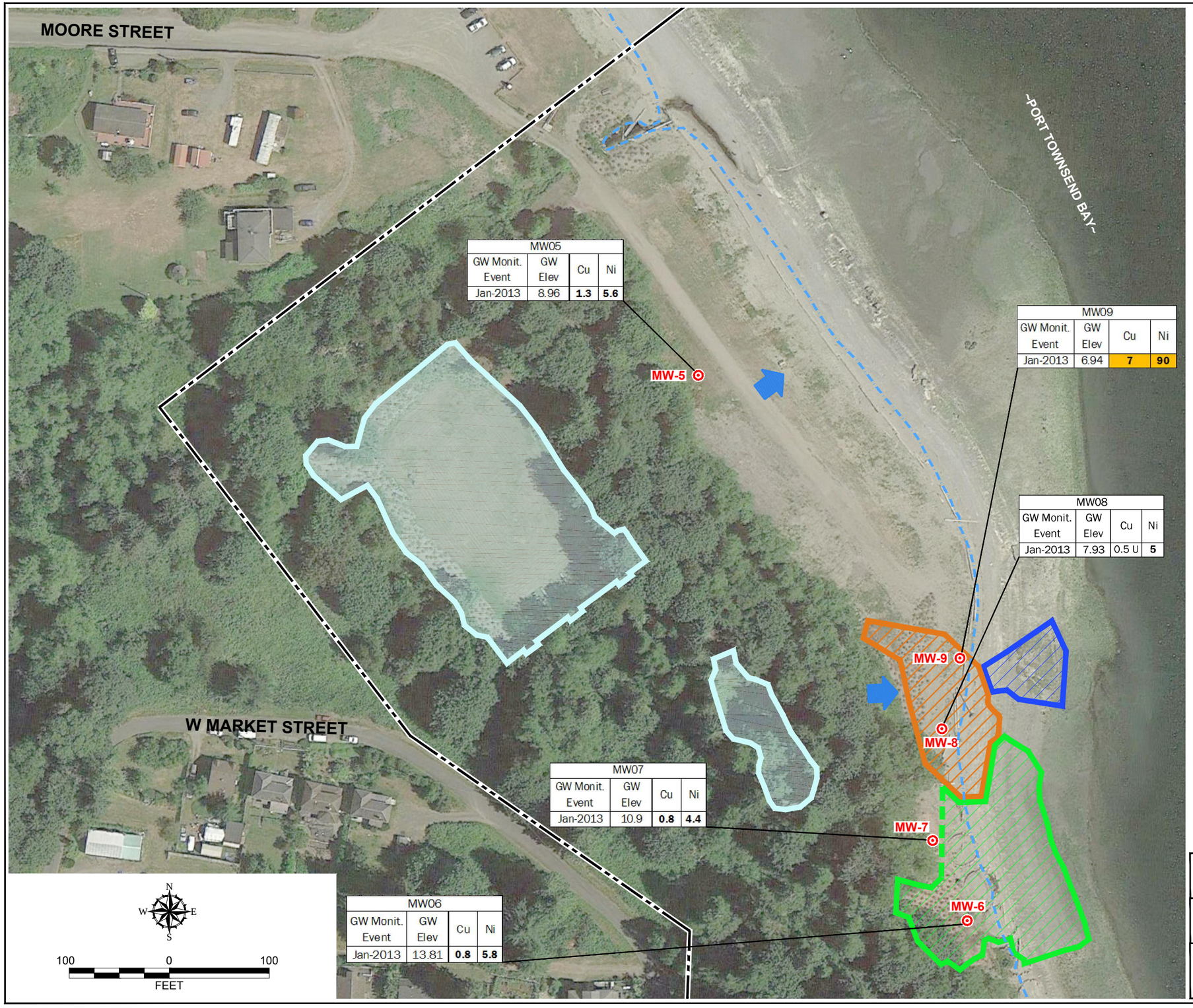
GeoEngineers

Figure 1

Map Revised: May 24, 2007

Path: P:\0504042\00\GIS\0504042 00_FIG-1.mxd

Office: SEA



Legend

- Site Boundary
- Ordinary High Water (Estimated at Elevation 10.5 feet)
- Metals Area - Excavation
- Metals Area - Cap
- TPH Area - Excavation
- Slag Outcrop - Removal
- MW-1 Monitoring Well Location
- Assumed Groundwater Flow Direction

Data Box Explanation:

GW Monit. = Groundwater Monitoring

GW Elev = Groundwater Elevation in feet

Cu = Dissolved Copper

Ni = Dissolved Nickel

Exceedance of site-specific groundwater cleanup level (Cu = 2.4 µg/L; Ni = 8.2 µg/L)

U = Analyte not detected above method reporting limit

Groundwater results in µg/L

Notes

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Dissolved metals (Copper and Nickel) were analyzed using EPA Method 200.8. Samples were field filtered.
4. TPH and PAH results are presented in Table 2.

Reference: Aerial photo (July 2013) from Google Earth Pro.

Groundwater Monitoring Results - Dissolved Metals

Irondale Iron and Steel Plant
Irondale, Washington

GeoEngineers

Figure 2

W:\Seattle\Projects\0\0504042\02\CAD\0504042202_Monitoring Plan 10.5 OHW_QI.dwg\TAB:Fig 2 modified by mhirsch on Dec 02, 2013 - 12:58

Legend

- Site Boundary
- Ordinary High Water (Estimated at Elevation 10.5 feet)
- MW-1 — Monitoring Well Location
- (8.96) — Groundwater Elevation (feet)
- 8 — Groundwater Elevation Contour (feet)
- Groundwater Flow Direction

Notes

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

Reference: Aerial photo (July 2013) from Google Earth Pro.

January 2013
Groundwater Elevation Contours

Former Irondale Iron and Steel Plant
Irondale, Washington

GeoEngineers

Figure 3

P:\0\0504042\02\CAD\2013 GW Elevation Contour Figures\January 2013 GW Elevation Contours.dwg\TAB:Fig 2 modified by tmichaud on Nov 26, 2014 - 14:10

APPENDICES

GeoEngineers

APPENDIX A
Field Procedures and Monitoring Well Construction Logs

APPENDIX A
FIELD PROCEDURES AND MONITORING WELL CONSTRUCTION LOGS

General

Monitoring well MW-5 was constructed at the Former Irondale Iron and Steel Plant Site (Site) in June 2007 and MW-6 through MW-9 were constructed at the Site in December 2012 after remedial activities had been completed. The monitoring well construction details for MW-5 through MW-9 are presented in this appendix.

Groundwater Monitoring Well Installation

Monitoring wells MW-6 through MW-9 were installed using direct-push drilling methods in accordance with WAC 173-160 Minimum Standards for Construction and Maintenance of Wells. The monitoring wells were constructed using 1-inch diameter, Schedule 40, threaded, polyvinyl chloride (PVC) casing with screen intervals spanning the water table. Well screens consisted of 1-inch diameter, Schedule 40, 0.010-inch machine-slotted, PVC well screens. Monitoring well construction is shown on the well construction logs presented in this appendix.

The 0.010-inch slot size was selected based on review of boring logs from the 2009 remedial investigation, which indicated that the shallow water-bearing zone consists primarily of silty, fine to medium sands with minor amounts of gravel.

The filter pack for the wells consists of 10-20 silica sand with the appropriate grain size distribution to limit entry of fine-grained particulates from the surrounding formation into the wells. The filter pack in each well extends from the bottom of the well screen to at least one foot above the top of the well screen.

The annular seal in each well consists of a 1-foot, or lesser, thick layer of hydrated bentonite pellets or chips installed between the filter pack and a 1.5-foot thick concrete surface seal. Monuments consisted of flush completions.

Monitoring Well Development

The new monitoring wells MW-6 through MW-9 were developed directly following installation to allow the sand pack to set and to establish hydraulic connection between the well and the aquifer. Prior to development, the depth to water in the well and the total well depth was measured and recorded. The wells were developed using a combination of surging and purging using a submersible pump until at least five well casing volumes are removed and discharge ran clear (free of visible turbidity).

Depth to Groundwater Measurements

The depth to groundwater was measured in the monitoring wells using an electric water level indicator. The depth to groundwater was measured relative to the top of the well casings. Water level measurement equipment was washed in a Liqui-Nox® solution, followed by a distilled water rinse prior to use in the well.

Groundwater Sample Collection and Handling

Groundwater samples were obtained from monitoring wells MW-5 through MW-9 in January 2013.

Groundwater samples were obtained from monitoring wells using a peristaltic pump and disposable polyethylene tubing. Groundwater was pumped at approximately 0.5 liter per minute using a peristaltic pump through tubing placed within the screened interval. A Horiba U-22 water quality measuring system with flow-through cell was used to monitor the following water quality parameters during purging: electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, turbidity, and temperature. Groundwater samples were obtained once ambient groundwater conditions were reached. Groundwater conditions were considered ambient once the measured parameters varied by less than 10 percent on three consecutive measurements taken approximately 3 minutes apart. The stabilized field measurements are documented in the attached Groundwater Sample Collection Forms.

Samples for dissolved metals analysis were field filtered by pumping water through a 0.45 micron filter directly into the sample container using a peristaltic pump. Samples for dissolved cPAHs analysis were lab filtered using a 0.7 micron glass fiber filter. Groundwater samples obtained were transferred to laboratory-prepared sample jars. Sample containers were filled to minimize headspace. The samples were placed in a cooler with ice pending transport to the analytical laboratory. Samples requiring preservative (e.g., HCl for diesel- and oil-range hydrocarbon analyses) contained the proper preservative in the laboratory-prepared bottles. Chain-of-custody procedures were followed in transporting the samples to the laboratory.

Investigative Wastes

Purge water was removed from the monitoring well casings on January 4, 2013 prior to collecting groundwater samples. Approximately 4 gallons of water generated during the well sampling activities were disposed in the sanitary sewer at GeoEngineers' office in Redmond, Washington in January 2013.

GROUNDWATER SAMPLE COLLECTION FORM

Project: IRONDALE STEEL PLANT | Job No. 0504-042-02 | Collector: FK | Sample ID: MW05-130104

PURGE DATA

Well Condition: Secure [X] Yes [ ] No | Describe Damage: NONE

(Padlock brand and number)

Depth to Water (from top of well casing): 5.01 FT

Depth to Base of Well: 16.75 | Height of Water Column:

Well Casing Type/Diameter: 1-INCH

One Casing Volume (gal.):

Purge Method | Pump (type): PERISTALTIC | Bailer (type):

Gallons Purged: 0.25

(Remove minimum of 3 well volumes or until field parameters stabilize)

Purge Water Storage/Disposal: BUCKET

(Drum identification, sample analysis, sample results, storage location, etc.)

Diameter (in.)	OD	ID	Volume Gal./ Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625	7.981	2.6

SAMPLING DATA

Date Collected (mo/dy/yr): 01/04/13

Sample Location and Depth: MW-5 | Time Collected: 1730

Tidal Cycle NA [ ] | High Tide at | Low Tide at | Weather: OVERCAST

Sample type (Groundwater, Product, Other): GW

Sample Collected with [ ] Bailer [X] Pump [ ] Other

Made of [ ] Stainless Steel [ ] PVC [ ] Teflon [X] Disposable LDPE [ ] Other

Sampler Decon Procedure: ALCONOX & DISTILLED WATER

Sample Description (color, free product thickness, odor, turbidity, etc.): NONE

FIELD PARAMETERS

Time	Depth to Water (feet)	Purge Volume (gallons)	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved O_2 (ppm)	Temperature (F/C)	ORP (mV)	SAL	TDS mg/L	
1700	5.01	1500	3.64	82.8	5.1	12.2	8.8	55	0	0.53	
1705		500	3.76	80.8	5.2	10.56	8.8	50	0	0.52	
1710		500	3.78	79.3	5.7	10.04	8.7	51	0	0.51	
1715		500	3.8	78.5	5.0	9.6	8.7	51	0	0.5	
1720		500	3.8	78.4		9.4	8.7	50	0	0.5	

Meters Used for Measurement: HORIBA U-22

pH/Con./DO Instrument Calibration [X] Yes [ ] No | E-Tape: ✓

ADDITIONAL INFORMATION

Samples Composited Overtime, Distance

Analyses, Number and Volume of Sample Containers

Duplicate Sample Number(s)

Comments: (Filtered, Not Filtered, Calculations, etc.)

Signature: FK | Date: 01/04/13 | Page of

Check if additional information on back [ ]

GROUNDWATER SAMPLE COLLECTION FORM

Project IRONDALE STEEL PLANT Job No. 0504-042-02 Collector EK Sample ID MW-06-130104

PURGE DATA

Well Condition: Secure [X] Yes [ ] No Describe Damage NONE
(Padlock brand and number)

Depth to Water (from top of well casing) 3.23 FT
Depth to Base of Well 11.25 FT Height of Water Column
Well Casing Type/Diameter 1-INCH
One Casing Volume (gal.)
Purge Method Pump (type) PERISTALTIC Bailer (type)
Gallons Purged 0.5 gal
(Remove minimum of 3 well volumes or until field parameters stabilize)
Purge Water Storage/Disposal 0 BUCKET
(Drum identification, sample analysis, sample results, storage location, etc.)

Diameter (in.)	OD	ID	Volume Gal./ Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625	7.981	2.6

SAMPLING DATA

Date Collected (mo/dy/yr) 01/04/13
Sample Location and Depth MW-06 Time Collected 1620
Tidal Cycle NA [ ] High Tide at Low Tide at Weather OVERCAST
Sample type (Groundwater, Product, Other) GW
Sample Collected with [ ] Bailer [X] Pump [ ] Other
Made of [ ] Stainless Steel [ ] PVC [ ] Teflon [X] Disposable LDPE [ ] Other
Sampler Decon Procedure LIQUINOX & DISTILLED WATER
Sample Description (color, free product thickness, odor, turbidity, etc.)

FIELD PARAMETERS

Time	Depth to Water (feet)	Purge Volume (gallons)	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved ~~mg/L~~ O_2 ~~(ppm)~~	Temperature (F/C)	ORP (mV)	SAL (%)	TDS g/L	
1355	3.23	1500	6.20	69.2	82.4	13.50	8.2	-57	0	0.45	
1400		500	6.16	71.3	31.3	13.11	8.3	-61	0	0.46	
1405		500	6.21	71.9	16.1	12.5	8.3	-66	0	0.46	
1410		500	6.27	70.4	10.2	11.71	8.3	-71	0	0.45	
1412		200	6.34	70.1	8.1	11.43	8.3	-74	0	0.44	
1415		300	6.40	69.8	7.6	11.03	8.3	-88	0	0.42	
1420		500	6.42	68.1	7.3	11.01	8.3	-84	0	0.41	
1425		500	6.44	67.1	7.1	11.01	8.3	-86	0	0.41	

Meters Used for Measurement HORIBA U-22
pH/Con./DO Instrument Calibration [X] Yes [ ] No E-Tape ✓

ADDITIONAL INFORMATION

Samples Composited Overtime, Distance
Analyses, Number and Volume of Sample Containers DUP FOR TPH.
Duplicate Sample Number(s)
Comments: (Filtered, Not Filtered, Calculations, etc.)

Signature Date 01/04/13 Page of

Check if additional information on back [ ]

GROUNDWATER SAMPLE COLLECTION FORM

Project TRONDALE STEEL PLANT Job No. 0504-042-02 Collector FK Sample ID MW07-1B0104

PURGE DATA

Well Condition: Secure [ ] Yes [ ] No Describe Damage

(Padlock brand and number) 5.08 FT

Depth to Water (from top of well casing) 5.08 FT

Depth to Base of Well 11.75 FT Height of Water Column

Well Casing Type/Diameter 1-1INCH

One Casing Volume (gal.)

