

Prepared for:  
**Terminal 117**  
**Port of Seattle**

July 31, 2008

# Organic and Inorganic Data Validation Report

Port of Seattle - Terminal 117  
Groundwater and Water QC Samples  
Analytical Resources, Inc. data  
June 2008

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ENSR Corporation  
July 2008  
**Document No.: 05482-023-210**

## Overview

The samples analyzed for the Port of Seattle - Terminal 117 groundwater event from June 2008 are listed in the Table of Samples Analyzed (page 3). Data validation was performed on a total of ten distinct groundwater samples and one trip blank water QC sample.

Samples were analyzed by Analytical Resources, Inc. (ARI) of Tukwila, Washington.

The validated analyses were Volatile Organic Compounds (VOCs) by Volatile Organic Compounds (VOCs) by SW-846 method 8260B; Semivolatile Organic Compounds (SVOCs) by SW-846 method 8270D; Polynuclear Aromatic Hydrocarbons (PAHs) including 1-Methylnaphthalene, 2-Methylnaphthalene, and Dibenzofuran by SW-846 method 8270D SIM (Select Ion Monitoring); Polychlorinated Biphenyls (PCBs) by SW-846 method 8082; Benzene, Toluene, Ethylbenzene, m,p-Xylene, and o-Xylene (BTEX) by SW-846 method 8021B modified; Gasoline Range Hydrocarbons (GRH) by WDOE method NWTPH-Gx; Diesel Range Hydrocarbons (DRH) and Motor Oil Range Hydrocarbons (MORH) by WDOE method NWTPH-Dx; Total and Dissolved Metals by SW-846 methods 6010B, 7060A (arsenic) and 7470A (mercury); and Total Suspended Solids (TSS) by EPA method 160.2).

The ENSR Analytical Data Validation Checklist is presented as pages 4-12. Data were evaluated based on project criteria outlined in the *Quality Assurance Project Plan – Non-Time Critical Removal Action – Preliminary Investigation and Interim Groundwater Monitoring Plan DRAFT (QAPP), Lower Duwamish Waterway Superfund Site, Terminal T117 Early Action Area, ENSR, December 31, 2007*, and based on validation criteria set forth in the *USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic/Inorganic Data Review*, document numbers EPA540/R-99/008 and EPA540/R-04/004 of October 1999 (Organic) and October 2004 (Inorganic), and the *USEPA CLP National Functional Guidelines for Superfund Organic Methods Data Review*, document number USEPA-540-R-07-003, July 2007, as they applied to the reported methodology. Washington State Department of Ecology (WDOE) methods were also reviewed as per *WDOE Analytical Methods for Petroleum Hydrocarbons*, ECY 97-602 of June 1997. Field duplicate RPD control limits were taken from the USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses, December 1996.

The following data components were reviewed during the data validation procedure:

<b>Deliverable Requirement</b>	<b>Method</b>	<b>Form*</b>	<b>Method</b>	<b>Form*</b>	
Case Narrative	Organics		Metals/GenChem		✓
Chain-of-Custody form	Organics		Metals/GenChem		✓
Sample results	Organics	I	Metals/GenChem	IA-IN	✓
Surrogate recoveries	Organics	II			✓
LCS, LCSD (blank spike) recoveries	Organics	III	Metals/GenChem	VII-IN	✓
CRQL standard check for ICP			Metals	IIB-IN	✓
Method and/or calibration blank summaries/results	Organics	IV	Metals/GenChem	III-IN	✓
Duplicate/Spike duplicate RPDs	Organics	III	Metals/GenChem	VI-IN	✓
Instrument performance check (tuning)	Organics	V	Metals	XIV-IN	✓
Initial and continuing calibration data/summaries	Organics	VI, VII	Metals/GenChem	IIA-IN	✓
Internal standards areas and/or retention times	Organics	VIII	Metals	XV-IN	✓
Method detection limits and/or Reporting limits	Organics	I	Metals/GenChem	IX-IN	✓
Preparation log	Organics		Metals/GenChem	XII-IN	✓
Analysis run log	Organics		Metals/GenChem	XIII-IN	✓
Reconstructed ion chromatograms (samples/standards)	Organics				✓
Raw Data (Quantitation lists, Instrument printouts)	Organics		Metals		✓
Electronic data deliverables (EDDs)	Organics		Metals/GenChem		✓

\* equivalent USEPA CLP summary form; as applicable to the organic methods

**Data Validation Qualifiers Assigned During this Review**

J	estimated concentration
J+	estimated concentration, biased high
R	rejected due to severe QAQC noncompliance
UJ	undetected, reporting limit is estimated

Assigned qualifiers are detailed in the ENSR Analytical Data Validation Checklist and are summarized in the Table of Qualified Analytical Results (pages 13-14).

**Other Qualifiers Assigned During this Review**

DNR – Do not report, used to identify duplicate results from dilutions or reanalysis that are not reportable because an alternate, acceptable result for that sample and analyte is available.

**Overall Data Assessment**

Precision, accuracy, method compliance, and completeness of the data set have been determined to be acceptable, based on the data submitted. One data point from method 8260B for sample MW-08R-0608 was rejected based on non-recovery of the matrix spike (see Checklist item 16). Diluted method 8082 data for sample MW-06-0608 were not compliant with instrument calibration requirements and were qualified with DNR (do not report) qualifiers. Data qualified with R qualifiers are rejected due to severe QC noncompliance and are not useable. Data qualified with DNR qualifiers are the result of duplicate analyses and should not be used. These data are designated as not reportable in the project database. The remaining data are suitable for their intended use with the qualifications and clarifications noted.

