Prepared for:
BASF Corporation
Mount Olive, New Jersey

CMS Supplemental Background Groundwater Sampling Results BASF North Works Facility

USEPA I.D. Number MID064197742

US EPA RECORDS CENTER REGION 5
1004390

ENSR Corporation
February 9, 2006
Document No.: 00760-177-600

ENSR | AECOM

Prepared for:
BASF Corporation
Mount Olive, New Jersey

CMS Supplemental Background Groundwater Sampling Results BASF North Works Facility

USEPA I.D. Number MID064197742

ENSR Corporation
February 9, 2006
Document No.: 00760-177-600

BASF

The Chemical Company

Helping Make
Products Better™

February 24, 2006

Mr. Juan Thomas
Project Manager
United States Environmental Protection Agency
Region V (DE-9J)
77 West Jackson Street
Chicago, Illinois 60604

Subject: CMS Supplemental Background Groundwater Sampling Results
RCRA Corrective Action
BASF Corporation, Wyandotte, Michigan

Dear Mr. Thomas:

In September 2005, ENSR re-sampled selected RFI background monitoring wells and off site background well BGMW-1 using the low flow sampling technique. Previously the RFI background wells had not been sampled using the low flow technique. Enclosed are three copies of the February 2006 report entitled CMS Supplemental Background Groundwater Sampling Results.

If you need additional information, please let me know.

Sincerely yours,

Bruce Roberts

Bruce Roberts
Project Manager

Enclosure

cc w/o enclosure:

LAubuchon – MDEQ Warren
RBlayer – MDEQ Lansing
MHarvey – WHI
ENuernberg – BASF
BVens – MDEQ Warren
JCashin – Bacon Memorial Public Library
REllis -- ENSR
BDiepeveen -- BASF

BASF Corporation
1609 Biddle Avenue
Wyandotte, MI 48192-3729
Tel: (734) 324-6000
www.basf.com/usa

Prepared for:
BASF Corporation
Wyandotte, Michigan

CMS Supplemental Background Groundwater Sampling Results

BASF North Works Facility

USEPA I.D. Number MID 064197742

Randy Ellis

Prepared By

John D. Hyder

Reviewed By

ENSR Corporation
February 9, 2006
Document No.: 00760-127-710

Contents

1.0 Introduction **1-1**

2.0 Sampling Methodology **2-1**

2.1 Groundwater Sampling 2-1

2.2 Laboratory Analysis and Sample QA/QC 2-1

3.0 Data Assessment **3-1**

4.0 Quality Assurance / Quality Control (QA/QC) **4-1**

4.1 QA/QC Summary 4-1

5.0 Summary and Conclusions **5-1**

List of Tables

Table 1 Inorganics in Groundwater September 2005 Sampling
Table 2 Groundwater Monitoring Well Inorganic Analyses During RFI and CMS Sampling

List of Figures

Figure 1 Site Location Map
Figure 2 Background Monitoring Well Locations September 2005

List of Appendices

Appendix A Laboratory Analytical Reports
Appendix B Data Validation Reports

1.0 Introduction

The September 2005 Corrective Measures Study (CMS) supplemental background groundwater sampling activities included sampling and analysis of select constituents of concern (COCs) performed at background monitoring wells upgradient of the BASF North Works Facility (**Figure 1**) where previous sampling results identified COCs that exceeded Michigan Part 201 Groundwater Surface Water Interface Protection Criteria (GSI criteria). Select COCs included antimony, arsenic, chromium, lead, nickel, selenium, thallium and vanadium parameters. CMS supplemental background groundwater sampling and analysis was conducted in accordance with ENSR's *CMS Supplemental Groundwater Sampling Plan for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID Number MID 064197742, November 2003.*

A total of 8 groundwater monitoring wells were sampled during the September 2005 groundwater sampling activity (BGMW-1, WHI3-1S, WHI2-3S, RFIMW-25, P35N, WHI2-1S and RFIMW-24). Well BGMW-1 was installed in November 2003 at a parcel of land upgradient of the North Works Facility that is owned by BASF. The remaining 7 wells are located along the upgradient property boundary (Biddle Avenue) and serve as indicators of background conditions in groundwater. **Figure 2** shows the location of the monitoring wells sampled.

Field sampling activities were conducted in accordance with the health and safety protocol presented in the RFI Health and Safety Plan (HASP) and the Quality Assurance Plan (QAPP). The remainder of this report presents the results of the groundwater sampling program.

2.0 Sampling Methodology

2.1 Groundwater Sampling

Groundwater samples were collected from 9 background groundwater monitoring wells. A groundwater sample was collected from monitoring well PM3NA as a substitute for well P34N, which was abandoned due to damage to the well. However, the sample collected from well PM3NA was not analyzed after it was determined that the well did not represent background groundwater conditions. The sampling locations are shown on Figure 2, Background Monitoring Well Locations. Groundwater samples were analyzed for antimony, arsenic, chromium, lead, nickel, selenium, thallium and vanadium. Groundwater sampling activities were conducted using low-flow sampling techniques in accordance with the SOPs presented in the RFI and CMS Supplemental Work Plans.

Prior to sampling, ENSR obtained water level measurements of the monitoring wells using an electronic water level indicator. The precleaned tubing was slowly lowered to the sampling depth and then connected to the peristaltic pump. After the groundwater stabilized, determined by three consecutive water quality readings within the established limits, the groundwater samples were collected. Groundwater quality parameters (specific conductivity, pH, temperature, oxidation-reduction potential and dissolved oxygen) were measured using a YSI 650XL water quality meter via a flow-through cell. Groundwater samples were collected in laboratory supplied bottles and placed in a cooler containing ice immediately after collection. Sampling equipment was decontaminated between sampling locations using an Alconox® detergent and distilled water wash followed by a distilled water rinse.

2.2 Laboratory Analysis and Sample QA/QC

Groundwater samples were submitted to Severn Trent Laboratories (STL) in n. Canton, OH for chromium, lead, nickel, selenium, thallium and vanadium analysis using SW-846 Method 6010B and antimony, arsenic and thallium using SW-846 Method 6020.

Each cooler submitted to the laboratory was accompanied by a Chain Of Custody (COC) record. The purpose of this procedure was to document the possession of the sample from the time of collection through laboratory analysis and reporting. Cooler contents and sample temperatures were recorded by the laboratory. All samples were preserved by cooling to 4° C using ice and delivered via FedEx Priority Overnight for laboratory analysis on a standard turnaround basis.

Each sample was assigned a unique sample identification code. The sample identification code for each sample was shown on the COC, sample container label, and field notebook along with the date/time sampled, analysis requested, preservation method, and the sampler's initials.

Throughout the investigation, ENSR collected quality assurance/quality control (QA/QC) samples. The QA/QC analyses included one field blank collected from RFIMW-24, one sample duplicate sample collected from WHI2-1S and matrix spike/matrix spike duplicate analyses performed on the sample collected from RFIMW-24. The results of the QA/QC analyses were provided in the laboratory analytical report. The QA/QC sample identification code for each sample was shown on the COC, sample container label, and field notebook(s) along with the date/time sampled, analysis requested, preservation method, and the sampler's initials.

3.0 Data Assessment

Groundwater samples were analyzed for antimony, arsenic, chromium, lead, nickel, selenium, thallium and vanadium. Laboratory analytical results were compared to MDEQ Part 201 Generic Cleanup Criteria and Screening Levels for Industrial and commercial II, III and IV Drinking Water Criteria, Groundwater and Surface Water Interface Criteria and Groundwater Contact Criteria. A summary of the compounds detected as part of the CMS supplemental background groundwater sampling activities are presented in **Table 1** and discussed below. Laboratory reports are included in **Appendix A**.

Low-flow sampling was performed to provide more accurate measurements of mobile metal concentrations. Groundwater sampling results for select metals are summarized on **Table 1**. When compared with screening level criteria, the Industrial and Commercial II, III and IV Drinking Water Criteria was the most stringent for metals except for selenium and vanadium, for which the Part 201 GSI criteria was more stringent. There were no exceedences of any of the screening level criteria for antimony, arsenic, selenium and thallium. Chromium and nickel concentrations exceeded the Part 201 GSI criteria in well RFIMW-24. Lead and vanadium concentrations exceeded the Part 201 GSI and Drinking Water criteria, respectively, in well WHI3-1S. The lead concentration in well WHI4-2S and nickel concentration in well RFIMW-25 exceeded their respective part 201 GSI criteria. Metals detected in background wells were not found to occur in a localized area that would suggest the presence of an off-site, upgradient source.