Purge Method Pump (type) PERISTALTIC Bailer (type)

Gallons Purged 0.75 gal

(Remove minimum of 3 well volumes or until field parameters stabilize)

Purge Water Storage/Disposal BUCKET

(Drum identification, sample analysis, sample results, storage location, etc.)

Diameter (in.)	OD	ID	Volume Gal./ Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625	7.981	2.6

SAMPLING DATA

Date Collected (mo/dy/yr) 01/04/13

Sample Location and Depth MW-7 Time Collected 1510

Tidal Cycle NA [ ] High Tide at Low Tide at Weather OVERCAST

Sample type (Groundwater, Product, Other) GW

Sample Collected with [ ] Bailer [X] Pump [ ] Other

Made of [ ] Stainless Steel [ ] PVC [ ] Teflon [X] Disposable LDPE [ ] Other

Sampler Decon Procedure

Sample Description (color, free product thickness, odor, turbidity, etc.) NONE

FIELD PARAMETERS

Time	Depth to Water (feet)	Purge Volume (gallons)	pH	Conductivity (mS/m)	Turbidity (NTU)	Dissolved O_2 (ppm)	Temperature (F/C)	ORP (mV)	SAL (%)	TDS mg/L	
1450	5.08	1500	6.16	39.9	238.1	11.38	8.8	-90	0	0.26	
1455		500	6.39	41.1	152.2	10.02	8.8	-102	0	0.26	
1500		500	6.53	39.2	70.0	9.22	8.8	-110	0	0.25	
1505		500	6.52	39.4	22.0	9.04	8.7	-112	0	0.26	
1510		500	6.51	39.3	10.1	9.01	8.7	-114	0	0.26	

Meters Used for Measurement HORIBA U-22

pH/Con./DO Instrument Calibration [X] Yes [ ] No E-Tape ✓

ADDITIONAL INFORMATION

Samples Composited Overtime, Distance

Analyses, Number and Volume of Sample Containers

Duplicate Sample Number(s)

Comments: (Filtered, Not Filtered, Calculations, etc.)

Signature Date 01/04/13 Page of

Check if additional information on back [ ]

GROUNDWATER SAMPLE COLLECTION FORM

Project IRONDALE STEEL PLANT Job No. 0504-042-02 Collector FK Sample ID MW08-130104

PURGE DATA

Well Condition: Secure [X] Yes [ ] No Describe Damage NONE

(Padlock brand and number)

Depth to Water (from top of well casing) 4.0 FT

Depth to Base of Well 12.15 FT Height of Water Column

Well Casing Type/Diameter 1-INCH

One Casing Volume (gal.)

Purge Method Pump (type) PERISTALTIC Bailer (type)

Gallons Purged 0.25 gal

(Remove minimum of 3 well volumes or until field parameters stabilize)

Purge Water Storage/Disposal BUCKET

(Drum identification, sample analysis, sample results, storage location, etc.)

Diameter (in.)	OD	ID	Volume Gal./ Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625	7.981	2.6

SAMPLING DATA

Date Collected (mo/dy/yr) 01/04/13

Sample Location and Depth MW-8 Time Collected 1600

Tidal Cycle NA [ ] High Tide at Low Tide at Weather OVERCAST

Sample type (Groundwater, Product, Other) GW

Sample Collected with [ ] Bailer [X] Pump [ ] Other

Made of [ ] Stainless Steel [ ] PVC [ ] Teflon [X] Disposable LDPE [ ] Other

Sampler Decon Procedure

Sample Description (color, free product thickness, odor, turbidity, etc.) NONE

FIELD PARAMETERS

Time	Depth to Water (feet)	Purge Volume (gallons) (mL)	pH	Conductivity (mS/m)	Turbidity (NTU)	Dissolved O_2 (mg/L ppm)	Temperature (F/C)	ORP (mV)	SAL	TDS SIL
1545	15	1500	5.86	62.9	248.1	11.36	9.0	-74	0	0.4
1550		500	5.89	63.2	123.4	10.73	9.0	-75	0	0.4
1555		500	5.91	63.5	27.2	9.82	9.0	-79	0	0.4
1600		500	5.93	63.8	6.5	9.72	9.0	-78	0	0.4

Meters Used for Measurement HORIBA U-22

pH/Con./DO Instrument Calibration [X] Yes [ ] No E-Tape ✓

ADDITIONAL INFORMATION

Samples Composited Overtime, Distance

Analyses, Number and Volume of Sample Containers

Duplicate Sample Number(s)

Comments: (Filtered, Not Filtered, Calculations, etc.)

Signature Date 01/04/13 Page of

Check if additional information on back [ ]

GROUNDWATER SAMPLE COLLECTION FORM

Project IRONDALE STEEL PLANT Job No. 0504-042-01 Collector FK Sample ID MW09-130104

PURGE DATA

Well Condition: Secure [X] Yes [ ] No Describe Damage NONE

(Padlock brand and number)

Depth to Water (from top of well casing) 4.83 FT

Depth to Base of Well 17.05 Height of Water Column

Well Casing Type/Diameter 1- INCH

One Casing Volume (gal.)

Purge Method Pump (type) PERISTALTIC Bailer (type)

Gallons Purged 0.5

(Remove minimum of 3 well volumes or until field parameters stabilize)

Purge Water Storage/Disposal BUCKET

(Drum identification, sample analysis, sample results, storage location, etc.)

Diameter (in.)	OD	ID	Volume Gal./ Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625	7.981	2.6

SAMPLING DATA

Date Collected (mo/dy/yr) 01 04 13 Time Collected 1315

Sample Location and Depth MW09 Weather OVERCAST

Tidal Cycle NA [ ] High Tide at Low Tide at

Sample type (Groundwater, Product, Other) GW

Sample Collected with [ ] Bailer [X] Pump [ ] Other

Made of [ ] Stainless Steel [ ] PVC [ ] Teflon [X] Disposable LDPE [ ] Other

Sampler Decon Procedure LIQUINOX & DISTILLED WATER

Sample Description (color, free product thickness, odor, turbidity, etc.) NONE

FIELD PARAMETERS

Time	Depth to Water (feet)	Purge Volume (gallons) (w.l.)	pH	Conductivity (S/m)	Turbidity (NTU)	Dissolved $mg/L O_2$ (ppm)	Temperature (F/C)	ORP (mV)	SALINITY ‰	TDS g/L	
1300	4.83	1500	4.13	2.81	131.0	17.59	10.0	67	1.7	.17	
1305		500	4.29	2.78	89.0	17.91	10.0	64	1.7	.17	
1310		500	4.31	2.76	75.0	17.43	10.1	58	1.7	.17	
1315		500	4.31	2.72	7.1	17.18	10.0	55	1.6	.17	

Meters Used for Measurement E-TAPE, HORIBA U-22

pH/Con./DO Instrument Calibration [X] Yes [ ] No E-Tape ✓

ADDITIONAL INFORMATION

Samples Composited Overtime, Distance

Analyses, Number and Volume of Sample Containers

Duplicate Sample Number(s) DUP FOR METALS

Comments: (Filtered, Not Filtered, Calculations, etc.) FILTERED

Signature Date 01/04/13 Page 1 of 1

Check if additional information on back [ ]

GeoEngineers

SOIL CLASSIFICATION CHART

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

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

ADDITIONAL MATERIAL SYMBOLS

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

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

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

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

Laboratory / Field Tests

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

Sheen Classification

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

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

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE A-1

Start / End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
Drilled 6/26/2007	20	AJS / RMB	ESN Northwest	Direct Push

Hammer Data		Drilling Equipment	AMS Powerprobe 9630
Surface Elevation (ft) Vertical Datum	14.57	Top of Casing Elevation (ft)	
Latitude Longitude		Horizontal Datum	N/A

A (in) well was installed on to a depth of 20 (ft).
Well was developed on 6/26/2007.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
6/26/2007	7.00	7.57

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered %	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		92			1			TS	Brown silty fine to coarse sand (moist) (topsoil)	NS	
									SP	Light brown fine to medium sand with trace silt (moist) (fill)		
									SP	Light brown fine to medium sand with occasional shell fragments (moist)		
	5		92								NS	
						2 CA			SP	Dark gray/brown fine to medium sand with occasional shell fragments (wet) (native sediment)		
			92									
	10								SW	Gray/brown fine to coarse sand with trace silt and occasional shell fragments (wet)		
						3					SS	
			92						SP-SM	Brown/gray fine sand with silt and occasional shell fragments (wet)		
	15		92									
									SM	Gray silty fine sand (wet)		
	20											

WELL LOG

Steel surface monument
Concrete surface seal
2.0'
Bentonite seal
3.0'
¾ inch schedule 40 solid PVC pipe
4.0'
Medium sand backfill
¾ inch schedule 40 PVC pipe with 0.020 slot width
19.0'
Natural soil backfill
20.0'

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

Log of MONITORING WELL MW05 (DP05)

GeoEngineers

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

Figure A-2
Sheet 1 of 1

Seattle: Date:4/4/13 Path:R:\0\0504042\GINT\0504042OO.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Drilled Start 12/14/2012	End 12/14/2012	Total Depth (ft) 12.5	Logged By FK / Checked By NFM	Driller Cascade Drilling, LP	Drilling Method Direct Push

Hammer Data	Drilling Equipment: Geoprobe 7730 DT	DOE Well I.D.: BHS 616 A 1 (in) well was installed on 12/14/2012 to a depth of 12.5 (ft).
Surface Elevation (ft) Vertical Datum: 17.52	Top of Casing Elevation (ft): 17.27	Groundwater: Date Measured 1/4/2013; Depth to Water (ft) 3.23; Elevation (ft) 14.04
Easting (X) Northing (Y)	Horizontal Datum	

Notes:

FIELD DATA: Interval Recovered (in); Blows/foot; Collected Sample; Sample Name; Water Level

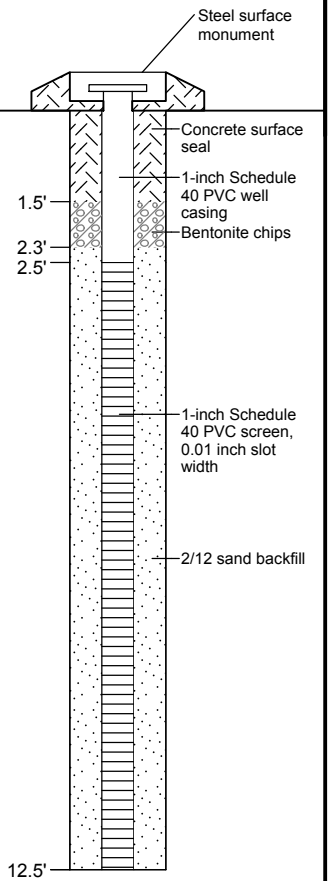
Elevation (feet); Depth (feet); Graphic Log; Group Classification; MATERIAL DESCRIPTION; Sheen; Headspace Vapor (ppm)

0 — 5 — 10 — 15 — 20

Groundwater encountered

Refusal encountered at 12.5 feet bgs. Above refusal backfill placed during the Dec 2012 remedial excavation was encountered. Backfill consisted of beach sand graded from the site, and imported sand.
No soil samples were obtained during well installation.

WELL LOG



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

Log of Monitoring Well MW-6

GeoEngineers

Project: Irondale Former Iron and Steel Plant
Project Location: Port Hadlock, Washington
Project Number: 0504-042-02

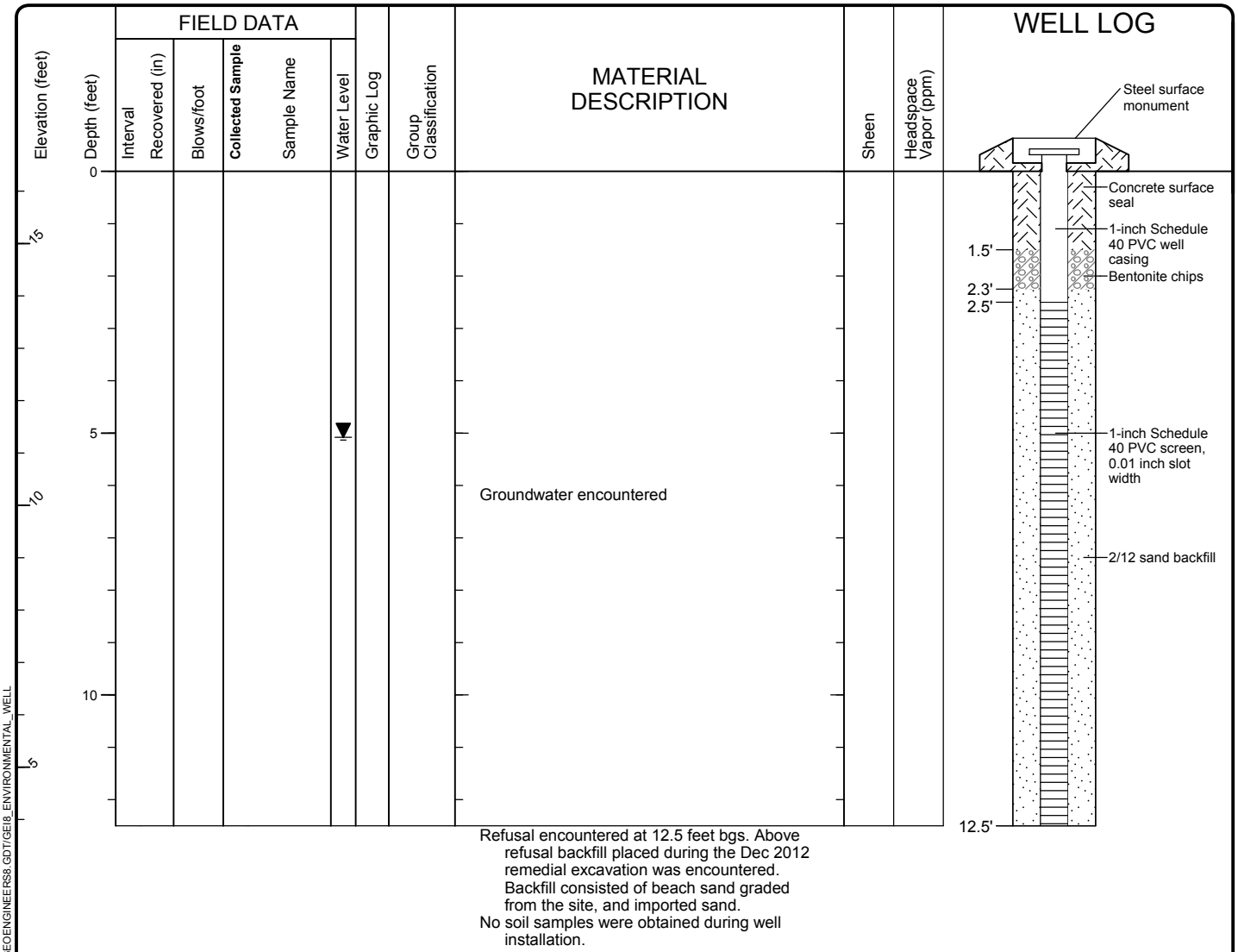
Figure A-3
Sheet 1 of 1

Seattle: Date:4/4/13 Path:C:\USERS\CVOSS\DESKTOP\050404202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Drilled Start 12/14/2012	End 12/14/2012	Total Depth (ft) 12.5	Logged By FK / Checked By NFM	Driller Cascade Drilling, LP	Drilling Method Direct Push

Hammer Data	Drilling Equipment: Geoprobe 7730 DT	DOE Well I.D.: BHS 439 A 1 (in) well was installed on 12/14/2012 to a depth of 12.5 (ft).
Surface Elevation (ft) Vertical Datum: 16.38	Top of Casing Elevation (ft): 16.13	Groundwater: Date Measured 1/4/2013; Depth to Water (ft) 5.08; Elevation (ft) 11.05
Easting (X) Northing (Y)	Horizontal Datum	

Notes:



Refusal encountered at 12.5 feet bgs. Above refusal backfill placed during the Dec 2012 remedial excavation was encountered. Backfill consisted of beach sand graded from the site, and imported sand.
No soil samples were obtained during well installation.