**Table of Samples Analyzed  
Port of Seattle - Terminal 117  
Groundwater and Water QC Samples  
Analytical Resources, Inc. (ARI) Laboratory Report MZ97  
June 2008**

Matrix	Sample ID		Sample Date and Time	Lab SDG	Lab Sample ID
Groundwater	MW-04R-0608		6/4/2008 09:00	MZ97	MZ97A,O
Groundwater	MW-05R-0608		6/3/2008 13:35	MZ97	MZ97B,P
Groundwater	MW-10-0608		6/3/2008 12:00	MZ97	MZ97C,Q
Groundwater	MW-06-0608 *		6/4/2008 09:25	MZ97	MZ97D,E
Groundwater	MW-06-0608 *		6/5/2008 09:00	MZ97	MZ97D,E
Groundwater	MW-03-0608 *		6/4/2008 10:25	MZ97	MZ97F,G,R
Groundwater	MW-03-0608 *		6/5/2008 10:26	MZ97	MZ97F,G,R
Groundwater	MW-103-0608 *	MW-03-0608 Dup	6/4/2008 10:15	MZ97	MZ97H,I,S
Groundwater	MW-103-0608 *	MW-03-0608 Dup	6/5/2008 10:15	MZ97	MZ97H,I,S
Groundwater	MW-01-0608		6/3/2008 11:06	MZ97	MZ97J,T
Groundwater	MW-02-0608		6/3/2008 13:05	MZ97	MZ97K,U
Groundwater	MW-07-0608		6/4/2008 10:56	MZ97	MZ97L,V
Groundwater	MW-08R-0608		6/4/2008 12:05	MZ97	MZ97M,W
Water QC	TRIP BLANK_0608	Trip Blank	6/5/2008	MZ97	MZ97N

\* See Checklist item 3 for a discussion on how multiple collection dates for same samples were treated.

## ENSR ANALYTICAL DATA VALIDATION CHECKLIST

Project Name: Port of Seattle (PSR) – Terminal 117	Laboratory: Analytical Resources, Inc. (ARI) of Tukwila, WA.					
Project Reference: Terminal 117 – 2Q2008	Sample Matrix: Groundwater and Soil samples					
ENSR Project: 05482-023-210	Sample Start Date: 06/04/2008					
Validated By/Date Validated: Sue Milcan 07/31/2008 (completed)	Sample End Date: 06/05/2008					
Samples Analyzed: see Table of Samples Analyzed, Port of Seattle - Terminal 117, Groundwater and Water QC Samples, June 2008 (page 3).						
Parameters Validated - Volatile Organic Compounds (VOCs) by SW-846 method 8260B; Semivolatile Organic Compounds (SVOCs) by SW-846 method 8270D; Polynuclear Aromatic Hydrocarbons (PAHs) including 1-Methylnaphthalene, 2-Methylnaphthalene, and Dibenzofuran by SW-846 method 8270D SIM (Select Ion Monitoring); Polychlorinated Biphenyls (PCBs) by SW-846 method 8082; Benzene, Toluene, Ethylbenzene, m,p-Xylene, and o-Xylene (BTEX) by SW-846 method 8021B modified; Gasoline Range Hydrocarbons (GRH) by WDOE method NWTPH-Gx; Diesel Range Hydrocarbons (DRH) and Motor Oil Range Hydrocarbons (MORH) by WDOE method NWTPH-Dx; Total and Dissolved Metals by SW-846 methods 6010B, 7060A (arsenic) and 7470A (mercury); and Total Suspended Solids (TSS) by EPA method 160.2.  Not all samples were analyzed for every parameter. Refer to Chain of Custody records for the exact analyses requested.						
Laboratory Project ID (SDG): MZ97						
<b>PRECISION, ACCURACY, METHOD COMPLIANCE, AND COMPLETENESS ASSESSMENT</b>						
Precision:	<b>X</b>	Acceptable		Unacceptable	SM	Initials
<p>Comments: Precision is the measure of variability of individual sample measurements. Field precision was determined by comparison of field duplicate sample results. Laboratory precision was determined by examination of laboratory duplicate results. Evaluation of field and laboratory duplicates for precision was done using the Relative Percent Difference (RPD) or Percent Difference (%D). The RPD is defined as the difference between two duplicate samples divided by the mean and expressed as a percent. The %D for serial dilutions during metals analysis indicates how close a diluted value corresponds with the original result. All RPD and %D precision measurements were compared to EPA published QC limits and QAPP requirements. Although some data require qualification due to laboratory RPDs (see item 17) or calculated field duplicate RPDs (see item 21), overall field and laboratory precision is acceptable since a majority of the data are unqualified and no data are rejected based on these measurements. Precision measurements are reviewed in items 17 and 21.</p>						
Accuracy:	<b>X</b>	Acceptable		Unacceptable	SM	Initials
<p>Comments: Field accuracy, a measure of the sampling bias, was determined by reviewing trip blank results for evidence of sample contamination stemming from bottles and/or sample transport. Laboratory accuracy, a measure of the system bias, was measured by evaluating laboratory control sample, laboratory control sample duplicate (LCS, LCSD), ICP Interference Check Sample (ICS), detection limit (CRI), and organic system monitoring compound (surrogate) percent recoveries (%Rs). LCS, LCSD, and CRI %Rs demonstrated the overall performance of the analysis and ability to achieve quantitation at reported detection limits.</p>						
Continued on next page						