During the RFI, filtered and unfiltered groundwater samples were collected from background monitoring wells RFIMW-24 through RFIMW-29 and P-34-N for analysis of select organic and inorganic constituents. The RFI groundwater samples were not collected using low-flow sampling techniques. Analytical results for background groundwater samples were statistically evaluated to establish mean concentrations of constituents. A summary of mean constituent concentrations detected in background groundwater samples were presented in Table 7-28 of the Final BASF Phase I RFI Report. A comparison of the mean constituent concentrations for metals in filtered and unfiltered background groundwater samples collected during the RFI and analytical results of metals in background groundwater samples collected during the CMS supplemental investigation are presented in **Table 2**.

Table 2 also presents a comparison of the mean concentrations of metals detected in downgradient, onsite wells sampled during the December 2003 ENSR CMS Supplemental Groundwater Investigation versus the upgradient, background wells sampled during the September 2005 ENSR CMS Supplemental Background Groundwater Investigation. With the exception of chromium and lead, the mean concentration of metals detected in background wells was lower than the mean concentration of metals in site wells.

4.0 Quality Assurance / Quality Control (QA/QC)

The following discussion summarizes the quality of the analytical data generated during the CMS Supplemental Background Groundwater Sampling. Data quality was assessed primarily using the results of the data validation process as described in the QAPP. On the basis of this assessment, data were either accepted without qualification, qualified as estimated (assigned a "J" flag), negated (assigned a "U" flag) or rejected ("R"). Data qualifying protocols were based on the US EPA validation guidelines cited in the QAPP. The data validation report is presented in **Appendix B**.

The elements evaluated during the data quality assessment included the following:

- Agreement of analyses conducted with chain-of-custody request;
- Adherence to sample holding times and preservation requirements;
- Evaluation of instrument turning and calibration;
- Results of field and laboratory quality control (QC) analyses such as blanks, duplicates, laboratory control samples and matrix spike/matrix spike duplicate;
- Conformance to analytical methodologies;
- Analytical performance checks;
- Analytical sensitivity; and,
- Completeness of results.

4.1 QA/QC Summary

Antimony, arsenic and selenium were detected in field blank sample RFIMW-24G-0905-S-FB. Antimony, arsenic, nickel and vanadium were detected in the initial calibration blank while antimony, arsenic, thallium and vanadium were detected in the continuing calibration blanks. The presence of blank contamination indicates that false positive or false negative results may exist for these analytes in samples associated with these blanks. However, antimony in the field blank was negated due to its presence in the continuing calibration blank and was therefore not used to qualify the associated groundwater samples. Analytical validation action levels were established for each analyte to evaluate the effects of false positive or negative results associated with the blank contamination and sample results were qualified as follows:

- Sample results that were greater than or equal to the method detection limit but less than or equal to the action level were qualified as non-detect at the reported concentration.
- Sample results that were greater than the action level or less than the method detection limit were not qualified.

Overall, the data generated is valid and may be used with confidence for decision-making. Data points qualified with a "J" flag should be considered estimated because of non-conformance with criteria established in the analytical methods or EPA validation protocols.

5.0 Summary and Conclusions

This report presents the findings of a CMS Supplemental Background Groundwater Sampling Program conducted at the BASF North Works facility in Wyandotte, Michigan. The sampling program focused on the collection/analysis of groundwater samples for select metals in upgradient background monitoring wells using low-flow sampling techniques.

The supplemental background groundwater sampling investigation was successful in establishing background concentrations for select metals at the BASF North Works facility. This data set provides current results that were collected using low-flow sampling techniques to ensure accurate concentration measurements. In general, when compared with historical data, the recent data resulted in mean concentrations of select metals that are similar in magnitude to historical unfiltered samples with the exception of chromium, nickel and vanadium, which were lower. The mean concentrations of select metals in background groundwater samples were also lower than mean concentrations in site groundwater samples with the exception of chromium, which was detected at 0.951 mg/L in background well RFIMW-24, and lead, which was detected in background wells WH3-1 and WHI4-2S at concentrations of 0.0136 and 0.0835 mg/L., respectively.

Tables

TABLE 1
Inorganics in Groundwater
September 2005 Sampling
BASF Corporation - Wyandotte, MI

Location ID Sample ID Sample Type Sample Date	units	INDUSTRIAL & COMMERCIAL II, III & IV DRINKING WATER CRITERIA	GROUNDWATER SURFACE WATER INTERFACE CRITERIA	GROUNDWATER CONTACT CRITERIA	BG-MW-1 BGMW-1-G-0905-S sample 13-Sep-05	WHI4-2S WHI4-2S-G-0905-S sample 13-Sep-05	WHI3-3S WHI3-3S-G-0905-S sample 13-Sep-05	WHI2-3S WHI2-3S-G-0905-S duplicate 14-Sep-05	WHI2-1S WHI2-1S-G-0905-S sample 14-Sep-05	RFIMW-24 RFIMW-24-G-0905-S sample 14-Sep-05
ANTIMONY	mg/l	0.006 (A)	0.13 (X)	68	0.00036 U	0.0055	0.00014 U	0.00067 U	0.00015 U	0.00025 U
ARSENIC	mg/l	0.05 (A)	0.15 (X)	4.3	0.0011 U	0.01	0.00082 U	0.0472	0.0368	0.0021 U
CHROMIUM	mg/l	0.1 (A)	(G, X)	290,000	0.0021 J+	0.0072	0.0019 J+	0.010 U	0.010 U	0.951
LEAD	mg/l	0.004 (L)	(G, X)	ID	0.0030 U	0.0835	0.003 U	0.003 U	0.0030 U	0.0030 U
NICKEL	mg/l	0.1 (A)	(G)	74,000	0.0117 J+	0.0057 U	0.0029 U	0.0051 U	0.0022 U	0.112
SELENIUM	mg/l	0.05 (A)	0.005	970	0.0035 U	0.0029 U	0.0033 U	0.0050 U	0.0050 U	0.0030 U
THALLIUM	mg/l	0.002 (A)	0.0037 (X)	13	0.0010 U	0.00024 U	0.000059 U	0.000095 U	0.0010 U	0.0010 U
VANADIUM	mg/l	0.062	0.012	970	0.0040 U	0.0079	0.004 U	0.0040 U	0.0040 U	0.0036

Qualifiers Used:

J = Estimated
J+ = Estimated, Biased High
J- = Estimated, Biased Low
R = Rejected
U = Non-detected
UJ = Non-detected, Estimated detection limit

Color Code:

Exceedances over the most stringent criteria.
Reporting limit above the most stringent criteria.

MDEQ Criteria Qualifiers:

A = Criterion is the state of Michigan drinking water standard established pursuant to section 5 of 1976 PA 399, MCL 325.1005.

E = Criterion is the aesthetic drinking water value, as required by section 20120a(5) of the act.

G = Groundwater surface water interface (GSI) criterion depends on the pH or water hardness, or both, of the receiving water..

L = Criteria for lead are derived using a biologically based model, as allowed for under section 20120a(10) of the act, and are not calculated using the algorithms and assumptions specified in pathway-specific rules.

M = Calculated criterion is below the analytical target detection limit, therefore, the criterion defaults to the target detection limit.

X = The groundwater surface water interface (GSI) criterion shown in the generic cleanup criteria tables is not protective for surface water that is used as a drinking water source. For a groundwater discharge to the Great Lakes and their connecting waters, the generic GSI criterion shall be the surface water human drinking water value (HDV), noted (xx).

ID = insufficient data to develop criterion.