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

Log of Monitoring Well MW-7

GeoEngineers

Project: Irondale Former Iron and Steel Plant
Project Location: Port Hadlock, Washington
Project Number: 0504-042-02

Figure A-4
Sheet 1 of 1

Seattle: Date:4/4/13 Path:C:\USERS\CVOSS\DESKTOP\050404202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Start / End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
Drilled 12/14/2012 / 12/14/2012	14.5	FK / NFM	Cascade Drilling, LP	Direct Push

Hammer Data		Drilling Equipment	Geoprobe 7730 DT
Surface Elevation (ft) Vertical Datum	12.28	Top of Casing Elevation (ft)	12.03
Easting (X) Northing (Y)		Horizontal Datum	

DOE Well I.D.: BHS 438
A 1 (in) well was installed on 12/14/2012 to a depth of 12.5 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1/4/2013	4.00	8.03

Notes:

FIELD DATA: Interval Recovered (in); Blows/foot; Collected Sample; Sample Name; Water Level

Elevation (feet) / Depth (feet): 0, 5, 10

Graphic Log; Group Classification

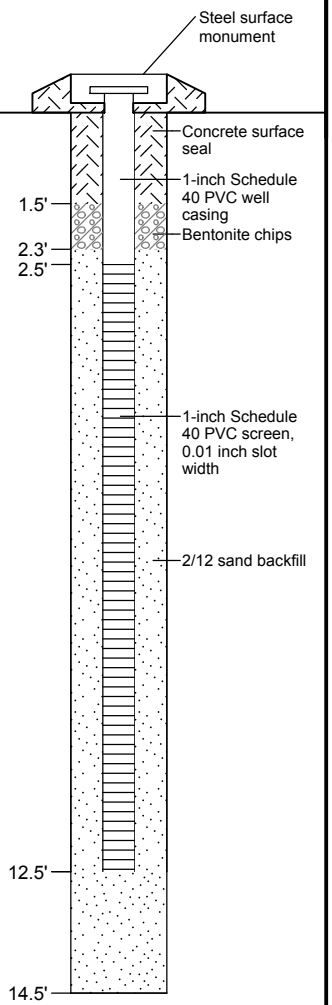
MATERIAL DESCRIPTION

Groundwater encountered

Refusal encountered at 14.5 feet bgs. Above refusal backfill placed during the Dec 2012 remedial excavation was encountered. Backfill consisted of beach sand graded from the site, and imported sand.
No soil samples were obtained during well installation.

Sheen; Headspace Vapor (ppm)

WELL LOG



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

Log of Monitoring Well MW-8

GeoEngineers

Project: Irondale Former Iron and Steel Plant
Project Location: Port Hadlock, Washington
Project Number: 0504-042-02

Figure A-5
Sheet 1 of 1

Seattle: Date:4/4/13 Path:C:\USERS\CVOSS\DESKTOP\050404202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

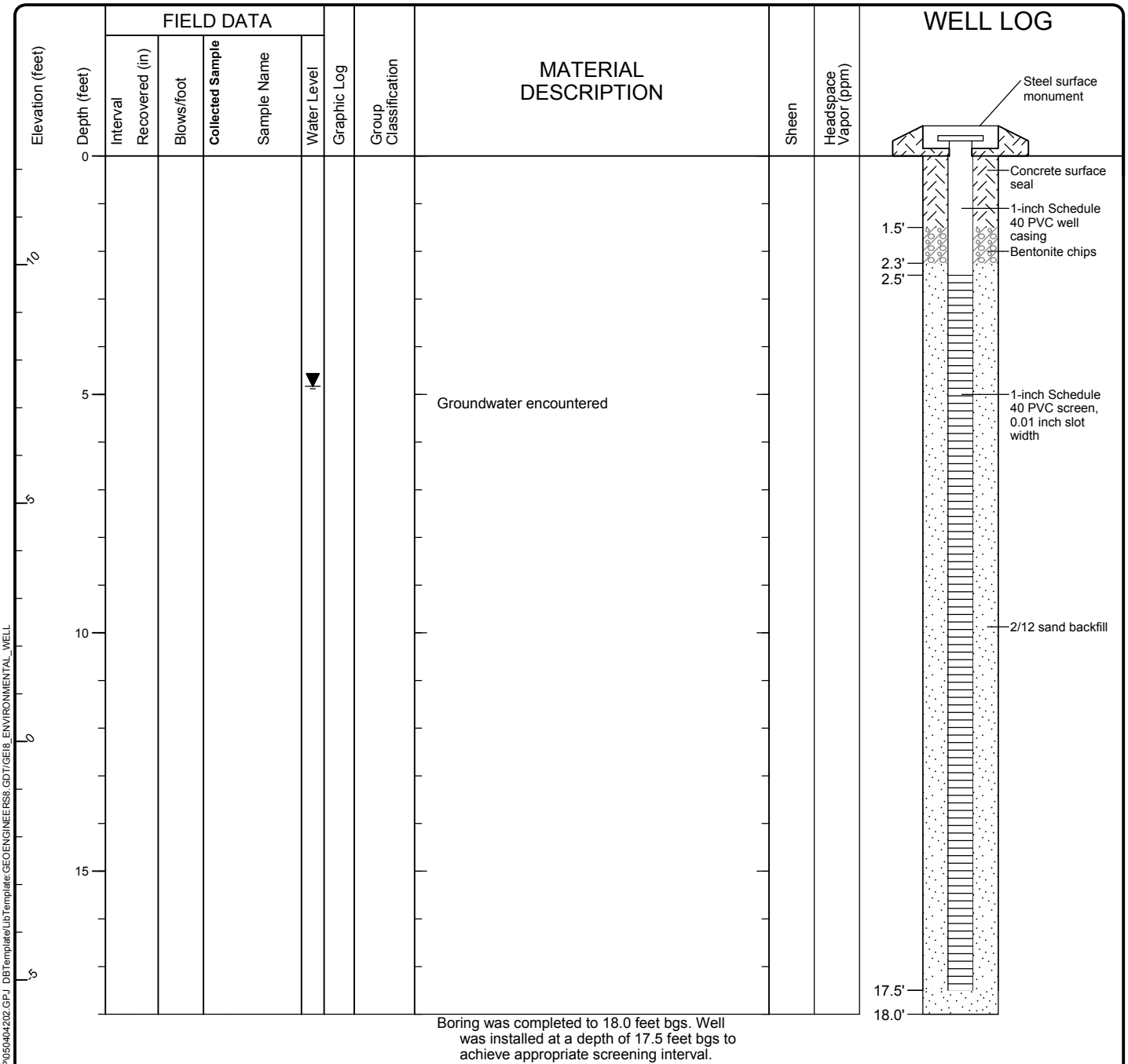
Drilled Start 12/14/2012	End 12/14/2012	Total Depth (ft) 18	Logged By FK / Checked By NFM	Driller Cascade Drilling, LP	Drilling Method Direct Push

Hammer Data		Drilling Equipment	Geoprobe 7730 DT
Surface Elevation (ft) Vertical Datum	12.28	Top of Casing Elevation (ft)	12.03
Easting (X) Northing (Y)		Horizontal Datum	

DOE Well I.D.: BHS 437
A 2 (in) well was installed on 12/14/2012 to a depth of 17.5 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1/4/2013	4.83	7.20

Notes:



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

Log of Monitoring Well MW-9

GeoEngineers

Project:	Irondale Former Iron and Steel Plant
Project Location:	Port Hadlock, Washington
Project Number:	0504-042-02

Figure A-6
Sheet 1 of 1

Seattle: Date:4/4/13 Path:C:\USERS\CVOSS\DESKTOP\050404202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

APPENDIX B
Data Validation Memorandum and Chemical Analytical Results

GeoEngineers

Plaza 600 Building, 600 Stewart Street, Suite 1700, Seattle, WA 98101, Telephone: 206.728.2674, Fax: 206.728.2732 www.geoengineers.com

Data Validation Report

Project:	Irondale Remedial Cleanup Action, Quarterly Groundwater Monitoring (Round 1)
File:	0504-042-02
Date:	February 21, 2013
Lab Report:	VY50 (ARI)

This report presents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2A validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of seven groundwater samples obtained from the Post-Construction Quarterly Groundwater Monitoring Event (Round 1) at the former Irondale Iron and Steel Plant site in Irondale, Washington. Samples obtained were submitted to Analytical Resources Incorporated (ARI) of Tukwila, Washington for chemical analysis of diesel- and heavy oil-range petroleum hydrocarbons (NWTPH-Dx), dissolved and total carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and dissolved metals (copper and nickel).

The objective of the data quality assessment was to review laboratory analytical procedures and QC results to evaluate whether the samples were analyzed using well-defined and acceptable methods that provide quantitation limits below applicable regulatory criteria, the precision and accuracy of the data are well defined and sufficient to provide defensible data, and the quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

The ARI Sample Delivery Group (SDG; noted above) was reviewed for the following quality control (QC) elements:

- Chain of Custody
- Holding Times
- Surrogates/Labeled Compounds
- Method and Equipment Rinsate Blanks
- Laboratory Control Samples/Ongoing Precision and Recovery Samples
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in two USEPA documents: USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2010) and USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 2008).

Chain-of-Custody Documentation

Chain-of-custody forms were provided with the laboratory analytical reports. No transcription errors were found, and the appropriate signatures were applied. There were no anomalies mentioned in the sample

receipt forms, as the samples were transported to the laboratory at the appropriate temperatures of between 2 and 6 degrees Celsius.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits, with the exceptions below:

- **SDG VY50 (SIM-CPAHs):** The laboratory had flagged several d14-dibenzo(a,h)anthracene %R values as being outside the control limit. Upon further inspection, this claim was revealed to be an error. All the associated d14-dibenzo(a,h)anthracene %R values were found to be within the laboratory prescribed control limits of 26% to 115%.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the contract required quantitation limits.

Matrix Spikes/Matrix Spike Duplicates

Because the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a %R is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a “spiked sample”) is typically followed by a post spike sample if any element recoveries were outside the control limits in the “spike sample”.

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference (RPD) values. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits.

Laboratory Control Samples

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the RPD values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Metals and Fuels only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample. In this case, the absolute difference is used instead of the RPD.

The following field duplicate sample sets were collected for this sampling event:

- MW06-130104/MW06-130104-DUP and MW09-130104/MW09-130104-DUP

The RPD/absolute difference value for the field duplicate sample sets were within their respective control limits.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogates, LCS/LCSD, and MS/MSD %R values. Precision was acceptable, as demonstrated by the laboratory duplicate, LCS/LCSD and MS/MSD RPD and absolute difference values.

Based on the data quality review, it is our opinion that the analytical data, including data qualified as noted above, are of acceptable quality for their intended use.

REFERENCES

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review," OSWER 9240.1-51, EPA 540-R-10-011. January 2010.

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review," EPA-540-R-08-01. June 2008.

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

Table of Contents: ARI Job VY50

Client: Geoengineers

Project: 0542-042-01 Irondale Former Iron & Steel Plant

	Page From:	Page To:
Inventory Sheet		
Cover Letter	1	1
Chain of Custody Documentation	2	5
Case Narrative, Data Qualifiers, Control Limits	6	16
SIM PAH Analysis		
Report and Summary QC Forms	17	35
TPHD Analysis		
Report and Summary QC Forms	36	49
Metals Analysis		
Report and Summary QC Forms	50	77
Geotechnical Analysis – NA		
Report and Summary QC Forms PREP ONLY	—	—
METALS RAW DATA	78	222

BC
Signature

January-16-2013
Date

Analytical Resources, Incorporated
Analytical Chemists and Consultants

January 16, 2013

Neil Morton
GeoEngineers, Inc.
Plaza 600 Building
600 Stewart Street, Suite 1700
Seattle, WA 98101

RE: Client Project: Irondale Former Iron & Steel Plant, 0542-042-01
ARI Job No.: VY50

Dear Neil:

Please find enclosed the Chain of Custody record (COC), sample receipt documentation, and the final data package for samples from the project referenced above.

Sample receipt and details of these analyses are discussed in the Case Narrative.

An electronic copy of this package will remain on file with ARI. Should you have any questions or problems, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Cheronne Oreiro
Project Manager
(206) 695-6214
cheronneo@arilabs.com
www.arilabs.com

cc: eFile: VY50

Enclosures

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Documentation

ARI Job ID: VY50

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: VY50	Turn-around Requested: STANDARD	Page: 1	of 1
ARI Client Company: GEI	Phone: 206.728.2674	Date: 01/04/13	Ice Present? YES
Client Contact: NEIL MORTON		No. of Coolers: 2	Cooler Temps: 1.1, 1.4
Client Project Name: IRONDALE FORMER IRON & STEEL PLANT			
Client Project #: 0542-042-01	Samplers: FASIH KHAN		

Sample ID	Date	Time	Matrix	No Containers	NW-TPH DIESEL	cPAHs	~~[struck]~~	DISSOLVED Cu, Ni				Notes/Comments
MW05-130104	1/4/13	1730	W	3	X			X				Please
MW06-130104	↓	1425	W	7	X	X		X				Call
MW07-130104	↓	1510	W	7	X	X		X				Neil
MW08-130104	↓	1630	W	7	X	X		X				Morton
MW09-130104	↓	1315	W	3	X			X				with any
MW06-130104-DUP	↓	1425	W	6	X	X						questions
MW09-130104-DUP	↓	1315	W	1				X				206.728.2674

Comments/Special Instructions	Relinquished by	Received by	Relinquished by	Received by
	(Signature) [signature]	(Signature) [signature]	(Signature)	(Signature)
	Printed Name: FASIH KHAN	Printed Name: Taylor Streeter	Printed Name:	Printed Name:
	Company: GEI	Company: ARI	Company:	Company:
	Date & Time: 01/07/13, 1100	Date & Time: 1/7/13 1100	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client GEI | Project Name Irondale

COC No(s) _____ (NA) | Delivered by Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No VY50 | Tracking No _____ (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	(NO)
Were custody papers included with the cooler?	(YES)	NO
Were custody papers properly filled out (ink, signed, etc)	(YES)	NO
Temperature of Cooler(s) (°C) (recommended 2.0-6 0 °C for chemistry)	1.1 1.4	
If cooler temperature is out of compliance fill out form 00070F	Temp Gun ID# 90877952	

Cooler Accepted by: TL Date 1-9-13 Time. 1100

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	(NO)
What kind of packing material was used? Bubble Wrap (Wet Ice) Gel Packs Baggies Foam Block Paper Other:			
Was sufficient ice used (if appropriate)?	NA	(YES)	NO
Were all bottles sealed in individual plastic bags?		YES	(NO)
Did all bottles arrive in good condition (unbroken)?		(YES)	NO
Were all bottle labels complete and legible?		(YES)	NO
Did the number of containers listed on COC match with the number of containers received?		(YES)	NO
Did all bottle labels and tags agree with custody papers?		(YES)	NO
Were all bottles used correct for the requested analyses?		(YES)	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)	NA	(YES)	NO
Were all VOC vials free of air bubbles?	(NA)	YES	NO
Was sufficient amount of sample sent in each bottle?		(YES)	NO
Date VOC Trip Blank was made at ARI.	(NA)		