## ENSR ANALYTICAL DATA VALIDATION CHECKLIST

<p>ICS %Rs provided information on sample matrix interferences. System monitoring compound or surrogate recoveries measured system performance and efficiency during organic analysis. All accuracy measurements were compared to EPA published QC limits, QAPP requirements, and/or laboratory control-charted QC limits. One method 8260B data point for 2-chloroethylvinylether was rejected in sample MW-08R-0608 due to non-recovery of the spiked analyte (see item 16). Although some additional data require qualification based on CRI %Rs, overall field and laboratory accuracy is acceptable since a majority of the data are unqualified and the one rejected data point is relegated to one analyte within a method for one sample, and not the entire method itself. Accuracy measurements are reviewed in items 12, 14, 15, 16, 19, and 20.</p>						
Method Compliance:	<b>X</b>	Acceptable		Unacceptable	SM	Initials
<p>Comments: For this data set, method compliance was determined by evaluating sample integrity, holding time, reporting limits, laboratory blanks, system performance checks, instrument calibrations, and organic sample chromatograms against method specified requirements. The diluted method 8082 data for sample MW-06-0608 were identified as not reportable due to lack of instrument calibration verification (see item 13). For these data, alternate, acceptable results were also reported. Although some data require qualification based on concentrations reported above the instrument calibration range (see item 6), instrument calibration outliers (see item 13), and/or analyte confirmation discrepancy (see item 22), overall method compliance is acceptable since a majority of the data are unqualified and no data are rejected based on these measurements. Method compliance measurements are reviewed in items 4, 6, 8, 11, 13, 18, 19, 20, and 22.</p>						
Completeness:	<b>X</b>	Acceptable		Unacceptable	SM	Initials
<p>Comments: Completeness is the overall ratio of the number of samples planned versus the number of samples with valid analyses. Completeness goals were set at 95-100%. Determination of completeness during this data validation procedure included a review of chain of custody records, laboratory analytical methods and detection limits, laboratory case narratives, and project requirements. Completeness also included 100% review of the laboratory sample data results and QC summary reports, with reference to supplied chromatograms and raw data. The electronic data deliverable query file (EDD file) was QA'd 100% for positive target analytes and method reporting limits. EDD file corrections/additions were made by the data validator during this review procedure as outlined in item 23.</p> <p>Alternate, reportable results were available for all data points designated as not-reportable based on multiple dilutions. One data point from method 8260B for sample MW-08R-0608 was rejected based on non-recovery of the matrix spike (see item 16). There were a total of 2067 distinct possible target analyte data points possible for this sample set. When considering the one rejected data point, completeness of the data set is calculated to be 99.9% and is acceptable and compliant with QAPP requirements.</p>						
<b>VALIDATION CRITERIA CHECK</b>						
<p>Data validation qualifiers assigned during this review for <u>reportable</u> results:</p> <p>J        estimated concentration</p> <p>J+      estimated concentration, biased high</p> <p>UJ      undetected, reporting limit is estimated</p> <p>Data validation and other qualifiers assigned during this review for <u>non-reportable</u> data:</p> <p>R        rejected due to severe QAQC noncompliance</p> <p>DNR    do not report; an alternate, acceptable result is available</p> <p>The following comments identifying sample results requiring qualification are in bold type. The other comments are of interest, but qualification of the sample results is not necessary.</p> <p><b>Refer to the table of Qualified Analytical Results for a listing of the samples, analytes, and concentrations qualified (pages 13-14).</b></p>						

## ENSR ANALYTICAL DATA VALIDATION CHECKLIST

1. Did the laboratory identify any non-conformances related to the analytical results?	<b>X</b>	Yes		No	SM	Initials
<p>Explanation by laboratory: Instrument calibration and surrogate outliers were noted in the laboratory case narrative. Any assigned laboratory flags were also reviewed and evaluated during the data validation procedure.</p> <p>Data qualification, if any, related to laboratory case narrative comments and assigned laboratory flags are discussed in the following sections.</p>						
2. Were sample Chain-of-Custody forms complete?		Yes		No	SM	Initials
<p>Comments: The COC records from field to laboratory were complete, and custody was maintained as evidenced by field and laboratory personnel signatures, and laboratory dates and times of sample receipt, except as noted.</p> <p>The trip blank sample was not listed on the COC record. The sample was correctly logged in and scheduled for method 8260B, 8021B modified, and NWTPH-Gx analyses by laboratory personnel. No action is required other than to document this observation.</p>						
3. Were all the analyses requested for the samples on the COCs completed by the laboratory?	<b>X</b>	Yes		No	SM	Initials
<p>Comments: All requested analyses as documented on the original COCs, or as added by laboratory personnel (see item 2), were completed by the laboratory, with the following clarification.</p> <p>Samples MW-06-0608, MW-03-0608, and MW-103-0608 are listed twice on the COC records, as being both collected on 06/04/2008 and 06/05/08. These are three distinct samples, each collected over a two day period. It was confirmed with the ENSR project manager that the final sample collection date of 06/05/08 be designated as the appropriate sample collection date to reference in this report and in the project database/EDD files. During review of holding time compliance though (see item 8), the collection date recorded on the COC was utilized as the starting point for consideration. All requested analyses for the three distinct samples were completed, data set completeness was not affected, and no action is required other than to note this observation.</p>						
4. Were samples received in good condition and at the appropriate temperature?	<b>X</b>	Yes		No	SM	Initials
<p>Comments: The samples were received intact, on ice, and in good condition with cooler temperatures of 0.6°C to 3.8°C as noted on the supplied Cooler Receipt Form received. Samples received at less than 2°C were determined to be in acceptable condition since sample containers were intact and samples themselves were not frozen.</p>						
5. Were the requested analytical methods in compliance with WP/QAPP, permit, or COC?	<b>X</b>	Yes		No	SM	Initials
<p>Comments: Reported methods met those requested on the COCs and/or the methods reported are in compliance with those methods listed in Table 2-3 (Sample Handling and Preservation Requirements for Water) found in the <i>Quality Assurance Project Plan – Non-Time Critical Removal Action – Preliminary Investigation and Interim Groundwater Monitoring Plan DRAFT (QAPP), Lower Duwamish Waterway Superfund Site, Terminal T117 Early Action Area, ENSR, December 31, 2007.</i></p>						
6. Were detection limits in accordance with WP/QAPP, permit, or method?	<b>X</b>	Yes		No	SM	Initials
<p>Comments: The practical quantitation limits/reporting limits (PQLs/RLs) are achievable by the quoted methods and meet the limit requirements listed in QAPP Table 2-5 (Method Reporting Limits in Water) prior to any dilution/volume adjustments. Some samples required dilution due to high target analyte concentration. Reporting limits for these samples were adjusted appropriately to reflect the dilution factors.</p> <p>Continued on next page</p>						