TABLE 1
Inorganics in Groundwater
September 2005 Sampling
BASF Corporation - Wyandotte, MI

Location ID Sample ID Sample Type Sample Date	units	INDUSTRIAL & COMMERCIAL II, III & IV DRINKING WATER CRITERIA	GROUNDWATER SURFACE WATER INTERFACE CRITERIA	GROUNDWATER CONTACT CRITERIA	RFIMW-24 RFIMW-24-G-0905-FB field blank 14-Sep-05	WHI2-1S WHI2-1S-G-0905-D duplicate 14-Sep-05	RFIMW-25 RFIMW-25-G-0905-S sample 14-Sep-05	WHI3-1S WHI3-1S-G-0905-S sample 14-Sep-05
ANTIMONY	mg/l	0.006 (A)	0.13 (X)	68	0.0001 U	0.00022 U	0.0012 U	0.00072 U
ARSENIC	mg/l	0.05 (A)	0.15 (X)	4.3	0.0019	0.0367	0.0039 U	0.0096
CHROMIUM	mg/l	0.1 (A)	(G, X)	290,000	0.010 U	0.010 U	0.0596	0.0093
LEAD	mg/l	0.004 (L)	(G, X)	ID	0.0030 U	0.0030 U	0.0030 U	0.0136
NICKEL	mg/l	0.1 (A)	(G)	74,000	0.020 U	0.0022 U	0.214	0.0069 U
SELENIUM	mg/l	0.05 (A)	0.005	970	0.0029	0.0050 U	0.0050 U	0.0032 U
THALLIUM	mg/l	0.002 (A)	0.0037 (X)	13	0.0010 U	0.0010 U	0.0050 U	0.00011 U
VANADIUM	mg/l	0.062	0.012	970	0.0040 U	0.0040 U	0.0040 U	0.0122

Qualifiers Used:

J = Estimated
J+ = Estimated, Biased High
J- = Estimated, Biased Low
R = Rejected
U = Non-detected
UJ = Non-detected, Estimated detection limit

Color Code:

Exceedances over the most stringent criteria.
Reporting limit above the most stringent criteria.

MDEQ Criteria Qualifiers:

A = Criterion is the state of Michigan drinking water standard established pursuant to section 5 of 1976 PA 399, MCL 325.1005.

E = Criterion is the aesthetic drinking water value, as required by section 20120a(5) of the act.

G = Groundwater surface water interface (GSI) criterion depends on the pH or water hardness, or both, of the receiving water..

L = Criteria for lead are derived using a biologically based model, as allowed for under section 20120a(10) of the act, and are not calculated using the algorithms and assumptions specified in pathway-specific rules.

M = Calculated criterion is below the analytical target detection limit, therefore, the criterion defaults to the target detection limit.

X = The groundwater surface water interface (GSI) criterion shown in the generic cleanup criteria tables is not protective for surface water that is used as a drinking water source. For a groundwater discharge to the Great Lakes and their connecting waters, the generic GSI criterion shall be the surface water human drinking water value (HDV), noted (xx).

ID = insufficient data to develop criterion.

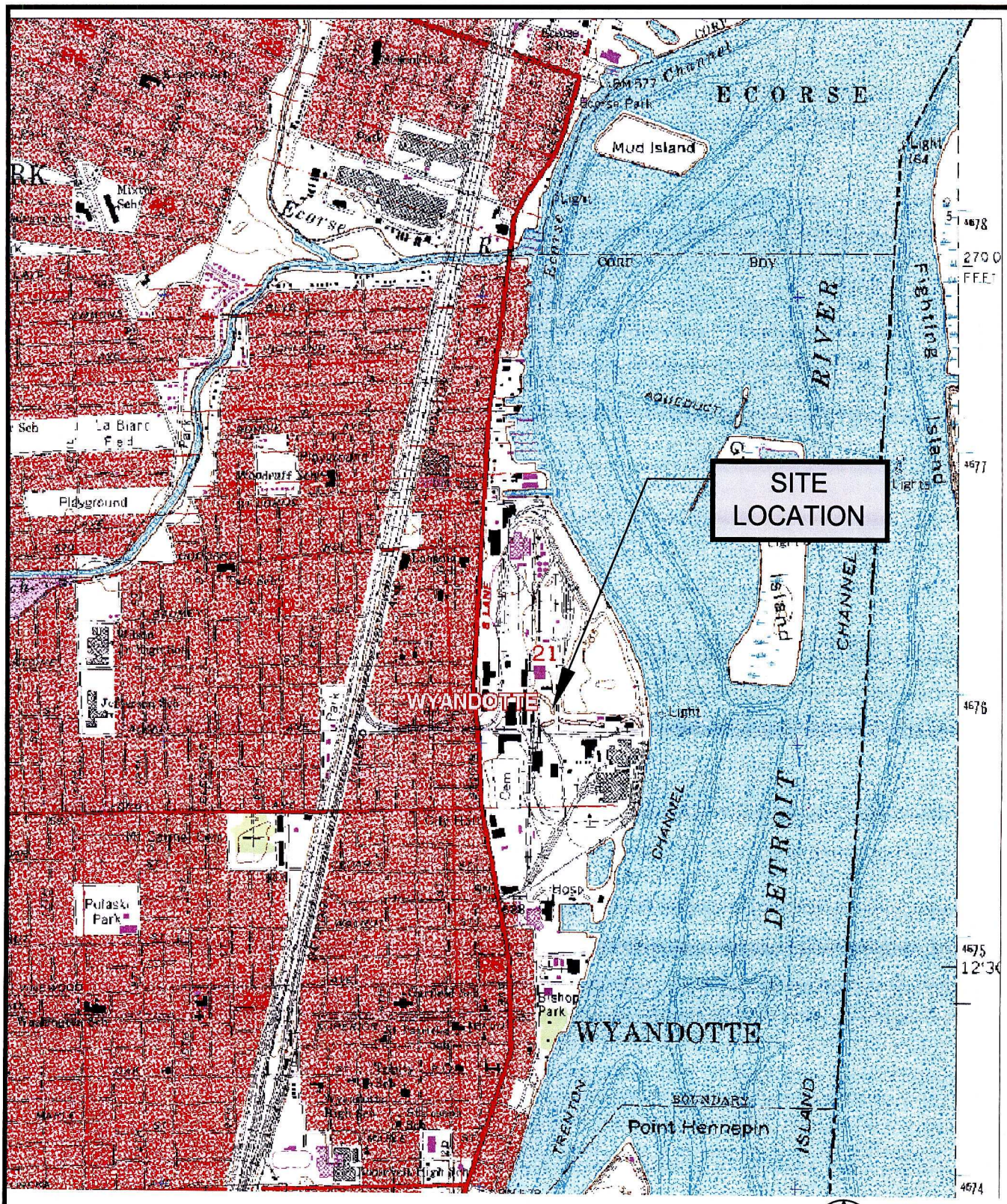
TABLE 2

Comparison of Background Groundwater Monitoring Well Inorganic Analyses During RFI and CMS Supplemental Groundwater Sampling BASF North Works Facility, Wyandotte, MI

Constituent	Mean Concentration in RFI Filtered Samples	Mean Concentration in RFI Unfiltered Samples	Mean Concentration in September 2005 CMS Supplemental Investigation Background Wells	Mean Concentration in December 2003 CMS Supplemental Investigation Site Wells
Antimony	0.003	0.003	0.0007	0.002
Arsenic	0.004	0.021	0.015	0.039
Chromium	0.004	0.743	0.105	0.055
Lead	0.002	0.010	0.011	0.001
Nickel	0.174	0.238	0.036	0.122
Selenium	0.003	0.003	0.002	0.002
Thallium	0.005	0.005	0.0005	0.003
Vanadium	0.01	0.027	0.004	0.011

All concentrations reported in mg/L

Figures



Source: USGS 7½ Minute Topographic Quadrangle, Wyandotte, Michigan. Dated 1981.