Was Sample Split by ARI : (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

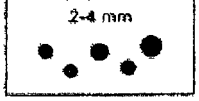
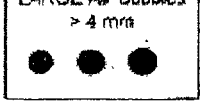
Samples Logged by: IS Date 1-14-13 Time. 1241

*** Notify Project Manager of discrepancies or concerns ***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By Date

Small Air Bubbles ~2mm	Peabubbles 2-4 mm	LARGE Air Bubbles > 4 mm	
			Small → "sm"
			Peabubbles → "pb"
			Large → "lg"
			Headspace → "hs"

VY50 : 66004

PRESERVATION VERIFICATION 01/07/13
Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **VY50**

Inquiry Number: NONE
Analysis Requested: 01/07/13
Contact: Morton, Neil
Client: Geoengineers
Logged by: TS
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

PC: Cheronne
VTSR: 01/07/13

Project #: 0542-042-01
Project: Irondale Former Iron & Steel Plant
Sample Site:
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	TPHD <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
13-275 **VY50A**	MW05-130104						DIS Pass									Y						
13-276 **VY50B**	MW06-130104						DIS Pass									Y						
13-277 **VY50C**	MW07-130104						DIS Pass									Y						
13-278 **VY50D**	MW08-130104						DIS Pass									Y						
13-279 **VY50E**	MW09-130104						DIS Pass									Y						
13-280 **VY50F**	MW06-130104-DUP																					
13-281 **VY50G**	MW09-130104-DUP						DIS Pass									Y						

VTSR 1/7/13

Checked By TT Date 1-7-13

Case Narrative, Data Qualifiers, Control Limits

ARI Job ID: VY50

ANALYTICAL
RESOURCES
INCORPORATED

Case Narrative

Client: GeoEngineers, Inc.
Project: Irondale Former Iron & Steel Plant, 0542-042-01
ARI Job No.: VY50

Sample Receipt

Seven water samples were received on 1/7/13 under ARI job VY50. The cooler temperatures measured by IR thermometer following ARI SOP were 1.1 and 1.4°C. For further details regarding sample receipt, please refer to the Cooler Receipt Form.

Select samples were requested for both total and dissolved SIM PAHs. Details regarding dissolved aliquot filtrations can be found in the Geotechnical Case Narrative. Dissolved SIM PAH results have been reported under ARI identifications 13-282-VY50H, 13-283-VY50I, 13-284-VY50J, and 13-285-VY50K

Low-Level SIM PAHs by SW8270

The samples were extracted and analyzed within the method recommended holding times.

Initial and continuing calibrations were within method requirements. Internal standard areas were within limits.

The surrogate percent recoveries of d10-2-Methylnaphthalene were outside ARI control limits high for several samples. No corrective action was taken.

The method blank was clean at the reporting limits. The LCS and LCSD percent recoveries were within control limits.

NWTPH-Dx

The samples were extracted and analyzed within the method recommended holding times.

Initial and continuing calibrations were within method requirements. Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank was clean at the reporting limits. The LCS and LCSD percent recoveries were within control limits.

VY50 : 000007

Dissolved Metals by Method 200.8

The samples and associated laboratory QC were digested and analyzed within recommended holding times.

The method blank was clean at the reporting limits. The LCS percent recoveries were within control limits.

The matrix spike percent recoveries and duplicate RPDs were within control limits.

Geotechnical Parameters

A laboratory-specific case narrative follows this page.

The filtered sample blank was used as an extraction batch method blank for all SIM PAH samples.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Client: Geoengineers	**ARI Job No.:** VY50
Client Project: Irondale Former Iron & Steel Plant	**Client Project No.:** 0542-042-01

Case Narrative

1. Four water samples were submitted for filtering on January 7, 2013, and were in good condition.
2. The samples were filtered using all glass filtering equipment.
3. All equipment was decontaminated prior to use.
4. All of the water was filtered through a 0.7µm borosilicate glass, binder free filters.
5. The filtered sample was decanted into 500mL amber glass sample bottles for the requested analysis.
6. 500mL of deionized water was filtered for a sample blank, and decanted into a 500mL amber glass bottle.
7. There were no other noted anomalies in the samples or methods on this project.

Released by: Yvonne Curtis Date: 1/8/13
Title: *Geotechnical Division Manager*

Reviewed by: _____ Date: 1-8-2013
Title: *Lead Technician*

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: VY50
Client: Geoengineers
Project Event: 0542-042-01
Project Name: Irondale Former Iron & Steel Plant

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	MW05-130104	VY50A	13-275	Water	01/04/13 17:30	01/07/13 11:00
2.	MW06-130104	VY50B	13-276	Water	01/04/13 14:25	01/07/13 11:00
3.	MW07-130104	VY50C	13-277	Water	01/04/13 15:10	01/07/13 11:00
4.	MW08-130104	VY50D	13-278	Water	01/04/13 16:30	01/07/13 11:00
5.	MW09-130104	VY50E	13-279	Water	01/04/13 13:15	01/07/13 11:00
6.	MW06-130104-DUP	VY50F	13-280	Water	01/04/13 14:25	01/07/13 11:00
7.	MW09-130104-DUP	VY50G	13-281	Water	01/04/13 13:15	01/07/13 11:00
8.	MW06-130104	VY50H	13-282	Water	01/04/13 14:25	01/07/13 11:00
9.	MW07-130104	VY50I	13-283	Water	01/04/13 15:10	01/07/13 11:00
10.	MW08-130104	VY50J	13-284	Water	01/04/13 16:30	01/07/13 11:00
11.	MW06-130104-DUP	VY50K	13-285	Water	01/04/13 14:25	01/07/13 11:00

VY50 : 00016

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S Indicates an analyte response that has saturated the detector. The calculated concentration is not valid, a dilution is required to obtain valid quantification of the analyte

NA The flagged analyte was not analyzed for

NR Spiked compound recovery is not reported due to chromatographic interference

NS The flagged analyte was not spiked into the sample

M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters This flag is used only for GC-MS analyses

M2 The sample contains PCB congeners that do not match any standard Aroclor pattern The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.

N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

Y The analyte is not detected at or above the reported concentration The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

EMPC Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**

C The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column

P The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

X Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**

Z Analyte signal includes interference from the sample matrix or perfluorokerosene ions **(Dioxin/Furan analysis only)**

Geotechnical Data

A	The total of all fines fractions This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

VY50:00013

LOD[1], LOQ[2] and Control Limits Summary
Analysis of Water Samples for Low Concentration PNA
EPA Method 8270 – SIM
ARI Analysis: PNLWSL

Separatory Funnel Extraction (EPA Method 3510C) using 500 mL sample with extract concentrated to 0.5 mL final volume. Silica gel cleanup performed on extract prior to analysis. ARI bench Sheet 3071F

DL, LOD & LOQ units are nanograms per liter (ng/L) = parts-per-trillion (ppt). LOD Spike level = LOQ

Analyte	DL[1] ng/L	LOD[1] ng/L	LOQ[1] ng/L	LCS Control Limit[2]	Replicate RPD[3]
Naphthalene	0.85	5	10	37 – 90	≤ 40
2-Methylnaphthalene	0.72	5	10	39 – 90	≤ 40
Acenaphthylene	0.81	5	10	35 – 95	≤ 40
Acenaphthene	0.83	5	10	38 – 94	≤ 40
Dibenzofuran	0.94	5	10	36 – 94	≤ 40
Fluorene	1.41	5	10	41 – 102	≤ 40
Phenanthrene	1.01	5	10	41 – 101	≤ 40
Anthracene	0.58	5	10	28 – 101	≤ 40
Fluoranthene	0.92	5	10	49 – 114	≤ 40
Pyrene	0.70	5	10	42 - 114	≤ 40
Benzo(a)anthracene	1.27	5	10	42 – 111	≤ 40
Chrysene	1.57	5	10	46 – 106	≤ 40
Benzo(b)fluoranthene	2.54	5	10	39 – 119	≤ 40
Benzo(k)fluoranthene	0.85	5	10	50 – 117	≤ 40
Benzo(j)fluoranthene	1.65	5	10	30 – 160[4]	≤ 40
Benzo(a)pyrene	1.14	5	10	20 – 99	≤ 40
Indeno(1,2,3-cd)pyrene	1.82	5	10	32 – 113	≤ 40
Dibenz(a,h)anthracene	0.97	5	10	30 – 113	≤ 40
Benzo(g,h,i)perylene	1.87	5	10	27 – 113	≤ 40
1-Methylnaphthalene	0.88	5	10	38 – 95	≤ 40
Perylene	3.21	5	10	30 – 160[4]	≤ 40
Surrogate Standard Recovery			**MB / LCS**	**Samples**	**RPD**
2-Methylnapthalene-d_{10}			40 – 93	35 – 94	≤ 40
Dibenzo(a,h)anthracene-d_{14}			31 – 115	26 – 115	≤ 40

(1) Detection Limit (DL), Limit of Detection (LOD) and Limit of Quantitation (LOQ)are defined in ARI SOP 1018S

(2) Control limits calculated using data from all samples prepared between 4/1/11 through 3/31/12.

(3) Relative Percent Difference between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then $RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$

(4) Default limits pending generation of historic limits for Benzo(j)fluoranthene.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Quality Control Criteria
Total Petroleum Hydrocarbons
(Diesel & Motor Oil)

Analysis Code	Analyte[5]	DL[1] ppm	LOD[1] ppm	LOQ[2] ppm	Spike % Recovery Control Limits[3]			RPD[4]
					LCS	MB/LCS Surrogate	Sample Surrogate	
HCIWVX	NWTPH-HCID – Water Samples	--	--	0.50 [7]	--	--	50-150	≤ 40
HCISVX	NWTPH-HCID – Solid Samples	--	--	50 [7]	--	--	50-150	
Aqueous Samples – No Extract Clean-up – Separatory Funnel Extraction – 500 to 1.0 mL								
DIESWI	DRO – NWTPH-Dext (C_{12}-C_{24})	0.022	0.05	0.1	64-112	50-150	50-150	≤ 40
AK2WSI	DRO – AK102 (C_{10}-C_{25})	0.022	0.05	0.1	75-125 [6]	60-120	50-150	
OILWSI	RRO – NWTPH-Dext (C_{24}-C_{38})	0.044	0.1	0.2	60 – 130 [8]	50-150	50-150	
AK3WSI	RRO – AK103 (C_{25}-C_{36})	0.030 [9]	0.1	0.2	60-120 [6]	60-120	50-150	
Aqueous Samples – With Acid and/or Silica Gel Clean-up – Separatory Funnel Extraction – 500 to 1.0 mL								
DIESWI	DRO – NWTPH-Dext (C_{12}-C_{24})	0.039	0.05	0.1	61-104	50-150	50-150	≤ 40
AK2WSI	DRO – AK102 (C_{10}-C_{25})	0.042	0.05	0.1	75-125 [6]	60-120	50-150	
OILWSI	RRO – NWTPH-Dext (C_{24}-C_{38})	0.010	0.1	0.2	60 – 130 [8]	50-150	50-150	
AK3WSI	RRO – AK103 (C_{25}-C_{36})	0.030 [8]	0.1	0.2	60-120 [6]	60-120	50-150	
Solid Matrix Samples – No Extract Clean-up – Microwave Extraction – 10 g to 1 mL								
DIESMI	DRO – NWTPH-Dext (C_{12}-C_{24})	1.35	2.5	5	62-119	50-150	50-150	≤ 40
DIESMI	DRO – NWTPH-Dext Jet A	2.22 [11]	2.5	5	60 – 130 [8]	50-150	50-150	
AK2SMI	DRO – AK102 (C_{10}-C_{25})	2.43	2.5	5	75-125 [6]	60-120	50-150	
OILSMI	RRO – NWTPH-Dext (C_{24}-C_{38})	2.48	5	10	60 – 130 [8]	50-150	50-150	
AK3SMI	RRO – AK103 (C_{25}-C_{36})	0.665 [9]	5	10	60-120 [6]	60-120	50-150	
Solid Matrix Samples – With Acid and/or Silica Gel Clean-up – Microwave Extraction – 10 g to 1 mL								
DIESMI	DRO – NWTPH-Dext (C_{12}-C_{24})	1.28	2.5	5	60-108	50-150	50-150	≤ 40
AK2SMI	DRO – AK102 (C_{10}-C_{25})	2.06	2.5	5	75-125 [6]	60-120	50-150	
OILSMI	RRO – NWTPH-Dext (C_{24}-C_{38})	1.57	5	10	60 – 130 [8]	50-150	50-150	
AK3SMI	RRO – AK103 (C_{25}-C_{36})	0.665 [10]	5	10	60-120 [6]	60-120	50-150	

(1) DL (Detection Limit) and LOD (Limit of Detection) as defined in ARI SOP 1018S.
(2) Limit of Quantitation as defined in ARI SOP 1018S. The spike concentration used to determine the DL and the concentration of the lowest standard used to calibrate the GC-FID instrument.
(3) All surrogate recovery limits are specified in the published methods (AK102, AK103 & NWTPH-Dext). The surrogate standard is o-Terphenyl.
(4) Acceptance criteria for the relative percent difference (RPD) between analytes in replicate analyzes. If C_O and C_D are the concentrations of the original and duplicate respectively then $RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$
(5) DRO = Diesel Range Organics and RRO = Residual Range Organics as defined in the methods referenced in footnote 3.
(6) Method specified LCS acceptance limits.
(7) Method specified reporting limits
(8) Default LCS control limits pending calculation of historic limits
(9) MDL study QD55 completed 2/12/10
(10) MDL study QD35 completed 1/29/10
(11) LOD Study UI44 completed 2/28/12

Quality Control Parameters for Metals Analysis ICP-MS EPA Methods 200.8 or 6020A

Analyte	Mass	Aqueous Samples[2]			Spike Recovery		RPD[3]	Solids[2]
		DL[1] µg/L	LOD[1] µg/L	LOQ[1] µg/L	Matrix Spike	LCS		LOQ[1] mg/kg
Aluminum	27	1.601	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
Antimony	121	0.010	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
	123	0.011	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Arsenic #1	75	0.048	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Arsenic #2	75	0.092	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Barium	135	0.020	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	137	0.019	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Beryllium	9	0.021	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Cadmium	111	0.010	0.05	**0.1**	75 – 125	80 – 120	≤ 20	**0.1**
	114	0.005	0.05	**0.1**	75 – 125	80 – 120	≤ 20	**0.1**
Calcium	43	3.983	25	**50.0**	75 – 125	80 – 120	≤ 20	**50.0**
Chromium	52	0.045	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	53	0.118	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Cobalt	59	0.011	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Copper	63	0.158	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	65	0.236	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Iron	54	5.753	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
	57	3.876	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
Lead	208	0.046	0.05	**0.1**	75 – 125	80 – 120	≤ 20	**0.1**
Magnesium	24	0.297	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
Manganese	55	0.022	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Molybdenum	98	0.013	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Nickel	60	0.079	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	62	0.089	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
Potassium	39	2.944	10	**20.0**	75 – 125	80 – 120	≤ 20	**20.0**
Selenium	82	0.127	0.25	**0.5**	75 – 125	80 – 120	≤ 20	**0.5**
	78	0.324	0.25	**2.0**	75 – 125	80 – 120	≤ 20	**2.0**
Silver	107	0.008	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Sodium	23	2.833	50	**100.0**	75 – 125	80 – 120	≤ 20	**100.0**
Thorium[4]	232	0.013	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Thallium	205	0.004	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Uranium[4]	238	0.003	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Vanadium	51	0.043	0.1	**0.2**	75 – 125	80 – 120	≤ 20	**0.2**
Zinc	66	0.497	2	**4.0**	75 – 125	80 – 120	≤ 20	**4.0**
	67	0.531	2	**4.0**	75 – 125	80 – 120	≤ 20	**4.0**
	68	0.524	2	**4.0**	75 – 125	80 – 120	≤ 20	**4.0**

(1) Detection Limit (DL), Limit of Detection Limit (LOD) and Limit of Quantitation (LOQ) as defined in ARI SOP 1018S
(2) 50 mL sample and 50 mL final volume Solids LOQ based on 100% solids using 1.0 g sample 100 mL final volume.
(3) Relative Percent Difference in replicate analyzes. $RPD = \frac{|C_O - C_D|}{\frac{C_O + C_D}{2}} x100$ where C_O=Original, C_D=Duplicate
(4) ARI has no accreditation for these elements.