## ENSR ANALYTICAL DATA VALIDATION CHECKLIST

Note that there were no trace concentrations (concentrations > method detection limit but < reporting limit) reported for target analytes in any analytical methods.

### Method 8082 –

**The laboratory appropriately reanalyzed at dilution analyte aroclor 1260 that exceeded instrument calibration range in the initial analysis of sample MW-06-0608. However, this diluted result was reported without a corresponding instrument calibration standard (see item 13) and was not useable. The initial sample concentration for aroclor 1260 in sample MW-06-0608 requires a J qualifier to indicate an estimated concentration due to inaccurate quantitation above the instrument calibration range. Note that this result was also qualified based on calibration outliers (see item 13).**

### All Methods –

Note that MDLs are provided in the EDD files for all methods except 160.2. The MDLs are not referenced in the hardcopy laboratory reports. In all cases, the MDLs are correctly listed in the EDDs as a lesser value than the corresponding practical quantitation limit or reporting limit (PQL/RL).

**Refer to the table of Qualified Analytical Results for a listing of the samples, analytes, and concentrations qualified (pages 13-14).**

7. Do the laboratory reports include only those constituents requested to be reported for a specific analytical method?	<b>X</b>	Yes		No	SM	Initials
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Comments: Only analytes applicable to the requested methods were reported. The data validator was not given specific target analyte lists for this project, however, the reported lists were consistent for all samples and methods.

Note that some analytes were reported by both methods 8260B and 8021BMod, or by method 8270D and 8270D SIM.

8. Were sample holding times met?	<b>X</b>	Yes		No	SM	Initials
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Comments: Extraction and/or analytical holding times were met for all samples and analyses.

The method required holding time periods for water/water QC samples were as follows:

7 days from sample collection to analysis for method 160.2;

7 days from sample collection to extraction, and 40 days from extraction to analysis for methods 8270D, 8270D SIM, and 8082;

14 days from sample collection to analysis for methods 8260B, 8021B modified, and NWTPH-Gx;

14 days from sample collection to extraction, and 40 days from extraction to analysis for method NWTPH-Dx;

28 days from sample collection to analysis for method 7470A; and

6 months from sample collection to analysis for methods 6010B and 7060A.

9. Were correct concentration units reported?	<b>X</b>	Yes		No	SM	Initials
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Comments: Correct concentration units were reported. All inorganic data and all organic method NWTPH-Gx and NWTPH-Dx data were reported as mg/L (ppm). All other organic method data were reported as µg/L (ppb). No action is required other than to alert the data user to these varying units of measure.

10. Were the reporting requirements for flagged data met?	<b>X</b>	Yes		No	SM	Initials
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Comments: Laboratory flags were reviewed and considered during the data validation procedure. Data validation qualifiers override assigned laboratory flags.