N

0 2000 4000

SCALE IN FEET

ENSR | AECOM

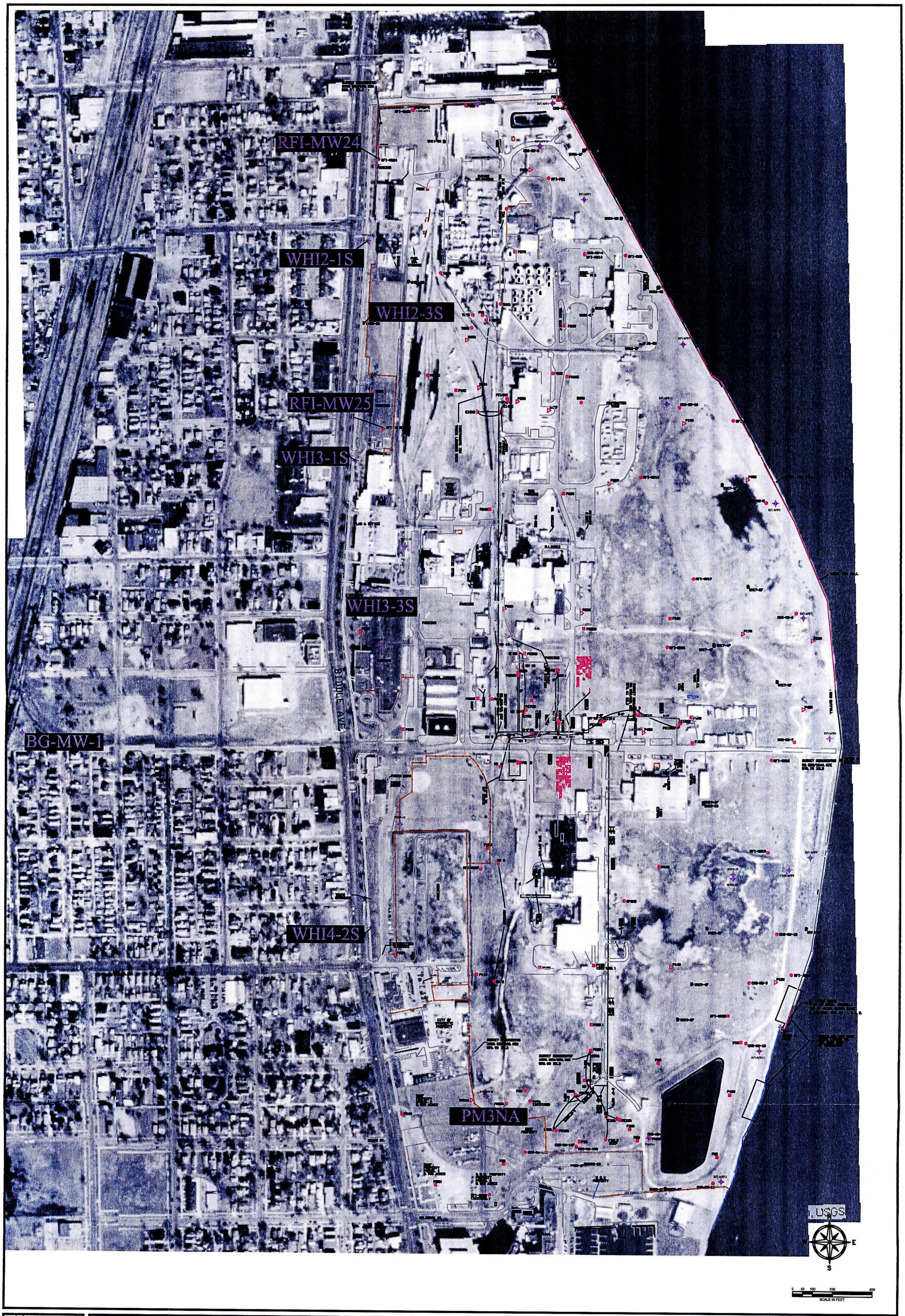
ENSR CORPORATION
27755 DIEHL RD. SUITE 100
WARRENVILLE, ILLINOIS 60555
PHONE: (630) 836-1700
FAX: (630) 836-1711
WEB: HTTP://WWW.ENSR.AECOM.COM

SITE LOCATION MAP
BASF-NORTH FACILITY
1609 BIDDLE AVENUE
WYANDOTTE, MI 48192

FIGURE NUMBER:	
1	

SCALE:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
AS SHOWN	1/27/06	00760-127	X

U:\Cad_Drive\00000-00599\127\Wyandotte Site Location Map.dwg, 1/27/2006 11:18:53 AM, Adobe PDF



SHEET NUMBER	DRAWING NUMBER
2	X

BACKGROUND MONITORING WELL LOCATIONS
SEPTEMBER 2005
BASF NORTH WORKS FACILITY
1609 BIDDLE AVENUE
WYANDOTTE, MI

SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	1/27/06	00760-127

ENSR | AECOM

ENSR CORPORATION
27755 DIEHL RD. SUITE 100
WARRENVILLE, ILLINOIS 60555
PHONE: (630) 836-1700
FAX: (630) 836-1711
WEB: HTTP://WWW.ENSR.AECOM.COM

DESIGNED BY:	REVISIONS			
X	NO:	DESCRIPTION:	DATE:	BY:
DRAWN BY:				
JG				
CHECKED BY:				
RE				
APPROVED BY:				
X				

U:\Cad_Drive\00000-00999\0760\127\metal exceedances\00760-127_Background Monitoring Well Locations.dwg, 2/6/2006 9:40:14 AM, Adobe PDF

Appendix A

Laboratory Analytical Reports

SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

ENSR International
BASF-WYANDOTTE, MI
Project Number: 00760-127-700

Lot #: A5I150248 **Date Reported:** 9/26/05

Client Sample ID: BGMW-1-G-0905-S
Sample #: 001 Date Sampled: 09/13/05 16:50 Date Received: 09/15/05 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	**2.1 B**	**10.0**	**ug/L**	**SW846 6010B**	
Nickel	**11.7 B**	**20.0**	**ug/L**	**SW846 6010B**	
Lead	ND	3.0	ug/L	SW846 6010B	
Selenium	**3.5 B**	**5.0**	**ug/L**	**SW846 6010B**	
Vanadium	ND	4.0	ug/L	SW846 6010B	
ICP-MS (6020)					Reviewed
Arsenic	**1.1 B**	**5.0**	**ug/L**	**SW846 6020**	
Antimony	**0.36 B**	**2.0**	**ug/L**	**SW846 6020**	
Thallium	ND	1.0	ug/L	SW846 6020	

B Estimated result. Result is less than RL.

Client Sample ID: WHI4-2S-G-0905-S
Sample #: 002 Date Sampled: 09/13/05 17:30 Date Received: 09/15/05 Matrix: WATER

Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	**7.2 B**	**10.0**	**ug/L**	**SW846 6010B**	
Nickel	**5.7 B**	**20.0**	**ug/L**	**SW846 6010B**	
Lead	**83.5**	**3.0**	**ug/L**	**SW846 6010B**	
Selenium	**2.9 B**	**5.0**	**ug/L**	**SW846 6010B**	
Vanadium	**7.9**	**4.0**	**ug/L**	**SW846 6010B**	
ICP-MS (6020)					Reviewed
Arsenic	**10**	**5.0**	**ug/L**	**SW846 6020**	
Antimony	**5.5**	**2.0**	**ug/L**	**SW846 6020**	
Thallium	**0.24 B**	**1.0**	**ug/L**	**SW846 6020**	

B Estimated result. Result is less than RL.

(Continued on next page)

SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Lot #: A5I150248

ENSR International
BASF-WYANDOTTE, MI
Project Number: 00760-127-700

Date Reported: 9/26/05

Client Sample ID: WHI3-3S-G-0905-S
Sample #: 003 Date Sampled: 09/13/05 18:20 Date Received: 09/15/05 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	**1.9 B**	**10.0**	**ug/L**	**SW846 6010B**	
Nickel	**2.9 B**	**20.0**	**ug/L**	**SW846 6010B**	
Lead	ND	3.0	ug/L	SW846 6010B	
Selenium	**3.3 B**	**5.0**	**ug/L**	**SW846 6010B**	
Vanadium	ND	4.0	ug/L	SW846 6010B	
ICP-MS (6020)					Reviewed
Arsenic	**0.82 B**	**5.0**	**ug/L**	**SW846 6020**	
Antimony	**0.14 B**	**2.0**	**ug/L**	**SW846 6020**	
Thallium	**0.059 B**	**1.0**	**ug/L**	**SW846 6020**	

B Estimated result. Result is less than RL.