SIM PAH Analysis
Report and Summary QC Forms

ARI Job ID: VY50

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: MW06-130104**
Extraction Method: SW3510C **SAMPLE**

Lab Sample ID: VY50B
LIMS ID: 13-276
Matrix: Water
Data Release Authorized: MW
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Date Extracted: 01/09/13
Date Analyzed: 01/11/13 13:49
Instrument/Analyst: NT11/VTS

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
205-99-2	Benzo(b)fluoranthene	0.010	< 0.010 U
207-08-9	Benzo(k)fluoranthene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	86.7%
d14-Dibenzo(a,h)anthracene	56.0% Q

VY50 : 00018

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: MW07-130104**
Extraction Method: SW3510C **SAMPLE**

Lab Sample ID: VY50C
LIMS ID: 13-277
Matrix: Water
Data Release Authorized: MW
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Date Extracted: 01/09/13
Date Analyzed: 01/11/13 14:18
Instrument/Analyst: NT11/VTS

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
205-99-2	Benzo(b)fluoranthene	0.010	< 0.010 U
207-08-9	Benzo(k)fluoranthene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	97.3%
d14-Dibenzo(a,h)anthracene	64.7% Q

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: MW08-130104**
Extraction Method: SW3510C **SAMPLE**

Lab Sample ID: VY50D
LIMS ID: 13-278
Matrix: Water
Data Release Authorized: MW
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Date Extracted: 01/09/13
Date Analyzed: 01/11/13 14:47
Instrument/Analyst: NT11/VTS

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	**Benzo(a)anthracene**	**0.010**	**0.0075 J**
218-01-9	**Chrysene**	**0.010**	**0.0094 J**
205-99-2	**Benzo(b)fluoranthene**	**0.010**	**0.0063 J**
207-08-9	Benzo(k)fluoranthene	0.010	< 0.010 U
50-32-8	**Benzo(a)pyrene**	**0.010**	**0.0078 J**
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	**Total Benzofluoranthenes**	**0.010**	**0.0063 J**

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	87.3%
d14-Dibenzo(a,h)anthracene	34.3% Q

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Extraction Method: SW3510C
Page 1 of 1

Sample ID: MW06-130104-DUP SAMPLE

Lab Sample ID: VY50F
LIMS ID: 13-280
Matrix: Water
Data Release Authorized:
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Date Extracted: 01/09/13
Date Analyzed: 01/11/13 15:16
Instrument/Analyst: NT11/VTS

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	**Chrysene**	**0.010**	**0.0066 J**
205-99-2	Benzo(b)fluoranthene	0.010	< 0.010 U
207-08-9	Benzo(k)fluoranthene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	94.3%
d14-Dibenzo(a,h)anthracene	60.3% Q

VY50 : 060821

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: MW06-130104**
Extraction Method: SW3510C **SAMPLE**

Lab Sample ID: VY50H
LIMS ID: 13-282
Matrix: Water
Data Release Authorized:
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Date Extracted: 01/09/13
Date Analyzed: 01/11/13 15:45
Instrument/Analyst: NT11/VTS

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
205-99-2	Benzo(b)fluoranthene	0.010	< 0.010 U
207-08-9	Benzo(k)fluoranthene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	93.3%
d14-Dibenzo(a,h)anthracene	65.0% Q

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: MW07-130104**
Extraction Method: SW3510C **SAMPLE**

Lab Sample ID: VY50I
LIMS ID: 13-283
Matrix: Water
Data Release Authorized:
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Date Extracted: 01/09/13
Date Analyzed: 01/11/13 16:18
Instrument/Analyst: NT11/VTS

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	**Chrysene**	**0.010**	**0.0072 J**
205-99-2	Benzo(b)fluoranthene	0.010	< 0.010 U
207-08-9	Benzo(k)fluoranthene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	98.3%
d14-Dibenzo(a,h)anthracene	71.3% Q

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: MW08-130104**
Extraction Method: SW3510C **SAMPLE**

Lab Sample ID: VY50J
LIMS ID: 13-284
Matrix: Water
Data Release Authorized:
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Date Extracted: 01/09/13
Date Analyzed: 01/11/13 16:47
Instrument/Analyst: NT11/VTS

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
205-99-2	Benzo(b)fluoranthene	0.010	< 0.010 U
207-08-9	Benzo(k)fluoranthene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	107%
d14-Dibenzo(a,h)anthracene	72.3% Q

VY50 : 000024

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: MW06-130104-DUP**
Extraction Method: SW3510C **SAMPLE**

Lab Sample ID: VY50K
LIMS ID: 13-285
Matrix: Water
Data Release Authorized:
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Date Extracted: 01/09/13
Date Analyzed: 01/11/13 17:16
Instrument/Analyst: NT11/VTS

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
205-99-2	Benzo(b)fluoranthene	0.010	< 0.010 U
207-08-9	Benzo(k)fluoranthene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	96.3%
d14-Dibenzo(a,h)anthracene	63.7% Q

ANALYTICAL RESOURCES INCORPORATED

SIM SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
0542-042-01

Client ID	MNP	DBA	TOT OUT
MB-010913	92.7%	65.0%	0
LCS-010913	93.7%*	72.0%	1
LCSD-010913	97.0%*	75.3%	1
MW06-130104	86.7%	56.0%	0
MW07-130104	97.3%*	64.7%	1
MW08-130104	87.3%	34.3%	0
MW06-130104-DUP	94.3%*	60.3%	1
MW06-130104	93.3%	65.0%	0
MW07-130104	98.3%*	71.3%	1
MW08-130104	107%*	72.3%	1
MW06-130104-DUP	96.3%*	63.7%	1

	LCS/MB LIMITS	QC LIMITS
(MNP) = d10-2-Methylnaphthalene	(40-93)	(35-94)
(DBA) = d14-Dibenzo(a,h)anthracene	(31-115)	(26-115)

Prep Method: SW3510C
Log Number Range: 13-276 to 13-285

FORM-II SIM SW8270

VY50 : 00025

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: LCS-010913**
Page 1 of 1 **LAB CONTROL SAMPLE**

Lab Sample ID: LCS-010913
LIMS ID: 13-276
Matrix: Water
Data Release Authorized:
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 01/09/13

Date Analyzed LCS: 01/11/13 12:51
LCSD: 01/11/13 13:20
Instrument/Analyst LCS: NT11/VTS
LCSD: NT11/VTS

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzo(a)anthracene	0.281	0.300	93.7%	0.299	0.300	99.7%	6.2%
Chrysene	0.270	0.300	90.0%	0.290	0.300	96.7%	7.1%
Benzo(b)fluoranthene	0.278	0.300	92.7%	0.306	0.300	102%	9.6%
Benzo(k)fluoranthene	0.291	0.300	97.0%	0.312	0.300	104%	7.0%
Benzo(a)pyrene	0.225	0.300	75.0%	0.238	0.300	79.3%	5.6%
Indeno(1,2,3-cd)pyrene	0.250	0.300	83.3%	0.267	0.300	89.0%	6.6%
Dibenz(a,h)anthracene	0.250	0.300	83.3%	0.265	0.300	88.3%	5.8%
Total Benzofluoranthenes	0.829	0.900	92.1%	0.896	0.900	99.6%	7.8%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

SIM Semivolatile Surrogate Recovery

	LCS	LCSD
d10-2-Methylnaphthalene	93.7%	97.0%
d14-Dibenzo(a,h)anthracene	72.0%	75.3%

4B

SEMIVOLATILE METHOD BLANK SUMMARY

BLANK NO.

VY50MBW1

Lab Name: ANALYTICAL RESOURCES INC

Client: GEOENGINEERS

ARI Job No: VY50

Project: IRONDALE FORMER IRON

Lab File ID: VY50MB

Date Extracted: 01/09/13

Instrument ID: NT11

Date Analyzed: 01/11/13

Matrix: LIQUID

Time Analyzed: 1223

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	VY50LCSW1	VY50LCSW1	VY50SB	01/11/13
02	VY50LCSDW1	VY50LCSDW1	VY50SBD	01/11/13
03	MW06-130104	VY50B	VY50B	01/11/13
04	MW07-130104	VY50C	VY50C	01/11/13
05	MW08-130104	VY50D	VY50D	01/11/13
06	MW06-130104-DUP	VY50F	VY50F	01/11/13
07	MW06-130104	VY50H	VY50H	01/11/13
08	MW07-130104	VY50I	VY50I	01/11/13
09	MW08-130104	VY50J	VY50J	01/11/13
10	MW06-130104-DUP	VY50K	VY50K	01/11/13
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

VY50 : 000028

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: MB-010913**
Extraction Method: SW3510C **METHOD BLANK**

Lab Sample ID: MB-010913
LIMS ID: 13-276
Matrix: Water
Data Release Authorized:
Reported: 01/14/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
Event: 0542-042-01
Date Sampled: NA
Date Received: NA

Date Extracted: 01/09/13
Date Analyzed: 01/11/13 12:23
Instrument/Analyst: NT11/VTS

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
205-99-2	Benzo(b)fluoranthene	0.010	< 0.010 U
207-08-9	Benzo(k)fluoranthene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	92.7%
d14-Dibenzo(a,h)anthracene	65.0% Q

5B

SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: ANALYTICAL RESOURCES INC Client: GEOENGINEERS

Instrument ID: NT11 Project: IRONDALE FORMER IRON

DFTPP Injection Date: 10/11/12 DFTPP Injection Time: 0858

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	10.0 - 80.0% of mass 198	55.1
68	Less than 2.0% of mass 69	0.9 (2.0)1
69	Mass 69 relative abundance	47.3
70	Less than 2.0% of mass 69	0.4 (0.8)1
127	10.0 - 80.0% of mass 198	59.4
197	Less than 2.0% of mass 198	0.6
198	Base Peak, 100% relative abundance	100.0
199	5.0 to 9.0% of mass 198	6.9
275	10.0 - 60.0% of mass 198	25.9
365	Greater than 1.0% of mass 198	4.52
441	0.0 - 24.0% of mass 442	27.8 (14.5)2
442	50.0 - 200.0% of mass 198	191.6
443	15.0 - 24.0% of mass 442	37.3 (19.5)2

1-Value is % mass 69 2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01		SIM250	IC1011A	10/11/12	0912
02		SIM1000	IC1011B	10/11/12	0941
03		SIM10	IC1011C	10/11/12	1010
04		SIM500	IC1011D	10/11/12	1039
05		SIM50	IC1011E	10/11/12	1108
06		SIM100	IC1011F	10/11/12	1137
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

5B

SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: ANALYTICAL RESOURCES INC Client: GEOENGINEERS

Instrument ID: NT11 Project: IRONDALE FORMER IRON

DFTPP Injection Date: 01/11/13 DFTPP Injection Time: 1117

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	10.0 - 80.0% of mass 198	31.5
68	Less than 2.0% of mass 69	0.0 (0.0)1
69	Mass 69 relative abundance	36.6
70	Less than 2.0% of mass 69	0.1 (0.3)1
127	10.0 - 80.0% of mass 198	49.9
197	Less than 2.0% of mass 198	0.0
198	Base Peak, 100% relative abundance	100.0
199	5.0 to 9.0% of mass 198	7.0
275	10.0 - 60.0% of mass 198	25.0
365	Greater than 1.0% of mass 198	3.14
441	0.0 - 24.0% of mass 442	12.9 (14.7)2
442	50.0 - 200.0% of mass 198	87.9
443	15.0 - 24.0% of mass 442	16.5 (18.8)2

1-Value is % mass 69 2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01		SIM 250	CC0111	01/11/13	1132
02	VY50MBW1	VY50MBW1	VY50MB	01/11/13	1223
03	VY50LCSW1	VY50LCSW1	VY50SB	01/11/13	1251
04	VY50LCSDW1	VY50LCSDW1	VY50SBD	01/11/13	1320
05	MW06-130104	VY50B	VY50B	01/11/13	1349
06	MW07-130104	VY50C	VY50C	01/11/13	1418
07	MW08-130104	VY50D	VY50D	01/11/13	1447
08	MW06-130104-DUP	VY50F	VY50F	01/11/13	1516
09	MW06-130104	VY50H	VY50H	01/11/13	1545
10	MW07-130104	VY50I	VY50I	01/11/13	1618
11	MW08-130104	VY50J	VY50J	01/11/13	1647
12	MW06-130104-DUP	VY50K	VY50K	01/11/13	1716
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

VY50:00031

6B

SEMIVOLATILE 8270-D INITIAL CALIBRATION DATA

Lab Name: ANALYTICAL RESOURCES INC Client: GEOENGINEERS

ARI Job No: VY50 Project: IRONDALE FORMER IRON

Instrument ID: NT11 Calibration Date: 10/11/12

LAB FILE ID: RRF10 =IC1011C RRF50 =IC1011E RRF100=IC1011F
RRF250=IC1011A RRF500=IC1011D RRF1000=IC1011B

COMPOUND	RRF 10	RRF 50	RRF 100	RRF 250	RRF 500	RRF 1000	___ RRF	%RSD /R^2
Naphthalene	0.965	0.968	0.948	0.972	0.927	0.924	0.951	2.2
2-Methylnaphthalene	0.574	0.594	0.592	0.630	0.604	0.616	0.602	3.2
Acenaphthylene	1.413	1.393	1.378	1.590	1.475	1.604	1.476	6.7
Acenaphthene	0.979	0.984	0.977	1.021	0.949	0.986	0.983	2.4
Dibenzofuran	1.536	1.563	1.556	1.574	1.466	1.500	1.532	2.7
Fluorene	1.022	1.034	1.057	1.161	1.064	1.127	1.078	5.1
Phenanthrene	1.202	1.198	1.177	1.212	1.106	1.124	1.170	3.8
Anthracene	0.791	0.817	0.846	1.061	0.981	1.084	0.930	13.8
Fluoranthene	0.906	0.969	1.006	1.107	1.048	1.112	1.025	7.9
Pyrene	1.193	1.230	1.274	1.381	1.291	1.377	1.291	5.9
Benzo(a)anthracene	1.029	1.024	1.038	1.180	1.059	1.139	1.078	6.1
Chrysene	1.200	1.205	1.227	1.259	1.151	1.181	1.204	3.1
Benzo(b)fluoranthene	1.155	1.221	1.208	1.333	1.262	1.287	1.244	5.1
Benzo(k)fluoranthene	1.186	1.285	1.276	1.417	1.340	1.398	1.317	6.5
Benzo(j)fluoranthene	1.386	1.530	1.531	1.648	1.490	1.547	1.522	5.6
Benzo(a)pyrene	0.978	1.092	1.112	1.264	1.195	1.263	1.151	9.7
Indeno(1,2,3-cd)pyrene	1.158	1.426	1.478	1.622	1.572	1.643	1.483	12.1
Dibenzo(a,h)anthracene	0.905	1.124	1.146	1.303	1.246	1.300	1.171	12.8
Benzo(g,h,i)perylene	1.232	1.339	1.364	1.446	1.353	1.403	1.356	5.3
1-methylnaphthalene	0.535	0.544	0.532	0.566	0.545	0.555	0.546	2.3
Perylene	1.039	1.178	1.201	1.291	1.212	1.252	1.196	7.2
2-Methylnaphthalene-d10	0.484	0.484	0.477	0.497	0.479	0.486	0.484	1.4
Dibenzo(a,h)anthracene-d14	1.081	0.949	0.965	0.936	0.990	1.006	0.988	5.3
Fluoranthene-d10	0.689	0.724	0.733	0.855	0.805	0.873	0.780	9.7