## ENSR ANALYTICAL DATA VALIDATION CHECKLIST

11. Were laboratory blank samples free of target analyte contamination?	<b>X</b>	Yes		No	SM	Initials
Comments: Laboratory blank samples (including method, preparation, and calibration blanks) were free of target analyte contamination, or else were not associated with project sample results.						
12. Were trip blank, field blank, and/or equipment rinse blank samples free of target analyte contamination?	<b>X</b>	Yes		No	SM	Initials
Comments: The trip blank sample submitted and scheduled for methods 8260B, 8021B modified, and NWTPH-Gx analyses was free of target analyte contamination. Field blank and equipment rinse blank samples were not applicable to the sampling procedures followed and/or were not submitted for analysis.						
13. Were instrument calibrations within method control limits?		Yes	<b>X</b>	No	SM	Initials
<p>Comments: Initial and continuing calibrations were within data validation criteria for all target analytes, except as noted. The frequency of both initial and continuing calibration verification checks (ICVs, CCVs) was sufficient for all methods. Noncompliant relative response factors (RRFs), percent relative standard deviations (%RSDs), percent differences (%Ds), and/or percent recoveries (%Rs) associated with non-target analytes or non-project samples, or high bias indicators associated with undetected project sample results, were not considered during validation since they do not affect reported project sample results.</p> <p>All calibration results were within these identified QC limits, except as noted:</p> <p>Organic method 8260B QC limits were set at 0-15%RSD for ICV or linearity &gt;0.995; 0-20%D for CCV; System Performance Check Compound (SPCC) RFs &gt; 0.10 than 0.30 depending on analyte.</p> <p>Organic methods 8270D and 8270D SIM QC limits were set at 0-20%RSD for ICV or linearity &gt;0.995; 0-20%D for CCV; SPCC RFs within SW-846 method 8270D Table 4 requirements.</p> <p>Organic method 8082 QC limits were set at 0-20%RSD for ICV and 0-25%D for CCV, or averaged %Ds were ≤15%. (Averaged percent deviations are allowed per method 8000B, Section 7 of <i>Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Final Update III.</i>)</p> <p>Organic methods 8021B modified QC limits were set at 0-20%RSD for ICV and 0-15%D for CCV, or averaged %Ds were ≤15%. (Averaged percent deviations are allowed per method 8000B, Section 7 of <i>Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Final Update III.</i>)</p> <p>Method NWTPH-Gx and NWTPH-Dx ICVs reported %RSDs within the 0-20% QC limits (±15% for secondary source calibration). NWTPH-Gx and NWTPH-Dx CCVs were within averaged percent deviations of ≤ 15% (&lt;20% acceptable for GRH). Averaged percent deviations are allowed per method 8000B, Section 7 of <i>Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Final Update III.</i></p> <p>Inorganic method 6010B ICV and CCV %R limits were set at 90-110%; 7470A ICV and CCV %R limits were set at 80-120%.</p> <p>Note that the following qualifications are assigned per national guidance of semivolatile and PCB organics and are not necessarily exceedences based on SW-846 or QAPP requirements.</p> <p><u>Method 8270D –</u></p> <p><b>Instrument NT4: The %Ds for benzyl alcohol (30.6%), 2,2'-oxybis(1-chloropropane) (32%), 2,4-dinitrophenol (23.6%), exceeded the ≤ 20%D QC limit in the CCV of 06/12/2008 at 12:24. These analytes were undetected in associated project samples and require UJ qualifiers to indicate estimated reporting limits due to compromised system sensitivity.</b></p> <p>Continued on next page</p>						

# ENSR ANALYTICAL DATA VALIDATION CHECKLIST

Method 8082 –

**Instrument ECD6: Average %Ds for aroclor 1260 exceeded the ≤15% method QC limit on both column ZB5 (21.5%) and ZB35 (20.9%) in the CCV of 06/19/08 at 01:52. Aroclor 1260 results in associated project samples require J/UJ qualifiers (as appropriate) to indicate estimated concentrations or estimated reporting limits due to demonstrated system bias.**

Instrument ECD6: A closing CCV was not analyzed in relation to the diluted analysis of sample MW-06-0608 from 06/19/08 at 10:53. Since instrument compliance was not demonstrated for this analysis, the initial analysis of sample MW-06-0608 was chosen as the reportable results (see item 6). The diluted results for sample MW-06-0608 were designated as not reportable in the project database file. No further action is required other than to note this observation and method noncompliance.

**Refer to the table of Qualified Analytical Results for a listing of the samples, analytes, and concentrations qualified (pages 13-14).**

14. Were surrogate recoveries within control limits?	<b>X</b>	Yes		No	SM	Initials
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Comments: Surrogate %Rs for organic analyses were within laboratory control-charted QC limits for all samples and associated QC samples, or met the following requirement. High surrogate recoveries associated with undetected project sample results did not initiate data qualification since the indicated high bias was not realized. Noncompliant surrogate %Rs in laboratory QC samples did not initiate qualification of project samples as long as surrogate %Rs in project samples were compliant.

15. Were laboratory control sample recoveries within control limits?	<b>X</b>	Yes		No	SM	Initials
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Comments: Reported LCS, LCSD recoveries were within QAPP Table 1-1 Data Quality Objectives and/or data validation QC limits (70-130% for organics; 80-120% for metals; 50-150% for general chemistry) for all target analytes, or were within laboratory control-charted QC limits for organic target analytes as allowed for SW-846 organic methods.

16. Were matrix spike recoveries within control limits?		Yes	<b>X</b>	No	SM	Initials
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Comments: Project specific MS, MSD %Rs for target analytes were within QAPP Table 1-1 Data Quality Objectives limits of 70-130% (50-150% for TSS) or laboratory control charted QC limits (as allowed for SW-846 methods), or were within data validation QC limits of 75-125% for metals analytes, or MS, MSD data met the following requirement. Organic MS/MSD %Rs must both be outside of QC limits in order for organic results to be qualified based on matrix. If organic matrix effect was not confirmed (either MS or MSD was compliant), data did not require qualification.

Method 8260B –

**Analyte 2-chloroethylvinyl ether was not recovered (0% R) in both the MS and the MSD of source sample MW-08R-0608. The non-recovery was below the lowest acceptable data validation QC limit of 10% for reportable data. The undetected 2-chloroethylvinyl ether result in the source sample requires rejection (R qualifier) due to severe QC failure and confirmed matrix interference resulting in a low bias.** Note that the same batch LCS/LCSD %Rs for this analyte were compliant at 87.5-97.5%, thereby demonstrating analytical accuracy.