Client Sample ID: WHI3-1S-G-0905-S
Sample #: 004 Date Sampled: 09/14/05 07:30 Date Received: 09/15/05 Matrix: WATER

Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	**9.3 B**	**10.0**	**ug/L**	**SW846 6010B**	
Nickel	**6.9 B**	**20.0**	**ug/L**	**SW846 6010B**	
Lead	**13.6**	**3.0**	**ug/L**	**SW846 6010B**	
Selenium	**3.2 B**	**5.0**	**ug/L**	**SW846 6010B**	
Vanadium	**12.2**	**4.0**	**ug/L**	**SW846 6010B**	
ICP-MS (6020)					Reviewed
Arsenic	**9.6**	**5.0**	**ug/L**	**SW846 6020**	
Antimony	**0.72 B**	**2.0**	**ug/L**	**SW846 6020**	
Thallium	**0.11 B**	**1.0**	**ug/L**	**SW846 6020**	

B Estimated result. Result is less than RL.

(Continued on next page)

SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

ENSR International
BASF-WYANDOTTE, MI
Project Number: 00760-127-700

Lot #: A5I150248 **Date Reported:** 9/26/05

Client Sample ID: WHI2-3S-G-0905-S
Sample #: 005 Date Sampled: 09/14/05 08:30 Date Received: 09/15/05 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	ND	10.0	ug/L	SW846 6010B	
Nickel	**5.1 B**	**20.0**	**ug/L**	**SW846 6010B**	
Lead	ND	3.0	ug/L	SW846 6010B	
Selenium	ND	5.0	ug/L	SW846 6010B	
Vanadium	ND	4.0	ug/L	SW846 6010B	
ICP-MS (6020)					Reviewed
Arsenic	**47.2**	**5.0**	**ug/L**	**SW846 6020**	
Antimony	**0.67 B**	**2.0**	**ug/L**	**SW846 6020**	
Thallium	**0.095 B**	**1.0**	**ug/L**	**SW846 6020**	

B Estimated result. Result is less than RL.

Client Sample ID: WHI2-1S-G-0905-S
Sample #: 006 Date Sampled: 09/14/05 09:20 Date Received: 09/15/05 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	ND	10.0	ug/L	SW846 6010B	
Nickel	**2.2 B**	**20.0**	**ug/L**	**SW846 6010B**	
Lead	ND	3.0	ug/L	SW846 6010B	
Selenium	ND	5.0	ug/L	SW846 6010B	
Vanadium	ND	4.0	ug/L	SW846 6010B	
ICP-MS (6020)					Reviewed
Arsenic	**36.8**	**5.0**	**ug/L**	**SW846 6020**	
Antimony	**0.15 B**	**2.0**	**ug/L**	**SW846 6020**	
Thallium	ND	1.0	ug/L	SW846 6020	

B Estimated result. Result is less than RL.

(Continued on next page)

SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

ENSR International
BASF-WYANDOTTE, MI
Project Number: 00760-127-700

Lot #: A5I150248 **Date Reported:** 9/26/05

Client Sample ID: RFIMW-24-G-0905-S
Sample #: 007 Date Sampled: 09/14/05 11:30 Date Received: 09/15/05 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	**951**	**10.0**	**ug/L**	**SW846 6010B**	
Nickel	**112**	**20.0**	**ug/L**	**SW846 6010B**	
Lead	ND	3.0	ug/L	SW846 6010B	
Selenium	**3.0 B**	**5.0**	**ug/L**	**SW846 6010B**	
Vanadium	**3.6 B**	**4.0**	**ug/L**	**SW846 6010B**	
ICP-MS (6020)					Reviewed
Arsenic	**2.1 B**	**5.0**	**ug/L**	**SW846 6020**	
Antimony	**0.25 B**	**2.0**	**ug/L**	**SW846 6020**	
Thallium	ND	1.0	ug/L	SW846 6020	

B Estimated result. Result is less than RL.

Client Sample ID: RFIMW-24-G-0905-FB
Sample #: 008 Date Sampled: 09/14/05 11:00 Date Received: 09/15/05 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	ND	10.0	ug/L	SW846 6010B	
Nickel	ND	20.0	ug/L	SW846 6010B	
Lead	ND	3.0	ug/L	SW846 6010B	
Selenium	**2.9 B**	**5.0**	**ug/L**	**SW846 6010B**	
Vanadium	ND	4.0	ug/L	SW846 6010B	
ICP-MS (6020)					Reviewed
Arsenic	**1.9 B**	**5.0**	**ug/L**	**SW846 6020**	
Antimony	**0.10 B**	**2.0**	**ug/L**	**SW846 6020**	
Thallium	ND	1.0	ug/L	SW846 6020	

B Estimated result. Result is less than RL.

(Continued on next page)

SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Lot #: A5I150248

ENSR International
BASF-WYANDOTTE, MI
Project Number: 00760-127-700

Date Reported: 9/26/05

Client Sample ID: WHI2-1S-G-0905-D
Sample #: 009 Date Sampled: 09/14/05 09:20 Date Received: 09/15/05 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	ND	10.0	ug/L	SW846 6010B	
Nickel	**2.2 B**	**20.0**	**ug/L**	**SW846 6010B**	
Lead	ND	3.0	ug/L	SW846 6010B	
Selenium	**5.0**	**5.0**	**ug/L**	**SW846 6010B**	
Vanadium	ND	4.0	ug/L	SW846 6010B	
ICP-MS (6020)					Reviewed
Arsenic	**36.7**	**5.0**	**ug/L**	**SW846 6020**	
Antimony	**0.22 B**	**2.0**	**ug/L**	**SW846 6020**	
Thallium	ND	1.0	ug/L	SW846 6020	

B Estimated result. Result is less than RL.

Client Sample ID: RFIMW-25-G-0905-S
Sample #: 010 Date Sampled: 09/14/05 12:30 Date Received: 09/15/05 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Chromium	**59.6**	**10.0**	**ug/L**	**SW846 6010B**	
Nickel	**214**	**20.0**	**ug/L**	**SW846 6010B**	
Lead	ND	3.0	ug/L	SW846 6010B	
Selenium	ND	5.0	ug/L	SW846 6010B	
Vanadium	ND	4.0	ug/L	SW846 6010B	
ICP-MS (6020)					Reviewed
Arsenic	**3.9 B,G**	**25.0**	**ug/L**	**SW846 6020**	
Antimony	**1.2 B,G**	**10.0**	**ug/L**	**SW846 6020**	
Thallium	ND G	5.0	ug/L	SW846 6020	

B Estimated result. Result is less than RL.

G Elevated reporting limit. The reporting limit is elevated due to matrix interference.

(Continued on next page)

SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

ENSR International

Lot #: A5I150248 BASF-WYANDOTTE, MI **Date Reported:** 9/26/05

Project Number: 00760-127-700

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD

Client Sample ID: PM3NA-G-0905-S

Sample #: 011 Date Sampled: 09/14/05 13:10 Date Received: 09/15/05 Matrix: WATER

Appendix B

Data Validation Report

ENSR INTERNATIONAL

MEMORANDUM

To:	Tim Adams/Warrenville	**Date:**	October 17, 2005
From:	Sheena Blair/Westford	**File:**	BW010.metsb.doc 00760-127-711
RE:	Data Validation Inorganic Analyses CMS Supplemental Groundwater Sampling BASF North Works Facility, Wyandotte, MI STL Lot# A5I150248	**CC:**	D. McGrath/Westford Paytha Elliott/Warrenville

SUMMARY

Full validation was performed on the data for nine groundwater samples and one field blank analyzed for project-specific metals by SW-846 methods 6010B and 6020. The samples were collected at the BASF facility in Wyandotte, Michigan on September 13, and 14, 2005 and submitted to Severn Trent Laboratories (STL) in North Canton, Ohio, for analysis. STL processed the samples under lot number A5I150248.

The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (October 2004), and the quality control (QC) criteria specified in the Quality Assurance Project Plan (QAPP). Modification of the Functional Guidelines was performed to accommodate the non-CLP methodologies.

In general, the data are valid as reported and may be used for decision making purposes. No data were rejected. Selected data points were negated (U) due to blank contamination or qualified for nonconformances of certain QC criteria (see discussion below).

SAMPLES

The samples included in this review are listed below:

REVIEW ELEMENTS

Sample data were reviewed for the following parameters, where applicable to the method:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Inductively coupled plasma-mass spectrometry (ICP-MS) tune
- Calibrations
- Laboratory blanks/field blanks
- Inductively coupled plasma (ICP)/ICP MS interference check sample (ICS) results
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results
- Laboratory control sample (LCS) results
- Serial dilution results
- Internal standard results/(ICP-MS only)
- Sample quantitation/detection limit results

ENSR INTERNATIONAL

DISCUSSION

Agreement of Analyses Conducted with COC Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the COC and any subsequent correspondence.