<- Outside QC limits: %RSD <20% or R^2 > 0.990

7B

SEMIVOLATILE 8270-D CONTINUING CALIBRATION CHECK

Lab Name: ANALYTICAL RESOURCES INC Client: GEOENGINEERS

ARI Job No: VY50 Project: IRONDALE FORMER IRON

Instrument ID: NT11 Cont. Calib. Date: 01/11/13

Init. Calib. Date: 10/11/12 Cont. Calib. Time: 1132

COMPOUND	CalAmt or ARF	CC Amt or RF	MIN RRF	CURVE TYPE	%D or Drift	
Naphthalene	0.951	1.010	0.700	AVRG	6.2	
2-Methylnaphthalene	0.602	0.683	0.400	AVRG	13.4	
Acenaphthylene	1.476	1.484	0.900	AVRG	0.5	
Acenaphthene	0.983	1.039	0.900	AVRG	5.7	
Dibenzofuran	1.532	1.463	0.800	AVRG	-4.5	
Fluorene	1.078	1.136	0.900	AVRG	5.4	
Phenanthrene	1.170	1.052	0.700	AVRG	-10.1	
Anthracene	0.930	1.049	0.700	AVRG	12.8	
Fluoranthene	1.025	1.089	0.600	AVRG	6.2	
Pyrene	1.291	1.443	0.600	AVRG	11.8	
Benzo(a)anthracene	1.078	1.220	0.800	AVRG	13.2	
Chrysene	1.204	1.274	0.700	AVRG	5.8	
Benzo(b)fluoranthene	1.244	1.275	0.700	AVRG	2.5	
Benzo(k)fluoranthene	1.317	1.521	0.700	AVRG	15.5	
Benzo(j)fluoranthene	1.522	1.714	0.010	AVRG	12.6	
Benzo(a)pyrene	1.151	1.284	0.700	AVRG	11.6	
Indeno(1,2,3-cd)pyrene	1.483	1.406	0.500	AVRG	-5.2	
Dibenzo(a,h)anthracene	1.171	1.115	0.400	AVRG	-4.8	
Benzo(g,h,i)perylene	1.356	1.254	0.500	AVRG	-7.5	
1-methylnaphthalene	0.546	0.624	0.010	AVRG	14.3	
Perylene	1.196	1.313	0.010	AVRG	9.8	
2-Methylnaphthalene-d10	0.484	0.554	0.010	AVRG	14.5	
Dibenzo(a,h)anthracene-d14	0.988	0.751	0.010	AVRG	-24.0	<-
Fluoranthene-d10	0.780	0.847	0.010	AVRG	8.6	

<- Exceeds QC limit of 20% D

* RF less than minimum RF

FORM VII SV-1

8B

SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES INC Client: GEOENGINEERS

ARI Job No: VY50 Project: IRONDALE FORMER IRON

Ical Midpoint ID: IC1011A Ical Date: 10/11/12

Instrument ID: NT11 Cont. Cal Date: 01/11/13

		IS1(NPT) AREA #	RT #	IS2(ANT) AREA #	RT #	IS3(PHN) AREA #	RT #
	ICAL MIDPT	341693	6.30	165641	9.29	224673	11.95
	UPPER LIMIT	683386		331282		449346	
	LOWER LIMIT	170846		82820		112336	
	CCAL	281783	6.24	157807	9.22	262925	11.86
	UPPER LIMIT		6.74		9.72		12.36
	LOWER LIMIT		5.74		8.72		11.36
01	VY50MBW1	245478	6.24	137244	9.22	232867	11.87
02	VY50LCSW1	243527	6.24	137174	9.22	226655	11.86
03	VY50LCSDW1	240059	6.24	136358	9.22	228184	11.86
04	MW06-130104	249332	6.24	141701	9.22	236910	11.86
05	MW07-130104	237486	6.24	135303	9.22	222638	11.86
06	MW08-130104	235531	6.24	134682	9.22	231578	11.86
07	MW06-130104-	249078	6.24	139571	9.22	228906	11.86
08	MW06-130104	251511	6.24	141159	9.22	227685	11.86
09	MW07-130104	246799	6.24	139891	9.22	226933	11.86
10	MW08-130104	236215	6.24	134835	9.22	227423	11.86
11	MW06-130104-	238004	6.24	136558	9.22	225257	11.86
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

IS1 = Naphthalene-d8
IS2 = Acenaphthene-d10
IS3 = Phenanthrene-d10

AREA UPPER LIMIT = +100% of internal standard area from Ical midpoint
AREA LOWER LIMIT = - 50% of internal standard area from Ical midpoint
RT UPPER LIMIT = + 0.50 minutes of internal standard RT from Cont. Cal
RT LOWER LIMIT = - 0.50 minutes of internal standard RT from Cont. Cal

* Values outside of QC limits.

FORM VIII SV-1

VY50 . 00034

8B

SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: ANALYTICAL RESOURCES INC Client: GEOENGINEERS

ARI Job No: VY50 Project: IRONDALE FORMER IRON

Ical Midpoint ID: IC1011A Ical Date: 10/11/12

Instrument ID: NT11 Cont. Cal Date: 01/11/13

		IS4(CRY) AREA #	RT #	IS5(PRY) AREA #	RT #	AREA #	RT #
	ICAL MIDPT	181470	16.67	169742	19.34		
	UPPER LIMIT	362940		339484			
	LOWER LIMIT	90735		84871			
	CCAL	202143	16.58	171468	19.21		
	UPPER LIMIT		17.08		19.71		
	LOWER LIMIT		16.08		18.71		
01	VY50MBW1	169446	16.58	140873	19.22		
02	VY50LCSW1	165145	16.57	137267	19.21		
03	VY50LCSDW1	168139	16.57	138631	19.21		
04	MW06-130104	173011	16.57	148905	19.21		
05	MW07-130104	160336	16.57	134389	19.21		
06	MW08-130104	175448	16.57	153681	19.20		
07	MW06-130104-	167857	16.57	148297	19.20		
08	MW06-130104	168405	16.57	143247	19.20		
09	MW07-130104	169556	16.57	143224	19.21		
10	MW08-130104	162207	16.57	137187	19.21		
11	MW06-130104-	165160	16.57	137378	19.21		
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

IS4 = Chrysene-d12
IS5 = Perylene-d12

AREA UPPER LIMIT = +100% of internal standard area from Ical midpoint
AREA LOWER LIMIT = - 50% of internal standard area from Ical midpoint
RT UPPER LIMIT = + 0.50 minutes of internal standard RT from Cont. Cal
RT LOWER LIMIT = - 0.50 minutes of internal standard RT from Cont. Cal

* Values outside of QC limits.

FORM VIII SV-2

VY50:00035

TPHD Analysis
Report and Summary QC Forms

ARI Job ID: VY50

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS

NWTPHD by GC/FID-Silica and Acid Cleaned
Extraction Method:
Page 1 of 1

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Pl
0542-042-01

Matrix: Water
Data Release Authorized: CB
Reported: 01/09/13

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range/Surrogate	RL	Result
MB-010813	Method Blank	01/08/13	01/08/13	1.00	Diesel Range	0.10	< 0.10 U
13-275	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		90.2%
VY50A	MW05-130104	01/08/13	01/08/13	1.00	Diesel Range	0.10	< 0.10 U
13-275	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		90.3%
VY50B	MW06-130104	01/08/13	01/08/13	1.00	Diesel Range	0.10	< 0.10 U
13-276	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		90.8%
VY50C	MW07-130104	01/08/13	01/08/13	1.00	Diesel Range	0.10	< 0.10 U
13-277	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		76.4%
VY50D	MW08-130104	01/08/13	01/08/13	1.00	Diesel Range	0.10	< 0.10 U
13-278	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		80.1%
VY50E	MW09-130104	01/08/13	01/08/13	1.00	Diesel Range	0.10	< 0.10 U
13-279	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		81.1%
VY50F	MW06-130104-DUP	01/08/13	01/08/13	1.00	Diesel Range	0.10	< 0.10 U
13-280	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		89.3%

Reported in mg/L (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel range quantitation on total peaks in the range from C12 to C24.
Motor Oil range quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

VY50 : 00037

ANALYTICAL RESOURCES INCORPORATED

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
0542-042-01

Client ID	OTER	TOT OUT
MB-010813	90.2%	0
LCS-010813	83.4%	0
LCSD-010813	81.9%	0
MW05-130104	90.3%	0
MW06-130104	90.8%	0
MW07-130104	76.4%	0
MW08-130104	80.1%	0
MW09-130104	81.1%	0
MW06-130104-DUP	89.3%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(50-150)	(50-150)

Prep Method: SW3510C
Log Number Range: 13-275 to 13-280

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned **Sample ID: LCS-010813**
Page 1 of 1 **LCS/LCSD**

Lab Sample ID: LCS-010813 QC Report No: VY50-Geoengineers
LIMS ID: 13-275 Project: Irondale Former Iron & Steel Plant
Matrix: Water 0542-042-01
Data Release Authorized: Date Sampled: 01/04/13
Reported: 01/09/13 Date Received: 01/07/13

Date Extracted LCS/LCSD: 01/08/13 Sample Amount LCS: 500 mL
LCSD: 500 mL
Date Analyzed LCS: 01/08/13 18:28 Final Extract Volume LCS: 1.0 mL
LCSD: 01/08/13 18:48 LCSD: 1.0 mL
Instrument/Analyst LCS: FID/JGR Dilution Factor LCS: 1.00
LCSD: FID/JGR LCSD: 1.00

Range	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Diesel	2.24	3.00	74.7%	2.28	3.00	76.0%	1.8%

TPHD Surrogate Recovery

	LCS	LCSD
o-Terphenyl	83.4%	81.9%

Results reported in mg/L
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: VY50
Matrix: Water
Project: Irondale Former Iron & Steel Plant
Date Received: 01/07/13
0542-042-01

ARI ID	Client ID	Samp Amt	Final Vol	Prep Date
13-275-010813MB1	Method Blank	500 mL	1.00 mL	01/08/13
13-275-010813LCS1	Lab Control	500 mL	1.00 mL	01/08/13
13-275-010813LCSD1	Lab Control Dup	500 mL	1.00 mL	01/08/13
13-275-VY50A	MW05-130104	500 mL	1.00 mL	01/08/13
13-276-VY50B	MW06-130104	500 mL	1.00 mL	01/08/13
13-277-VY50C	MW07-130104	500 mL	1.00 mL	01/08/13
13-278-VY50D	MW08-130104	500 mL	1.00 mL	01/08/13
13-279-VY50E	MW09-130104	500 mL	1.00 mL	01/08/13
13-280-VY50F	MW06-130104-DUP	500 mL	1.00 mL	01/08/13

VY50:00040

4

TPH METHOD BLANK SUMMARY

BLANK NO.

VY50MBW1

Lab Name: ANALYTICAL RESOURCES INC Client: GEOENGINEERS

SDG No.: VY50 Project No.: IRONDALE

Date Extracted: 01/08/13 Matrix: LIQUID

Date Analyzed : 01/08/13 Instrument ID : FID4A

Time Analyzed : 1808

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS, and MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED
01	VY50LCSW1	VY50LCSW1	01/08/13
02	VY50LCSDW1	VY50LCSDW1	01/08/13
03	MW05-130104	VY50A	01/08/13
04	MW06-130104	VY50B	01/08/13
05	MW07-130104	VY50C	01/08/13
06	MW08-130104	VY50D	01/08/13
07	MW09-130104	VY50E	01/08/13
08	MW06-130104-	VY50F	01/08/13
09			

FORM IV TPH

6a
DIESEL INITIAL CALIBRATION

Lab Name: ANALYTICAL RESOURCES, INC. Client: GEOENGINEERS

Instrument: FID4A.I Project: IRONDALE FORMER IRON

Calibration Date: 05-JAN-2013 SDG No.: VY50

Diesel Range	RF1 50	RF2 100	RF3 250	RF4 500	RF5 1000	RF6 2500	Ave RF	%RSD
WA Diesel	11335	10789	10056	10522	9933	10117	10458	5.1
AK Diesel	13067	12501	11657	12220	11622	11749	12136	4.7
OR Diesel	13241	12592	11722	12282	11679	11804	12220	5.0
Cal Diesel	13016	12449	11633	12203	11602	11716	12103	4.7
o-Terph	12713	12144	12109	12921	12751	13461	12683	4.0

<- Indicates %RSD outside limits
Surrogate areas are not included in Diesel RF calculation.

Quant Ranges : WA Diesel C12-C24 (4.052-7.519)
AK Diesel C10-C25 (3.127-7.768)
OR Diesel C10-C28 (3.127-8.466)
Cal Diesel C10-C24 (3.127-7.519)

Calibration Files	Analysis Time
0105a020.d	05-JAN-2013 16:41
0105a021.d	05-JAN-2013 17:01
0105a022.d	05-JAN-2013 17:21
0105a023.d	05-JAN-2013 17:41
0105a024.d	05-JAN-2013 18:01
0105a025.d	05-JAN-2013 18:21

6a

NW MOTOR OIL RANGE INITIAL CALIBRATION

Lab Name: ANALYTICAL RESOURCES, INC.

Client: GEOENGINEERS

Instrument: FID4A.I

Project: IRONDALE FORMER IRON

Calibration Date: 05-JAN-2013

SDG No.: VY50

Product Range	RF1 100	RF2 250	RF3 500	RF4 1000	RF5 2500	RF6 5000	Ave RF	%RSD
WA M.Oil C24-C38	8641	8346	7827	8197	8415	8686	8352	3.8
Triac Surr	9375	9943	9918	11207	11601	12000	10674	10.0

<- Indicates %RSD outside limits
Surrogate areas are not included in Motor Oil RF calculation.