Continued on next page

## ENSR ANALYTICAL DATA VALIDATION CHECKLIST

Method 8082 –

**Analyte aroclor 1260 was not recovered in the MS (0%R) and was recovered low (38%) in the MSD of source sample MW-08R-0608. Although the MSD %R is within published data validation QC limits of 29-135%, the laboratory control charted QC requirements were not met. The MS/MSD outliers were not noted in the laboratory case narrative comments. Since the aroclor 1260 result for sample MW-08R-0608 was a detection, the data point requires a J qualifier (rather than rejection) to indicate an estimated concentration, possibly biased low, due to confirmed matrix interference. Note that the same batch LCS/LCSD %Rs for this analyte were compliant at 98-102%, thereby demonstrating analytical accuracy.**

**Refer to the table of Qualified Analytical Results for a listing of the samples, analytes, and concentrations qualified (pages 13-14).**

17. Were duplicate RPDs and/or serial dilution %Ds within control limits?		Yes	<b>X</b>	No	SM	Initials
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Comments: Laboratory RPDs for target analytes in LCS/LCSD, and project-specific MS/MSD or laboratory duplicate samples were within QAPP Table 1-1 Data Quality Objectives limits of 0-20%, or RPDs were not applicable due to undetected results in both samples, or sample results were within  $\pm$  the detection limit (RL), except as noted. High RPDs associated with undetected project sample results did not initiate data qualification since the precision of the reporting limit is not in question.

Serial dilutions were not applicable for this data set due to lower sample concentrations reported.

Method 8082 –

**The RPD for aroclor 1260 in the spiked analysis of sample MW-08R-0608 exceeded the 0-20% QAPP QC limits at 42.9%. The positive aroclor 1260 result reported for this sample requires a J qualifier to indicate an estimated concentration due to the laboratory precision outlier.**

**Refer to the table of Qualified Analytical Results for a listing of the samples, analytes, and concentrations qualified (pages 13-14).**

18. Were organic system performance criteria met?	<b>X</b>	Yes		No	SM	Initials
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Comments: GC/MS method 8260B BFB and 8270D/SIM DFTPP tunes were within ion abundance and 12-hour clock method criteria for all analytical sequences. Method 8270D and 8270D SIM DDT degradation was <20%. Acceptable performance for organic GC methods were demonstrated by compliant correlation coefficients, instrument calibrations, and retention times as appropriate to the method.

19. Were internal standards within method criteria for GC/MS and/or ICP-MS sample analyses?	<b>X</b>	Yes		No	SM	Initials
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Comments: Internal standard area counts and retention times (RTs) were within data validation QC criteria for all GC/MS method 8260B, 8270D, 8270D SIM, and 8082 project sample results.

Note that internal standard area counts and RTs were not listed on Form 8 for sample MW-04R-0608 analyzed on 06/19/08 at 04:06. Compliance with area and RT objectives for this sample were confirmed only by raw data review. No action is required other than to note this omission on the data summary form.

20. Were inorganic system performance criteria met?		Yes	<b>X</b>	No	SM	Initials
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Comments: ICP interference check standards (ICS) and CRDL standard (CRI) frequency and percent recoveries were within data validation QC limits (80-120% for ICS; 70-130% for CRI) for all target analytes, or else undetected project sample results were associated with high bias indicators and did not require qualification, or else the following outliers were noted.

Continued on next page

## ENSR ANALYTICAL DATA VALIDATION CHECKLIST

### Method 6010B -

The CRI %R for silver (53%) was below the 70-130% QC limit in QC batch 62221. All silver results in associated samples were non-detects and therefore require UJ qualifiers to indicate undetected results at estimated reporting limits due to compromised instrument sensitivity.

The CRI %R for nickel (68.8%) was below the 70-130% QC limit in QC batch 62521. All nickel results in associated samples were non-detects and therefore require UJ qualifiers to indicate undetected results at estimated reporting limits due to compromised instrument sensitivity.

The CRI %R for copper (166.5%) exceeded the 70-130% QC limit in QC batch 62521. All positive copper results in associated samples exceed twice the RL and no action is required other than to document this occurrence.

### Method 7060A –

The CRI %R for arsenic (132%) exceeded the 70-130% QC limit in QC batch 61851. The total and dissolved arsenic results in sample MW-06-0608 did not exceed twice the RL, and require J+ qualifiers to indicate estimated concentrations, associated with a high instrument bias.

Refer to the table of Qualified Analytical Results for a listing of the samples, analytes, and concentrations qualified (pages 13-14).

21. Were blind field duplicates collected? If so, discuss the precision (RPD) of the results.	<b>X</b>	Yes	No	SM	Initials
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Duplicate Sample No.	MW-103-0608	Primary Sample No.	MW-03-0608
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Comments: Field duplicate RPDs were within data validation QC limits of 0-30% for water matrices, or RPDs were not applicable due to results that were  $\pm$  the detection limit or were undetected in both samples. Field duplicate and native sample concentrations that were both undetected are not reflected in the table below since RPDs are not applicable.

The following RPDs were calculated:

Method	Units	Analyte	MW-03-0608	MW-103-0608	RPD	Qualifiers
160.2	mg/L	Total Suspended Solids	1460	725	<b>67.3</b>	<b>J/J</b>
NWTPH-Dx	mg/L	DRH	3.0	3.2	6.5	
NWTPH-Dx	mg/L	MORH	0.85	1.2	+/- RL	
7060A	mg/L	Arsenic, dissolved	0.024	0.022	8.7	
7060A	mg/L	Arsenic, total	0.023	0.021	9.1	
8082	µg/L	Aroclor 1260	< 0.010	0.016	+/- RL	
8260B	µg/L	Acetone	7.0	7.6	8.2	
8270D SIM	µg/L	Acenaphthene	< 0.10	0.14	+/- RL	
8270D SIM	µg/L	Naphthalene	0.47	0.10	<b>129.8</b>	<b>J/J</b>

The highlighted target analytes require J qualifiers in the native sample and in the field duplicate sample to indicate estimated concentrations due to variability between field duplicate results (RPD exceeded QC limit).