- Sample PM3 NA-G-0905-S was recorded on the COC and placed on hold at ENSR's request. No validation action was taken other than this notation.
- The laboratory analyzed the samples for arsenic, antimony and thallium by SW846 Method 6020 instead of 6010B as stated in the Revised Proposal to Perform Supplemental Groundwater Sampling Plan (July 2005). No validation action was taken based on this deviation from the Sampling Plan.

Holding Times/Sample Preservation

All samples were digested and/or analyzed within the method specified holding times.

The cooler temperature upon receipt at the laboratory was 2.9°C which met the acceptable range of 4 ± 2°C.

Chemical preservation was acceptable.

ICP-MS Tune

The ICP-MS tunes met the QC acceptance criteria for arsenic, antimony and thallium.

Calibrations

All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards for all metals.

Although a Contract Required Detection Limit (CRDL) standard is not applicable to SW-846 methods, STL chose to analyze a similar standard (CRI for ICP 6010B analyses and QC STD 3 for 6020). All standards met the acceptance criteria for 6010B and 6020 analyses.

Laboratory Blanks/Field Blanks

The calibration blank summary forms are generated using CLP-format software, which reports the blank results to the instrument detection limits (IDLs) as required, by CLP methodology. The sample result and preparation blank summary forms are generated using the laboratory information management system (LIMS), which reports metals to the method detection limit (MDL). Blank actions were applied based on the highest of the IDL/MDL exceedances.

Target analytes were not detected in the laboratory preparation blanks. Selected analytes were detected in field blank sample RFIMW-24-G-0905-S-FB, and in the initial and continuing calibration blanks (ICBs and CCBs) associated with these samples. The presence of blank contamination indicates that false positive results or false negative results (for negative blanks) may exist for these analytes in the associated samples. An Action Level (AL) was established for each analyte at 5x the highest concentration detected in the ICB and the CCBs bracketing each sample and were used to qualify associated sample data. The following table summarizes these ALs and the associated samples.

Blank/6010B	Analyte	Conc. Detected (µg/L)	Action Level (µg/L)
ICB	Nickel	1.8	9.0
	Vanadium	0.4	2.0
Associated samples: All samples			

Blank/6020	Analyte	Conc. Detected (µg/L)	Action Level (µg/L)
ICB	Antimony	0.082	0.41
	Arsenic	0.18	0.90
Associated samples: All samples			

Blank/6010B	Analyte	Conc. Detected (µg/L)	Action Level (µg/L)
CCB 16:51	Vanadium	0.5	2.5
Associated samples: RFIMW-24-G-0905-S, RFIMW-24-G-0905-FB, WHI2-1S-G-0905-D, RFIMW-25-G-0905-S			

Blank/6020	Analyte	Conc. Detected (µg/L)	Action Level (µg/L)
CCB 20:37 - CCB 21:23	Antimony	0.16	0.80
	Thallium	0.032	0.16
Associated samples: BGMW-1-G-0905-S , WHI4-2S-G-0905-S, WHI3-3S-G-0905-S, WHI3-1S-G-0905-S, WHI2-3S-G-0905-S, WHI2-1S-G-0905-S, RFIMW-24-G-0905-S			

Blank/6020	Analyte	Conc. Detected (µg/L)	Action Level (µg/L)
CCB 21:23-CCB 22:12	Antimony	0.16	0.80
	Arsenic	0.14	0.70
	Thallium	0.034	0.17
Associated samples Associated samples: RFIMW-24-G-0905-S-FB, WHI2-1S-G-0905-D, RFIMW-25-G-0905-S			

Blank Type	Analyte	Conc. Detected (µg/L)	Action Level (µg/L)
Field Blank	Selenium	2.9	14.5
	Arsenic	1.9	9.5
	Antimony	0.10	0.50
Associated samples: All groundwater samples.			

Note: antimony in the field blank was negated (U) due to calibration blank and was therefore not used to qualify the groundwater samples.

Sample results were qualified as follows:

For positive contamination:

- Sample results ≥ method detection limit (MDL) but ≤ AL were qualified as nondetected (U) at the reported concentration.
- Sample results > AL or nondetected results (< MDL) were not qualified.

For negative contamination:

- Sample results ≥ MDL but ≤ the absolute value of the AL were qualified as estimated (J-) at the reported concentration.
- Nondetected results (< MDL) were qualified as estimated (UJ).
- Sample results ≥ the absolute value of the AL were not qualified.

ICP ICS/ICP-MS Results

All criteria were met for the analysis of the ICS AB solutions.

Positive results for chromium, nickel, lead and antimony were observed in the ICS A solutions at concentrations greater than the MDL although these analytes are not present in this solution. These false positives indicate a potential bias due to high levels of interfering elements present in the ICS A solution. High levels of one or more interfering element were observed in samples BGMW-1-G-0905-S, WHI3-3S-G-0905-S and RFIMW-25-G-0905-S. Estimated interferences were calculated for each analyte for each of these samples. The following actions were taken.

Sample	Analyte	Action
BGMW-1-G-0905-S	Chromium	Estimate positive result, biased high (J+)
	Nickel	Estimate positive result, biased high (J+)
	Lead	None
WHI3-3S-G-0905-S	Chromium	Estimate positive result, biased high (J+)
	Nickel	Estimate positive result, biased high (J+)
	Lead	None
RFIMW-25-G-0905-S	Chromium	None
	Nickel	None
	Lead	None

Antimony was nondetect in samples BGMW-1-G-0905-S, WHI3-3S-G-0905-S and RFIMW-25-G-0905-S; therefore these nondetect results were accepted unqualified.

MS/MSD Results

MS/MSD analyses were performed on sample RFIMW-24-G-0905-S for all metals. The percent recoveries (%Rs) and relative percent differences (RPDs) were within acceptance limits.

Laboratory Duplicate Results

Laboratory duplicate analyses were not performed. Precision in the laboratory was demonstrated by the MS/MSD analyses as discussed above.

Field Duplicate Results

Samples WHI2-1S-G-0905-S and WH12-1S-G-0905-D were submitted as the field duplicate pair with this sample set. The following table summarizes the RPD of the detected analyte in field duplicate pair.

Analytes	WHI2-1S-G-0905-S (µg/L)	WHI2-1S-G-0905-D (µg/L)	RPD (%)
Arsenic	36.8	36.7	<1

The RPD for arsenic was within the QC acceptance criterion of ±30% for an aqueous matrix.

LCS Results

The %Rs met the QC acceptance criteria in the LCS analyses for all metals analyzed.

Serial Dilution Results

The laboratory performed the serial dilution analysis on sample BGMW-1-G-0905-S for arsenic, antimony and thallium. The percent differences (%Ds) for all analytes met the QC acceptance criteria of <10% for analyte concentrations >10x the MDL before dilution.

The laboratory performed serial dilution analyses for the remaining metals on a sample from a different client. Although this practice is acceptable, the results could not be directly applied to the samples analyzed in this data package because of possible differences in the sample matrix and type. No validation action was taken on this basis.

Internal standard results

All internal standard results met the QC acceptance criteria for all sample analyses.

Sample Quantitation/Detection Limit Results

Sample RFIMW-25-G-0905-S was analyzed at a 5-fold dilution for arsenic, antimony and thallium due to matrix interferences. The laboratory elevated the MDLs and RLs by a factor equivalent to the dilution factor.

Result calculations were spot checked; no discrepancies were noted.

The following laboratory qualifiers were removed during data validation in order to avoid confusion with the validated results.