Calibration Files	Analysis Time
0105a027.d	05-JAN-2013 19:00
0105a028.d	05-JAN-2013 19:20
0105a029.d	05-JAN-2013 19:40
0105a030.d	05-JAN-2013 20:00
0105a031.d	05-JAN-2013 20:20
0105a032.d	05-JAN-2013 20:40

7a

DIESEL CONTINUING CALIBRATION VERIFICATION

Lab Name: ANALYTICAL RESOURCES, INC. Client: GEOENGINEERS

ICal Date: 05-JAN-2013 Project: IRONDALE FORMER

CCal Date: 08-JAN-2013 SDG No.: VY50

Analysis Time: 17:27 Lab ID: DIESEL#1

Instrument: FID4A.I Lab File Name: 0108a005.d

Diesel Range	Area*	CalcAmnt	NomAmnt	% D	
WADies(C12-C24)	2620079	250.5	250	0.2	
AK102 (C10-C25)	3036495	250.2	250	0.1	
NASDies(C10-C24)	3031551	192.3	250	-23.1	<-
Terphenyl	556086	43.8	45	-2.6	

* Surrogate areas are subtracted from range areas

<- Indicates a %D outside QC limits

VY50 : 00644

7a

MOTOR OIL CONTINUING CALIBRATION VERIFICATION

Lab Name: ANALYTICAL RESOURCES, INC. Client: GEOENGINEERS

ICal Date: 05-JAN-2013 Project: IRONDALE FORMER

CCal Date: 08-JAN-2013 SDG No.: VY50

Analysis Time: 17:47 Lab ID: MOIL#1

Instrument: FID4A.I Lab File Name: 0108a006.d

M.oil Range	Area*	CalcAmnt	NomAmnt	% D
WAMoil(C24-C38)	4211354	504.2	500	0.8
AK103 (C25-C36)	3535346	384.2	500	-23.2
OR MOIL(C28-C40)	3544550	469.3	500	-6.1
CRUDE(Tol-C40)	5173662	685.0	500	37.0
n-Triacontane	500502	46.9	45	4.2

* Surrogate areas are subtracted from range areas

<- Indicates a %D outside QC limits

VY50 : 000045

7a

DIESEL CONTINUING CALIBRATION VERIFICATION

Lab Name: ANALYTICAL RESOURCES, INC. Client: GEOENGINEERS

ICal Date: 05-JAN-2013 Project: IRONDALE FORMER

CCal Date: 08-JAN-2013 SDG No.: VY50

Analysis Time: 21:31 Lab ID: DIESEL#2

Instrument: FID4A.I Lab File Name: 0108a017.d

Diesel Range	Area*	CalcAmnt	NomAmnt	% D	
WADies(C12-C24)	2699087	258.1	250	3.2	
AK102 (C10-C25)	3134731	258.3	250	3.3	
NASDies(C10-C24)	3126648	198.4	250	-20.7	<-
Terphenyl	578614	45.6	45	1.4	

* Surrogate areas are subtracted from range areas

<- Indicates a %D outside QC limits

VY50:00046

7a

MOTOR OIL CONTINUING CALIBRATION VERIFICATION

Lab Name: ANALYTICAL RESOURCES, INC. Client: GEOENGINEERS

ICal Date: 05-JAN-2013 Project: IRONDALE FORMER

CCal Date: 08-JAN-2013 SDG No.: VY50

Analysis Time: 21:51 Lab ID: MOIL#2

Instrument: FID4A.I Lab File Name: 0108a018.d

M.oil Range	Area*	CalcAmnt	NomAmnt	% D
WAMoil(C24-C38)	4458801	533.9	500	6.8
AK103 (C25-C36)	3800999	413.1	500	-17.4
OR MOIL(C28-C40)	3784995	501.1	500	0.2
CRUDE(Tol-C40)	5419470	717.5	500	43.5
n-Triacontane	526327	49.3	45	9.6

* Surrogate areas are subtracted from range areas

<- Indicates a %D outside QC limits

VY50.00047

TPH ANALYTICAL SEQUENCE

Lab Name: ANALYTICAL RESOURCES INC Client: GEOENGINEERS

SDG No.: VY50 Project: IRONDALE

Instrument ID: FID4A GC Column: RTX-1

THE ANALYTICAL SEQUENCE OF BLANKS, SAMPLES, AND STANDARDS, IS GIVEN BELOW:

SURROGATE RT FROM DAILY STANDARD
TERPH: 6.02 TRIAC: 8.90

	CLIENT SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TERPH RT #	TRIAC RT #
01	ZZZZZ	ZZZZZ	01/08/13	1605	6.03	8.88
02	ZZZZZ	ZZZZZ	01/08/13	1625	6.02	8.90
03	RT	RT	01/08/13	1646	6.02	8.90
04	IB	IB	01/08/13	1706	6.02	8.90
05	DIESEL#1	DIESEL#1	01/08/13	1727	6.02	8.91
06	MOIL#1	MOIL#1	01/08/13	1747	6.03	8.90
07	VY50MBW1	VY50MBW1	01/08/13	1808	6.02	8.89
08	VY50LCSW1	VY50LCSW1	01/08/13	1828	6.02	8.89
09	VY50LCSDW1	VY50LCSDW1	01/08/13	1848	6.02	8.89
10	ZZZZZ	ZZZZZ	01/08/13	1909	6.02	8.90
11	MW05-130104	VY50A	01/08/13	1929	6.02	8.89
12	MW06-130104	VY50B	01/08/13	1949	6.02	8.89
13	MW07-130104	VY50C	01/08/13	2010	6.02	8.88
14	MW08-130104	VY50D	01/08/13	2030	6.02	8.89
15	MW09-130104	VY50E	01/08/13	2050	6.02	8.89
16	MW06-130104-	VY50F	01/08/13	2110	6.02	8.88
17	DIESEL#2	DIESEL#2	01/08/13	2131	6.02	8.90
18	MOIL#2	MOIL#2	01/08/13	2151	6.02	8.89

QC LIMITS

TERPH = o-terph (+/- 0.05 MINUTES)
TRIAC = Triacon Surr (+/- 0.05 MINUTES)

* Values outside of QC limits.

FORM VIII TPH

VY50 : 060648

TPH ANALYTICAL SEQUENCE

Lab Name: ANALYTICAL RESOURCES INC Client: GEOENGINEERS

SDG No.: VY50 Project: IRONDALE

Instrument ID: FID4A GC Column: RTX-1

THE ANALYTICAL SEQUENCE OF BLANKS, SAMPLES, AND STANDARDS, IS GIVEN BELOW:

SURROGATE RT FROM DAILY STANDARD
TERPH: 6.02 TRIAC: 8.90

	CLIENT SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TERPH RT #	TRIAC RT #
01		RT	01/05/13	1602	6.02	8.90
02		IB	01/05/13	1621	6.02	8.89
03		DIES 50	01/05/13	1641	6.02	8.89
04		DIES 100	01/05/13	1701	6.01	8.90
05		DIES250	01/05/13	1721	6.02	8.90
06		DIES500	01/05/13	1741	6.03	8.89
07		DIES1000	01/05/13	1801	6.04	8.91
08		DIES2500	01/05/13	1821	6.06	8.89
09		DIES250-ICV	01/05/13	1840	6.02	8.90
10		MOIL 100	01/05/13	1900	6.03	8.88
11		MOIL 250	01/05/13	1920	6.03	8.88
12		MOIL 500	01/05/13	1940	6.02	8.89
13		MOIL 1000	01/05/13	2000	6.02	8.90
14		MOIL 2500	01/05/13	2020	6.02	8.92
15		MOIL 5000	01/05/13	2040	6.02	8.95*
16		M OIL500-ICV	01/05/13	2101	6.02	8.89

QC LIMITS

TERPH = o-terph (+/- 0.05 MINUTES)
TRIAC = Triacon Surr (+/- 0.05 MINUTES)

* Values outside of QC limits.

VY50 : 00045

Metals Analysis
Report and Summary QC Forms

ARI Job ID: VY50

Cover Page

INORGANIC ANALYSIS DATA PACKAGE

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

CLIENT ID	ARI ID	ARI LIMS ID	REPREP
MW05-130104	VY50A	13-275	
MW05-130104D	VY50ADUP	13-275	
MW05-130104S	VY50ASPK	13-275	
MW06-130104	VY50B	13-276	
PBW	VY50MB1	13-276	
LCSW	VY50MB1SPK	13-276	
MW07-130104	VY50C	13-277	
MW08-130104	VY50D	13-278	
MW09-130104	VY50E	13-279	
MW09-130104-DUP	VY50G	13-281	

Were ICP interelement corrections applied ?	Yes/No	YES
Were ICP background corrections applied ?	Yes/No	YES
If yes - were raw data generated before application of background corrections ?	Yes/No	NO

Comments: _____

THIS DATA PACKAGE HAS BEEN REVIEWED AND AUTHORIZED FOR RELEASE BY:

Signature: _____ Name: Jay Kuhn

Date: 1/13/13 Title: Inorganics Director

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW05-130104
SAMPLE

Lab Sample ID: VY50A
LIMS ID: 13-275
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	01/08/13	200.8	01/10/13	**7440-50-8**	**Copper**	0.5	**1.3**	
200.8	01/08/13	200.8	01/10/13	**7440-02-0**	**Nickel**	0.5	**5.6**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW06-130104
SAMPLE

Lab Sample ID: VY50B
LIMS ID: 13-276
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	01/08/13	200.8	01/10/13	**7440-50-8**	**Copper**	0.5	**0.8**	
200.8	01/08/13	200.8	01/10/13	**7440-02-0**	**Nickel**	0.5	**5.8**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW07-130104
SAMPLE

Lab Sample ID: VY50C
LIMS ID: 13-277
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	01/08/13	200.8	01/10/13	**7440-50-8**	**Copper**	0.5	**0.8**	
200.8	01/08/13	200.8	01/10/13	**7440-02-0**	**Nickel**	0.5	**4.4**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW08-130104
SAMPLE

Lab Sample ID: VY50D
LIMS ID: 13-278
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	01/08/13	200.8	01/10/13	7440-50-8	Copper	0.5	0.5	U
200.8	01/08/13	200.8	01/10/13	**7440-02-0**	**Nickel**	0.5	**5.0**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW09-130104
SAMPLE

Lab Sample ID: VY50E
LIMS ID: 13-279
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	01/08/13	200.8	01/14/13	7440-50-8	Copper	20	20	U
200.8	01/08/13	200.8	01/14/13	**7440-02-0**	**Nickel**	20	**90**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW09-130104-DUP
SAMPLE

Lab Sample ID: VY50G
LIMS ID: 13-281
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	01/08/13	200.8	01/10/13	**7440-50-8**	**Copper**	5	**7**	
200.8	01/08/13	200.8	01/10/13	**7440-02-0**	**Nickel**	5	**83**	

U-Analyte undetected at given RL
RL-Reporting Limit

VY50 : 00057

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS

Sample ID: MW05-130104
MATRIX SPIKE

Lab Sample ID: VY50A
LIMS ID: 13-275
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant 0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Copper	200.8	1.3	26.6	25.0	101%	
Nickel	200.8	5.6	30.2	25.0	98.4%	

Reported in µg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

VY50 : 09058

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS

Sample ID: MW05-130104
DUPLICATE

Lab Sample ID: VY50A
LIMS ID: 13-275
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
0542-042-01
Date Sampled: 01/04/13
Date Received: 01/07/13

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Copper	200.8	1.3	1.3	0.0%	+/- 0.5	L
Nickel	200.8	5.6	5.3	5.5%	+/- 20%	

Reported in µg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

VY50 : 00059

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: VY50LCS
LIMS ID: 13-276
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
0542-042-01
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Copper	200.8	26.5	25.0	106%	
Nickel	200.8	25.9	25.0	104%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS

Sample ID: METHOD BLANK

Lab Sample ID: VY50MB
LIMS ID: 13-276
Matrix: Water
Data Release Authorized:
Reported: 01/15/13

QC Report No: VY50-Geoengineers
Project: Irondale Former Iron & Steel Plant
0542-042-01
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	01/08/13	200.8	01/10/13	7440-50-8	Copper	0.5	0.5	U
200.8	01/08/13	200.8	01/10/13	7440-02-0	Nickel	0.5	0.5	U

U-Analyte undetected at given RL
RL-Reporting Limit

Calibration Verification

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

UNITS: ug/L

SDG: VY50

ANALYTE	EL	M	RUN	ICVTV	ICV	%R	CCVTV	CCV1	%R	CCV2	%R	CCV3	%R	CCV4	%R	CCV5	%R
Copper	CU	PMS	MS011081	50.0	51.05	**102.1**	50.0	50.76	**101.5**	50.87	**101.7**	50.13	**100.3**	50.94	**101.9**	52.56	**105.1**
Nickel	NI	PMS	MS011081	50.0	51.08	**102.2**	50.0	49.42	**98.8**	50.22	**100.4**	49.10	**98.2**	50.98	**102.0**	52.30	**104.6**

Control Limits: Mercury 80-120; Other Metals 90-110

FORM II (1)

Calibration Verification

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

UNITS: ug/L

SDG: VY50

ANALYTE	EL	M	RUN	CCVTV	CCV6	%R	CCV7	%R	CCV8	%R	CCV9	%R	CCV10	%R	CCV11	%R
Copper	CU	PMS	MS011081	50.0	53.09	**106.2**	53.75	**107.5**	53.31	**106.6**						
Nickel	NI	PMS	MS011081	50.0	53.23	**106.5**	53.44	**106.9**	52.52	**105.0**						

Control Limits: Mercury 80-120; Other Metals 90-110

VY50 : 000053

ANALYTICAL RESOURCES INCORPORATED

Calibration Verification

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

UNITS: ug/L

ANALYTE	EL	M	RUN	ICVTV	ICV	%R	CCVTV	CCV1	%R	CCV2	%R	CCV3	%R	CCV4	%R	CCV5	%R
Copper	CU	PMS	MS011481	50.0	50.42	**100.8**	50.0	50.40	**100.8**	49.69	**99.4**	52.07	**104.1**	49.96	**99.9**		
Nickel	NI	PMS	MS011481	50.0	50.76	**101.5**	50.0	50.80	**101.6**	49.60	**99.2**	51.00	**102.0**	49.81	**99.6**		

Control Limits: Mercury 80-120; Other Metals 90-110

FORM II (1)

CRDL Standard

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

UNITS:ug/L

ANALYTE	EL	M	RUN	CRA/I TV	CR-1	%R	CR-2	%R	CR-3	%R	CR-4	%R	CR-5	%R	CR-6	%R
Copper	CU	PMS	MS011081	0.5	0.55	**110.0**										
Nickel	NI	PMS	MS011081	0.5	0.53	**106.0**										
Copper	CU	PMS	MS011481	0.5	0.54	**108.0**										
Nickel	NI	PMS	MS011481	0.5	0.54	**108.0**										

Control Limits: no control limits have been established by the EPA at this time.

FORM II (2)

Calibration Blanks

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

UNITS: ug/L

ANALYTE	EL	METH	RUN	CRDL	IDL	ICB	C	CCB1	C	CCB2	C	CCB3	C	CCB4	C	CCB5	C
Copper	CU	PMS	MS011081	25.0	0.5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Nickel	NI	PMS	MS011081	40.0	0.5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U

Calibration Blanks

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

UNITS: ug/L

ANALYTE	EL	METH	RUN	CRDL	IDL	CCB6	C	CCB7	C	CCB8	C	CCB9	C	CCB10	C	CCB11	C
Copper	CU	PMS	MS011081	25.0	0.5	0.5	U	0.5	U	0.5	U						
Nickel	NI	PMS	MS011081	40.0	0.5	0.5	U	0.5	U	0.5	U						

VY50 09055

Calibration Blanks

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

UNITS: ug/L

ANALYTE	EL	METH	RUN	CRDL	IDL	ICB	C	CCB1	C	CCB2	C	CCB3	C	CCB4	C	CCB5	C
Copper	CU	PMS	MS011481	25.0	0.5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U		
Nickel	NI	PMS	MS011481	40.0	0.5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U		

FORM III

ICP Interference Check Sample

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

ICS SOURCE: I.V.