Refer to the table of Qualified Analytical Results for a listing of the samples, analytes, and concentrations qualified (pages 13-14).

## ENSR ANALYTICAL DATA VALIDATION CHECKLIST

22. Were qualitative/quantitative criteria for organic target analyte identification met?		Yes	<b>X</b>	No	SM	Initials	
<p>Comments: Organic method quantitation reports and chromatograms were reviewed by trained laboratory personnel in accordance with the laboratory's internal QA/QC program. No identification/quantitation flags were assigned, and no anomalies were identified during the data validation process, except as noted.</p> <p><u>Method 8082 –</u></p> <p><b>Current guidance states that the percent difference (%D) for detected aroclor analytes between the two GC columns must be within <math>\pm</math> 25%. This QC criteria was not met for aroclor 1254 (40%D) in sample MW-05R-0609. Sample chromatograms show that interference is present in the elution area of aroclor 1254. Since the %D column confirmation was not met for aroclor 1254, accurate quantitation of the analyte is in question. The aroclor 1254 result for sample MW-05R-0609 requires a J qualifier to indicate an estimated concentration due to high percent difference in analyte confirmation.</b></p> <p><u>Method NWTPH-Dx –</u></p> <p>The laboratory noted that the diesel results reported for samples MW-10-0608, MW-03-0608, MW-103-0608, and MW-02-0608 and the motor oil results reported for samples MW-03-0608 and MW-103-0608 were affected by unidentifiable organics and/or hydrocarbons within the specified carbon ranges. Although the hardcopy laboratory report lists the target analytes as “diesel” and “motor oil” in the report pages, the submitted EDD query correctly lists the analyte names as “Diesel Range Hydrocarbons” and “Motor Oil Range Hydrocarbons” to correctly encompass not only diesel and motor oil, but other co-eluting/interfering compounds found within the target ranges of C<sub>12</sub>-C<sub>24</sub> and C<sub>24</sub>-C<sub>38</sub> respectively. No action is required for the NWTPH-Dx data other than to note these observations since the database contains the correct target analyte determinations.</p> <p><b>Refer to the table of Qualified Analytical Results for a listing of the samples, analytes, and concentrations qualified (pages 13-14).</b></p>							
23. Were 100% of the EDD concentrations and reporting limits compared to the hardcopy data reports?		<b>X</b>	Yes		No	SM	Initials
<p>Comments: 100% EDD QA/QC of positive concentrations and RLs was done as part of this data validation procedure. The EDD entries were resolved with the hardcopy data results and corrected as necessary for significant figures. According to validation protocol, the hardcopy data report was accepted as the correct reference. The matrix code was corrected to WG (groundwater) and WQ (water QC) from W (water) as appropriate to more accurately reflect the nature and matrix of the project samples. The sample_date for the trip blank sample was corrected to reflect the date of transport. Duplicate results within method 8082) were evaluated as documented within this checklist (see items 6 and 13). Duplicate results determined to be less reliable were maintained in the project database but were designated with DNR qualifiers (Do Not Report) and identified as not-reportable since alternate, acceptable results were provided.</p> <p>The ENSR project manager in Seattle, WA was informed of all EDD corrections made to the file via this checklist. The updated EDD file, with corrections and data validation qualifiers added, was sent to the ENSR project manager and database manager in Seattle, WA on 07/31/2008.</p>							
<p>24. General Comments: Data were evaluated based on project criteria outlined in the <i>Quality Assurance Project Plan – Non-Time Critical Removal Action – Preliminary Investigation and Interim Groundwater Monitoring Plan DRAFT (QAPP), Lower Duwamish Waterway Superfund Site, Terminal T117 Early Action Area, ENSR, December 31, 2007</i>, and based on validation criteria set forth in the <i>USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic/Inorganic Data Review</i>, document numbers EPA540/R-99/008 and EPA540/R-04/004 of October 1999 (Organic) and October 2004 (Inorganic), and the <i>USEPA CLP National Functional Guidelines for Superfund Organic Methods Data Review</i>, document number USEPA-540-R-07-003, July 2007, as they applied to the reported methodology. Washington State Department of Ecology (WDOE) methods were also reviewed as per <i>WDOE Analytical Methods for Petroleum Hydrocarbons</i>, ECY 97-602 of June 1997. Field duplicate RPD control limits were taken from the USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses, December 1996.</p> <p><b>Refer to the table of Qualified Analytical Results for a listing of the samples, analytes, and concentrations qualified (pages 13-14).</b></p>							

**Table of Qualified Analytical Results  
Port of Seattle - Terminal 117  
Groundwater and Water QC Samples  
Analytical Resources, Inc. (ARI) Laboratory Report MZ97  
June 2008**