Laboratory Qualifiers	Laboratory Definition
B	Values were between the MDL and the RL
G	The reporting Limit was elevated due to matrix interferences

ENSR International

Client Sample ID: BGMW-1-G-0905-S

TOTAL Metals

Lot-Sample #...: A5I150248-001 Matrix.....: WG
Date Sampled...: 09/13/05 16:50 Date Received..: 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	2.1 ~~B~~ J+	10.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9A1AT
		Dilution Factor: 1		Analysis Time..: 15:05	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	11.7 ~~B~~ J+	20.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9A1AP
		Dilution Factor: 1		Analysis Time..: 15:05	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	~~NB~~	3.0 U	ug/L	SW846 6010B	09/16-09/19/05	HKL9A1AN
		Dilution Factor: 1		Analysis Time..: 15:05	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	3.5 ~~B~~ U	5.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9A1AQ
		Dilution Factor: 1		Analysis Time..: 15:05	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	~~NB~~	4.0 U	ug/L	SW846 6010B	09/16-09/19/05	HKL9A1AR
		Dilution Factor: 1		Analysis Time..: 15:05	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.9		
Prep Batch #...: 5265019						
Arsenic	1.1 ~~B~~ U	5.0	ug/L	SW846 6020	09/22/05	HKL9A1AL
		Dilution Factor: 1		Analysis Time..: 20:49	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: [illegible]		
Antimony	0.36 ~~B~~ U	2.0	ug/L	SW846 6020	09/22/05	HKL9A1AK
		Dilution Factor: 1		Analysis Time..: 20:49	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.065		
Thallium	~~NB~~	1.0 U	ug/L	SW846 6020	09/22/05	HKL9A1AM
		Dilution Factor: 1		Analysis Time..: [illegible]	Analyst ID.....: [illegible]	
		Instrument ID..: I7		MDL.....: [illegible]		

NOTE(S):

~~U Estimated result. Less than MDL~~

ENSR International

Client Sample ID: WHI4-2S-G-0905-S

TOTAL Metals

Lot-Sample #...: A5I150248-002 Matrix.....: WG
Date Sampled...: 09/13/05 17:30 Date Received..: 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	7.2 B	10.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9P1AT
		Dilution Factor: 1		Analysis Time..: 15:10	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	5.7 B µ	20.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9P1AP
		Dilution Factor: 1		Analysis Time..: 15:10	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	83.5	3.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9P1AN
		Dilution Factor: 1		Analysis Time..: 15:10	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	2.9 B µ	5.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9P1AQ
		Dilution Factor: 1		Analysis Time..: 15:10	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	7.9	4.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9P1AR
		Dilution Factor: 1		Analysis Time..: 15:10	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.3		
Prep Batch #...: 5265019						
Arsenic	10	5.0	ug/L	SW846 6020	09/22/05	HKL9P1AL
		Dilution Factor: 1		Analysis Time..: 20:52	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.47		
Antimony	5.5	2.0	ug/L	SW846 6020	09/22/05	HKL9P1AK
		Dilution Factor: 1		Analysis Time..: 20:52	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.065		
Thallium	0.24 B µ	1.0	ug/L	SW846 6020	09/22/05	HKL9P1AM
		Dilution Factor: 1		Analysis Time..: 20:52	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.022		

NOTE(S):

B--Estimated result. Result is less than RL.

ENSR International

Client Sample ID: WHI3-3S-G-0905-S

TOTAL Metals

Lot-Sample #...: A5I150248-003 Matrix.....: WG
Date Sampled...: 09/13/05 18:20 Date Received..: 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	1.9 B J+	10.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9T1AT
		Dilution Factor: 1		Analysis Time..: 15:14	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	2.9 B	20.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9T1AP
		Dilution Factor: 1		Analysis Time..: 15:14	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	ND	3.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9T1AN
		Dilution Factor: 1		Analysis Time..: 15:14	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	3.3 B	5.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9T1AQ
		Dilution Factor: 1		Analysis Time..: 15:14	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	ND	4.0	ug/L	SW846 6010B	09/16-09/19/05	HKL9T1AR
		Dilution Factor: 1		Analysis Time..: 15:14	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.9		
Prep Batch #...: 5265019						
Arsenic	0.82 B	5.0	ug/L	SW846 6020	09/22/05	HKL9T1AL
		Dilution Factor: 1		Analysis Time..: 10:05	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.47		
Antimony	0.14 B	2.0	ug/L	SW846 6020	09/22/05	HKL9T1AK
		Dilution Factor: 1		Analysis Time..: [illegible]	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.065		
Thallium	0.059 B	1.0	ug/L	SW846 6020	09/22/05	HKL9T1AM
		Dilution Factor: 1		Analysis Time..: [illegible]	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: [illegible]		

NOTE(S):
B-Estimated result. Result is less than RL.

ENSR International

Client Sample ID: WHI3-1S-G-0905-S

TOTAL Metals

Lot-Sample #...: A5I150248-004 Matrix.....: WG
Date Sampled...: 09/14/05 07:30 Date Received..: 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	9.3 B	10.0	ug/L	SW846 6010B	09/16-09/19/05	HKL901AT
		Dilution Factor: 1		Analysis Time..: 15:19	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	6.9 B	20.0	ug/L	SW846 6010B	09/16-09/19/05	HKL901AP
		Dilution Factor: 1		Analysis Time..: 15:19	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	13.6	3.0	ug/L	SW846 6010B	09/16-09/19/05	HKL901AN
		Dilution Factor: 1		Analysis Time..: 15:19	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	3.2 B	5.0	ug/L	SW846 6010B	09/16-09/19/05	HKL901AQ
		Dilution Factor: 1		Analysis Time..: 15:19	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	12.2	4.0	ug/L	SW846 6010B	09/16-09/19/05	HKL901AR
		Dilution Factor: 1		Analysis Time..: 15:19	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.9		
Prep Batch #...: 5265019						
Arsenic	9.6	5.0	ug/L	SW846 6020	09/22/05	HKL901AL
		Dilution Factor: 1		Analysis Time..: 20:58	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.47		
Antimony	0.72 B	2.0	ug/L	SW846 6020	09/22/05	HKL901AK
		Dilution Factor: 1		Analysis Time..: 20:58	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.065		
Thallium	0.11 B	1.0	ug/L	SW846 6020	09/22/05	HKL901AM
		Dilution Factor: 1		Analysis Time..: 20:58	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.022		

NOTE(S):

B ~~Estimated result. Result is less than RL.~~

ENSR International

Client Sample ID: WHI2-3S-G-0905-S

TOTAL Metals

Lot-Sample #...: A5I150248-005 **Matrix.....:** WG
Date Sampled...: 09/14/05 08:30 **Date Received..:** 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	~~ND~~	10.0 µ	ug/L	SW846 6010B	09/16-09/19/05	HKL921AT
		Dilution Factor: 1		Analysis Time..: 15:23	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	5.1 ~~B~~ µ	**20.0**	**ug/L**	**SW846 6010B**	**09/16-09/19/05**	**HKL921AP**
		Dilution Factor: 1		Analysis Time..: 15:23	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	~~ND~~	3.0 µ	ug/L	SW846 6010B	09/16-09/19/05	HKL921AN
		Dilution Factor: 1		Analysis Time..: 15:23	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	~~ND~~	5.0 µ	ug/L	SW846 6010B	09/16-09/19/05	HKL921AQ
		Dilution Factor: 1		Analysis Time..: 15:23	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	~~ND~~	4.0 µ	ug/L	SW846 6010B	09/16-09/19/05	HKL921AR
		Dilution Factor: 1		Analysis Time..: 15:23	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.9		
Prep Batch #...: 5265019						
Arsenic	47.2	5.0	ug/L	SW846 6020	09/22/05	HKL921AL
		Dilution Factor: 1		Analysis Time..: 21:01	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.47		
Antimony	0.67 ~~B~~ µ	2.0	ug/L	SW846 6020	09/22/05	HKL921AK
		Dilution Factor: 1		Analysis Time..: 21:01	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.065		
Thallium	0.095 ~~B~~ µ	1.0	ug/L	SW846 6020	09/22/05	HKL921AM
		Dilution Factor: 1		Analysis Time..: [illegible]	Analyst ID.....: [illegible]	
		Instrument ID..: I7		MDL.....: [illegible]		