RUNID: MS011081

INSTRUMENT ID: PE ELAN 6000

UNITS: ug/L

ANALYTE	ICSA TV	ICSAB TV	ICSA1	ICSAB1	%R	ICSA2	ICSAB2	%R	ICSA3	ICSAB3	%R
Antimony			0.1	0.1							
Arsenic		20	0.1	19.4	**97.0**						
Cadmium		20	0.1	19.9	**99.5**						
Chromium		20	0.5	20.3	**101.5**						
Cobalt		20	0.0	20.0	**100.0**						
Copper		20	0.4	20.0	**100.0**						
Manganese		20	0.1	20.1	**100.5**						
Molybdenum	400	400	390.1	397.2	**99.3**						
Nickel		20	0.5	19.7	**98.5**						
Silver		20	0.0	19.6	**98.0**						
Vanadium			0.1	-0.4							
Zinc		20	1.7	20.4	**102.0**						

ICP Interference Check Sample

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

ICS SOURCE: I.V.

RUNID: MS011481

INSTRUMENT ID: PE ELAN 6000

UNITS: ug/L

ANALYTE	ICSA TV	ICSAB TV	ICSA1	ICSAB1	%R	ICSA2	ICSAB2	%R	ICSA3	ICSAB3	%R
Antimony			0.1	0.1							
Arsenic		20	0.1	19.7	**98.5**						
Cadmium		20	0.0	19.5	**97.5**						
Chromium		20	0.4	20.6	**103.0**						
Cobalt		20	0.0	19.7	**98.5**						
Copper		20	0.4	19.8	**99.0**						
Manganese		20	0.1	20.2	**101.0**						
Molybdenum	400	400	414.3	413.0	**103.3**						
Nickel		20	0.5	20.1	**100.5**						
Silver		20	0.0	19.5	**97.5**						
Vanadium			0.0	-0.3							
Zinc		20	1.3	20.4	**102.0**						

IDLs and ICP Linear Ranges

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50 UNITS: ug/L

ANALYTE	EL	METH	INSTRUMENT	WAVELENTH (nm)	GFA BACK-GROUND	CLP CRDL	RL	RL DATE	ICP LINEAR RANGE (ug/L)	ICP LR DATE
Copper	CU	PMS	PE ELAN 6000 MS	0.00		25	0.5	4/1/2012		
Nickel	NI	PMS	PE ELAN 6000 MS	0.00		40	0.5	4/1/2012		

VY50 : 000074

Preparation Log

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

ANALYSIS METHOD: PMS

ARI PREP CODE: REN

PREPDATE: 1/8/2013

CLIENT ID	ARI ID	MASS (g)	INITIAL VOLUME (mL)	FINAL VOLUME (mL)
MW05-130104	VY50A	0.000	50.0	25.0
MW05-130104D	VY50ADUP	0.000	50.0	25.0
MW05-130104S	VY50ASPK	0.000	50.0	25.0
MW06-130104	VY50B	0.000	50.0	25.0
MW07-130104	VY50C	0.000	50.0	25.0
MW08-130104	VY50D	0.000	50.0	25.0
MW09-130104	VY50E	0.000	50.0	25.0
MW09-130104-DUP	VY50G	0.000	50.0	25.0
PBW	VY50MB1	0.000	50.0	25.0
LCSW	VY50MB1SPK	0.000	50.0	25.0

Analysis Run Log

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron   INSTRUMENT ID: PE ELAN 6000 MS   START DATE: 1/10/2013

SDG: VY50   RUNID: MS011081   METHOD: PMS   END DATE: 1/10/2013

CLIENT ID	ARI ID	DIL.	TIME	%R	AG	AL	AS	B	BA	BE	CA	CD	CO	CR	CU	FE	HG	K	MG	MN	MO	NA	NI	PB	SB	SE	SI	SN	TI	TL	U	V	ZN
S0	S0	1.00	09120												X								X										
S1	S1	1.00	09180												X								X										
S2	S2	1.00	09240												X								X										
S3	S3	1.00	09300												X								X										
S4	S4	1.00	09360												X								X										
ZZZZZZ	Rinse Sampl	1.00	09430																														
ICV	MICV	1.00	09500												X								X										
ICB	ICB	1.00	09570												X								X										
CCV	MCCV1	1.00	10030												X								X										
CCB	CCB1	1.00	10090												X								X										
CRI	MCRI	1.00	10150												X								X										
ICSA	ICSAI	1.00	10210												X								X										
ICSAB	ICSABI	1.00	10270												X								X										
ZZZZZZ	LR200	1.00	10330																														
ZZZZZZ	LR300	1.00	10400																														
CCV	MCCV2	1.00	10470												X								X										
CCB	CCB2	1.00	10530												X								X										
ZZZZZZ	VR65MB1	20.00	10590																														
ZZZZZZ	VR65ADUP	100.00	11050																														
ZZZZZZ	VR65A	100.00	11120																														
ZZZZZZ	VR65ASPK	100.00	11180																														
ZZZZZZ	VR65B	50.00	11240																														
ZZZZZZ	VR65C	50.00	11310																														
ZZZZZZ	VR65D	100.00	11370																														
ZZZZZZ	VR65G	50.00	11430																														
ZZZZZZ	VR65I	50.00	11490																														
ZZZZZZ	VY32MB1SPK	20.00	11560																														
CCV	MCCV3	1.00	12020												X								X										
CCB	CCB3	1.00	12090												X								X										
PBW	VY50MB1	2.00	12170												X								X										
ZZZZZZ	VR65J	50.00	12230																														
ZZZZZZ	VR65L	50.00	12300																														
MW05-130104D	VY50ADUP	2.00	12360												X								X										
MW05-130104	VY50A	2.00	12420												X								X										
MW05-130104S	VY50ASPK	2.00	12480												X								X										

FORM XIV

Analysis Run Log

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron | INSTRUMENT ID: PE ELAN 6000 MS | START DATE: 1/10/2013

SDG: VY50 | RUNID: MS011081 | METHOD: PMS | END DATE: 1/10/2013

CLIENT ID	ARI ID	DIL.	TIME	%R	AG	AL	AS	B	BA	BE	CA	CD	CO	CR	CU	FE	HG	K	MG	MN	MO	NA	NI	PB	SB	SE	SI	SN	TI	TL	U	V	ZN
ZZZZZZ	ZZZZZZ	2.00	12550																														
MW06-130104	VY50B	2.00	13010												X								X										
MW07-130104	VY50C	2.00	13070												X								X										
LCSW	VY50MB1SPK	2.00	13130												X								X										
CCV	MCCV4	1.00	13190												X								X										
CCB	CCB4	1.00	13260												X								X										
ZZZZZZ	ZZZZZZ	1.00	13330																														
ZZZZZZ	VY68MB1	2.00	13380																														
MW08-130104	VY50D	2.00	13450												X								X										
MW09-130104	VY50E	2.00	13510																														
MW09-130104-DUP	VY50G	2.00	13570																														
ZZZZZZ	VY68ADUP	2.00	14040																														
ZZZZZZ	VY68A	2.00	14110																														
ZZZZZZ	VY68ASPK	2.00	14170																														
ZZZZZZ	VY68B	2.00	14230																														
ZZZZZZ	VY68MB1SPK	2.00	14280																														
CCV	MCCV5	1.00	14350												X								X										
CCB	CCB5	1.00	14410												X								X										
ZZZZZZ	VY68MB2	2.00	14500																														
MW09-130104	VY50E	20.00	14560																														
MW09-130104-DUP	VY50G	20.00	15030												X								X										
ZZZZZZ	VY68D	2.00	15090																														
ZZZZZZ	VY68CDUP	2.00	15150																														
ZZZZZZ	VY68C	2.00	15220																														
ZZZZZZ	VY68CSPK	2.00	15280																														
ZZZZZZ	VY68MB2SPK	2.00	15340																														
CCV	MCCV6	1.00	15400												X								X										
CCB	CCB6	1.00	15470												X								X										
CRI	MCRI	1.00	15530												X								X										
ZZZZZZ	VY78MB1	2.00	15590																														
ZZZZZZ	VY44RMB1	2.00	16050																														
ZZZZZZ	VY78A-L	10.00	16110																														
ZZZZZZ	VY78A	2.00	16180																														
ZZZZZZ	VY78ADUP	2.00	16240																														
ZZZZZZ	VY78ASPK	2.00	16300																														

FORM XIV

Analysis Run Log

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron

SDG: VY50

INSTRUMENT ID: PE ELAN 6000 MS

RUNID: MS011081   METHOD: PMS

START DATE: 1/10/2013

END DATE: 1/10/2013

CLIENT ID	ARI ID	DIL.	TIME	%R	AG	AL	AS	B	BA	BE	CA	CD	CO	CR	CU	FE	HG	K	MG	MN	MO	NA	NI	PB	SB	SE	SI	SN	TI	TL	U	V	ZN
ZZZZZZ	ZZZZZZ	2.00	16370																														
ZZZZZZ	VY78MB1SPK	2.00	16430																														
ZZZZZZ	VY44RMB1SPK	2.00	16490																														
CCV	MCCV7	1.00	16560												X								X										
CCB	CCB7	1.00	17020												X								X										
MW09-130104	VY50E	50.00	17080																														
ZZZZZZ	VY44RA-L	25.00	17140																														
ZZZZZZ	VY44RA	5.00	17210																														
ZZZZZZ	VY44RADUP	5.00	17270																														
ZZZZZZ	VY44RASPK	5.00	17330																														
ZZZZZZ	ZZZZZZ	5.00	17390																														
ZZZZZZ	VY78B	5.00	17460																														
ZZZZZZ	VY78C	50.00	17520																														
ZZZZZZ	VY78D	50.00	17580																														
MW09-130104-DUP	VY50G	50.00	18050																														
CCV	MCCV8	1.00	18110												X								X										
CCB	CCB8	1.00	18180												X								X										

FORM XIV

Analysis Run Log

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron | INSTRUMENT ID: PE ELAN 6000 MS | START DATE: 1/14/2013

SDG: VY50 | RUNID: MS011481 METHOD: PMS | END DATE: 1/14/2013

CLIENT ID	ARI ID	DIL.	TIME	%R	AG	AL	AS	B	BA	BE	CA	CD	CO	CR	CU	FE	HG	K	MG	MN	MO	NA	NI	PB	SB	SE	SI	SN	TI	TL	U	V	ZN
S0	S0	1.00	09070												X								X										
S1	S1	1.00	09130												X								X										
S2	S2	1.00	09190												X								X										
S3	S3	1.00	09250												X								X										
S4	S4	1.00	09310												X								X										
ZZZZZZ	Rinse Sampl	1.00	09380																														
ZZZZZZ	ZZZZZZ	1.00	09450																														
ZZZZZZ	ZZZZZZ	1.00	09520																														
S0	S0	1.00	10000												X								X										
ICV	MICV	1.00	10060												X								X										
ICB	ICB	1.00	10130												X								X										
CCV	MCCV1	1.00	10190												X								X										
CCB	CCB1	1.00	10250												X								X										
CRI	MCRI	1.00	10310												X								X										
ICSA	ICSAI	1.00	10370												X								X										
ICSAB	ICSABI	1.00	10430												X								X										
ZZZZZZ	LR200	1.00	10500																														
ZZZZZZ	LR300	1.00	10560																														
CCV	MCCV2	1.00	11030												X								X										
CCB	CCB2	1.00	11090												X								X										
ZZZZZZ	VZ05A-L	250.00	11190																														
ZZZZZZ	VZ05A	50.00	11250																														
ZZZZZZ	VZ05ADUP	50.00	11310																														
ZZZZZZ	VZ05ASPK	50.00	11380																														
ZZZZZZ	ZZZZZZ	50.00	11440																														
CCV	MCCV3	1.00	11500												X								X										
CCB	CCB3	1.00	11570												X								X										
ZZZZZZ	VY37MB	1.00	12080																														
MW09-130104	VY50E	100.00	12140												X								X										
ZZZZZZ	VY83A	100.00	12210																														
ZZZZZZ	VY37ADUP	1.00	12270																														
ZZZZZZ	VY37A	1.00	12330																														
ZZZZZZ	VY37ASPK	1.00	12390																														
ZZZZZZ	VY37B	1.00	12460																														
ZZZZZZ	VY37C	1.00	12520																														

FORM XIV

Analysis Run Log

ANALYTICAL RESOURCES INCORPORATED

CLIENT: Geoengineers

PROJECT: Irondale Former Iron | INSTRUMENT ID: PE ELAN 6000 MS | START DATE: 1/14/2013

SDG: VY50 | RUNID: MS011481 | METHOD: PMS | END DATE: 1/14/2013

CLIENT ID	ARI ID	DIL.	TIME	%R	AG	AL	AS	B	BA	BE	CA	CD	CO	CR	CU	FE	HG	K	MG	MN	MO	NA	NI	PB	SB	SE	SI	SN	TI	TL	U	V	ZN
ZZZZZZ	VY37D	1.00	12580																														
ZZZZZZ	VY37MBSPK	1.00	13040																														
CCV	MCCV4	1.00	13100												X								X										
CCB	CCB4	1.00	13170												X								X										

APPENDIX C
Report Limitations and Guidelines for Use

APPENDIX C
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This Appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering, geology and environmental science) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Environmental Services Are Performed For Specific Purposes, Persons And Projects

This report has been prepared for the exclusive use by the Washington Department of Ecology. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, an environmental site assessment study conducted for a property owner may not fulfill the needs of a prospective purchaser of the same property. Because each environmental study is unique, each environmental report is unique, prepared solely for the specific client and project site. This report should not be applied for any purpose or project except the one originally contemplated.

This Environmental Report Is Based On A Unique Set Of Project-Specific Factors

This report has been prepared for the former Irondale Iron and Steel Plant site at the intersection of East Moore Street and 1st Avenue in Irondale, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

Reliance Conditions For Third Parties

No other party may rely on the product of our services unless we agree in advance and in writing to such reliance. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted environmental practices in this area at the time this report was prepared.

Environmental Regulations Are Always Evolving

Some substances may be present in the site vicinity in quantities or under conditions that may have led, or may lead, to contamination of the subject site, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substance change, or if more stringent environmental standards are developed in the future.

Uncertainty May Remain Even After This Study Is Completed

No environmental assessment can wholly eliminate uncertainty regarding the potential for contamination in connection with a property. Our interpretation of subsurface conditions in this study is based on field observations and chemical analytical data from widely-spaced sampling locations. It is always possible that contamination exists in areas that were not explored, sampled or analyzed.

Subsurface Conditions Can Change

This environmental report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, by new releases of hazardous substances, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying this report to determine if it is still applicable.

Soil And Groundwater End Use

The cleanup levels referenced in this report are site- and situation-specific. The cleanup levels may not be applicable for other sites or for other on-site uses of the affected media (soil and/or groundwater). Note that hazardous substances may be present in some of the site soil and/or groundwater at detectable concentrations that are less than the referenced cleanup levels. GeoEngineers should be contacted prior to the export of soil or groundwater from the subject site or reuse of the affected media on site to evaluate the potential for associated environmental liabilities. We cannot be responsible for potential environmental liability arising out of the transfer of soil and/or groundwater from the subject site to another location or its reuse on site in instances that we were not aware of or could not control.

Most Environmental Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations and chemical analytical data from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Have we delivered World Class Client Service?

Please let us know by visiting **www.geoengineers.com/feedback**.

GeoEngineers