Sample ID	Lab Sample ID	Method	Sequence	Analyte	Concentration		Qualifier	Reason Code
<b>Reportable, qualified Groundwater data:</b>								
MW-01-0608	MZ97J	6010B	1	Nickel	<	0.01 mg/L	UJ	CRI
MW-01-0608	MZ97J	8082	1	Aroclor 1260	<	0.010 µg/L	UJ	CCV
MW-01-0608	MZ97J	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-01-0608	MZ97J	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-01-0608	MZ97J	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV
MW-01-0608	MZ97T	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
MW-02-0608	MZ97K	6010B	1	Nickel	<	0.01 mg/L	UJ	CRI
MW-02-0608	MZ97K	8082	1	Aroclor 1260		0.012 µg/L	J	CCV
MW-02-0608	MZ97K	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-02-0608	MZ97K	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-02-0608	MZ97K	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV
MW-02-0608	MZ97U	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
MW-03-0608	MZ97F	160.2	10	Total Suspended Solids		1460 mg/L	J	FD
MW-03-0608	MZ97F	6010B	1	Silver	<	0.003 mg/L	UJ	CRI
MW-03-0608	MZ97G	8082	1	Aroclor 1260	<	0.010 µg/L	UJ	CCV
MW-03-0608	MZ97G	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-03-0608	MZ97G	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-03-0608	MZ97G	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV
MW-03-0608	MZ97G	8270D SIM	1	Naphthalene		0.47 µg/L	J	FD
MW-03-0608	MZ97R	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
MW-04R-0608	MZ97A	6010B	1	Nickel	<	0.01 mg/L	UJ	CRI
MW-04R-0608	MZ97A	8082	1	Aroclor 1260	<	0.010 µg/L	UJ	CCV
MW-04R-0608	MZ97A	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-04R-0608	MZ97A	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-04R-0608	MZ97A	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV
MW-04R-0608	MZ97O	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
MW-05R-0608	MZ97B	6010B	1	Nickel	<	0.01 mg/L	UJ	CRI
MW-05R-0608	MZ97B	8082	1	Aroclor 1254		0.017 µg/L	J	column %D
MW-05R-0608	MZ97B	8082	1	Aroclor 1260		0.039 µg/L	J	CCV
MW-05R-0608	MZ97B	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-05R-0608	MZ97B	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-05R-0608	MZ97B	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV
MW-05R-0608	MZ97P	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
MW-06-0608	MZ97D	6010B	1	Nickel	<	0.01 mg/L	UJ	CRI
MW-06-0608	MZ97D	7060A	1	Arsenic		0.001 mg/L	J+	CRI
MW-06-0608	MZ97D	8082	1	Aroclor 1260		0.76 µg/L	J	CCV, ECR
MW-06-0608	MZ97D	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-06-0608	MZ97D	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-06-0608	MZ97D	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV

Continued on next page

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Sample ID	Lab Sample ID	Method	Sequence	Analyte	Concentration		Qualifier	Reason Code
MW-06-0608	MZ97E	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
MW-06-0608	MZ97E	7060A, Diss	1	Arsenic, dissolved		0.001 mg/L	J+	CRI
MW-07-0608	MZ97L	6010B	1	Nickel	<	0.01 mg/L	UJ	CRI
MW-07-0608	MZ97L	8082	1	Aroclor 1260	<	0.010 µg/L	UJ	CCV
MW-07-0608	MZ97L	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-07-0608	MZ97L	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-07-0608	MZ97L	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV
MW-07-0608	MZ97V	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
MW-08R-0608	MZ97M	6010B	1	Nickel	<	0.01 mg/L	UJ	CRI
MW-08R-0608	MZ97M	8082	1	Aroclor 1260		0.049 µg/L	J	CCV, RPD
MW-08R-0608	MZ97M	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-08R-0608	MZ97M	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-08R-0608	MZ97M	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV
MW-08R-0608	MZ97W	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
MW-10-0608	MZ97C	6010B	1	Silver	<	0.003 mg/L	UJ	CRI
MW-10-0608	MZ97C	8082	1	Aroclor 1260	<	0.010 µg/L	UJ	CCV
MW-10-0608	MZ97C	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-10-0608	MZ97C	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-10-0608	MZ97C	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV
MW-10-0608	MZ97Q	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
MW-103-0608	MZ97H	160.2	6	Total Suspended Solids		725 mg/L	J	FD
MW-103-0608	MZ97H	6010B	1	Nickel	<	0.01 mg/L	UJ	CRI
MW-103-0608	MZ97I	8082	1	Aroclor 1260		0.016 µg/L	J	CCV
MW-103-0608	MZ97I	8270D	1	2,2'-Oxybis(1-Chloropropane)	<	1.0 µg/L	UJ	CCV
MW-103-0608	MZ97I	8270D	1	2,4-Dinitrophenol	<	10 µg/L	UJ	CCV
MW-103-0608	MZ97I	8270D	1	Benzyl Alcohol	<	5.0 µg/L	UJ	CCV
MW-103-0608	MZ97I	8270D SIM	1	Naphthalene		0.10 µg/L	J	FD
MW-103-0608	MZ97S	6010B, Diss	1	Nickel, dissolved	<	0.01 mg/L	UJ	CRI
<b>Rejected (R) or Non-reportable duplicate (DNR) Groundwater data:</b>								
MW-06-0608	MZ97D	8082	3	All Analytes			DNR	no CCV - use Initial result
MW-08R-0608	MZ97M	8260B	1	2-Chloroethylvinylether	<	1.0 µg/L	R	MS 0%

**Reason Codes:**

column %D – percent difference of quantified values between primary and secondary columns exceeded  $\pm 25\%$ , estimated concentration

CCV – continuing calibration outlier, demonstrated analytical system bias

CRI - detection limit standard %R outlier, possible system bias

ECR – target analyte concentration exceeded instrument calibration range, dilution required

FD – relative percent difference between field duplicates exceeds QC limits; field precision outlier

MS 0% - matrix spike was not recovered; confirmed matrix interference; severe noncompliance

RPD - relative percent difference between laboratory duplicates (or spiked duplicates) exceeds QC limits; laboratory precision outlier