NOTE(S):
~~B Estimated result. Result is less than RL.~~

ENSR International

Client Sample ID: WHI2-1S-G-0905-S

TOTAL Metals

Lot-Sample #...: A5I150248-006 Matrix.....: WG
Date Sampled...: 09/14/05 09:20 Date Received..: 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	ND	10.0	ug/L	SW846 6010B	09/16-09/19/05	HKL941AT
		Dilution Factor: 1		Analysis Time..: 15:28	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	2.2 B	20.0	ug/L	SW846 6010B	09/16-09/19/05	HKL941AP
		Dilution Factor: 1		Analysis Time..: 15:28	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	ND	3.0	ug/L	SW846 6010B	09/16-09/19/05	HKL941AN
		Dilution Factor: 1		Analysis Time..: 15:28	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	ND	5.0	ug/L	SW846 6010B	09/16-09/19/05	HKL941AQ
		Dilution Factor: 1		Analysis Time..: 15:28	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	ND	4.0	ug/L	SW846 6010B	09/16-09/19/05	HKL941AR
		Dilution Factor: 1		Analysis Time..: 15:28	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.9		
Prep Batch #...: 5265019						
Arsenic	36.8	5.0	ug/L	SW846 6020	09/22/05	HKL941AL
		Dilution Factor: 1		Analysis Time..: 21:04	Analyst ID.....: 001044	
		Instrument ID..: I7		MDL.....: 0.47		
Antimony	0.15 B	2.0	ug/L	SW846 6020	09/22/05	HKL941AK
		Dilution Factor: 1		Analysis Time..: 21:04	Analyst ID.....: 001044	
		Instrument ID..: I7		MDL.....: 0.060		
Thallium	ND	1.0	ug/L	SW846 6020	09/22/05	HKL941AM
		Dilution Factor: 1		Analysis Time..: [illegible]	Analyst ID.....: [illegible]	
		Instrument ID..: [illegible]		MDL.....: [illegible]		

NOTE(S):
B Estimated result. Result is less than RL.

ENSR International

Client Sample ID: RFIMW-24-G-0905-S

TOTAL Metals

Lot-Sample #...: A5I150248-007 Matrix.....: WG
Date Sampled...: 09/14/05 11:30 Date Received..: 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	951	10.0	ug/L	SW846 6010B	09/16-09/19/05	HKL981C1
		Dilution Factor: 1		Analysis Time..: 15:45	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	112	20.0	ug/L	SW846 6010B	09/16-09/19/05	HKL981CP
		Dilution Factor: 1		Analysis Time..: 15:45	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	~~ND~~	3.0 μ	ug/L	SW846 6010B	09/16-09/19/05	HKL981CL
		Dilution Factor: 1		Analysis Time..: 15:45	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	3.0 ~~B~~ μ	5.0	ug/L	SW846 6010B	09/16-09/19/05	HKL981CT
		Dilution Factor: 1		Analysis Time..: 15:45	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	3.6 ~~B~~	4.0	ug/L	SW846 6010B	09/16-09/19/05	HKL981CW
		Dilution Factor: 1		Analysis Time..: 15:45	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.9		
Prep Batch #...: 5265019						
Arsenic	2.1 ~~B~~ μ	5.0	ug/L	SW846 6020	09/22/05	HKL981CE
		Dilution Factor: 1		Analysis Time..: 21:08	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.47		
Antimony	0.25 ~~B~~ μ	2.0	ug/L	SW846 6020	09/22/05	HKL981CA
		Dilution Factor: 1		Analysis Time..: 21:08	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.065		
Thallium	~~ND~~	1.0 μ	ug/L	SW846 6020	09/22/05	HKL981CH
		Dilution Factor: 1		Analysis Time..: 21:08	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: [illegible]		

NOTE(S):
B - Estimated result. Result is less than RL.

ENSR International

Client Sample ID: RFIMW-24-G-0905-FB

TOTAL Metals

Lot-Sample #...: A5I150248-008 Matrix.....: WQ
Date Sampled...: 09/14/05 11:00 Date Received..: 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	ND	10.0	ug/L	SW846 6010B	09/16-09/19/05	HKMAF1AT
		Dilution Factor: 1		Analysis Time..: 15:59	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	ND	20.0	ug/L	SW846 6010B	09/16-09/19/05	HKMAF1AP
		Dilution Factor: 1		Analysis Time..: 15:59	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	ND	3.0	ug/L	SW846 6010B	09/16-09/19/05	HKMAF1AN
		Dilution Factor: 1		Analysis Time..: 15:59	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	2.9 B	**5.0**	**ug/L**	**SW846 6010B**	**09/16-09/19/05**	**HKMAF1AQ**
		Dilution Factor: 1		Analysis Time..: 15:59	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	ND	4.0	ug/L	SW846 6010B	09/16-09/19/05	HKMAF1AR
		Dilution Factor: 1		Analysis Time..: 15:59	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.9		
Prep Batch #...: 5265019						
Arsenic	1.9 B	5.0	ug/L	SW846 6020	09/22/05	HKMAF1AL
		Dilution Factor: 1		Analysis Time..: 21:21	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.47		
Antimony	0.10 B	2.0	ug/L	SW846 6020	09/22/05	HKMAF1AK
		Dilution Factor: 1		Analysis Time..: 21:21	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.065		
Thallium	ND	1.0	ug/L	SW846 6020	09/22/05	HKMAF1AM
		Dilution Factor: 1		Analysis Time..: [illegible]	Analyst ID.....: [illegible]	
		Instrument ID..: I7		MDL.....: [illegible]		

NOTE(S):
B - Estimated result. Result is less than RL.

ENSR International

Client Sample ID: WHI2-1S-G-0905-D

TOTAL Metals

Lot-Sample #...: A5I150248-009 Matrix.....: WG
Date Sampled...: 09/14/05 09:20 Date Received..: 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	ND	10.0	ug/L	SW846 6010B	09/16-09/19/05	HKMAT1AT
		Dilution Factor: 1		Analysis Time..: 16:04	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	2.2 B	20.0	ug/L	SW846 6010B	09/16-09/19/05	HKMAT1AP
		Dilution Factor: 1		Analysis Time..: 16:04	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	ND	3.0	ug/L	SW846 6010B	09/16-09/19/05	HKMAT1AN
		Dilution Factor: 1		Analysis Time..: 16:04	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	5.0	5.0	ug/L	SW846 6010B	09/16-09/19/05	HKMAT1AQ
		Dilution Factor: 1		Analysis Time..: 16:04	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	ND	4.0	ug/L	SW846 6010B	09/16-09/19/05	HKMAT1AR
		Dilution Factor: 1		Analysis Time..: 16:04	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.9		
Prep Batch #...: 5265019						
Arsenic	36.7	5.0	ug/L	SW846 6020	09/22/05	HKMAT1AL
		Dilution Factor: 1		Analysis Time..: 21:34	Analyst ID.....: [illegible]	
		Instrument ID..: I7		MDL.....: 0.47		
Antimony	0.22 B	2.0	ug/L	SW846 6020	09/22/05	HKMAT1AK
		Dilution Factor: 1		Analysis Time..: 21:34	Analyst ID.....: [illegible]	
		Instrument ID..: I7		MDL.....: 0.[illegible]		
Thallium	ND	1.0	ug/L	SW846 6020	09/22/05	HKMAT1A[illegible]
		[illegible]		Analysis Time..: [illegible]	Analyst ID.....: [illegible]	
		[illegible]		MDL.....: [illegible]		

COMMENT(S):
B Estimated result. Result is less than RL.

ENSR International

Client Sample ID: RFIMW-25-G-0905-S

TOTAL Metals

Matrix.....: WG

Lot-Sample #...: A5I150248-010
Date Sampled...: 09/14/05 12:30 Date Received..: 09/15/05

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 5259021						
Chromium	59.6	10.0	ug/L	SW846 6010B	09/16-09/19/05	HKMA61AT
		Dilution Factor: 1		Analysis Time..: 16:08	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.6		
Nickel	214	20.0	ug/L	SW846 6010B	09/16-09/19/05	HKMA61AP
		Dilution Factor: 1		Analysis Time..: 16:08	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.4		
Lead	~~ND~~	3.0	ug/L	SW846 6010B	09/16-09/19/05	HKMA61AN
		Dilution Factor: 1		Analysis Time..: 16:08	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.7		
Selenium	~~ND~~	5.0	ug/L	SW846 6010B	09/16-09/19/05	HKMA61AQ
		Dilution Factor: 1		Analysis Time..: 16:08	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 2.4		
Vanadium	~~ND~~	4.0	ug/L	SW846 6010B	09/16-09/19/05	HKMA61AR
		Dilution Factor: 1		Analysis Time..: 16:08	Analyst ID.....: 001637	
		Instrument ID..: I5		MDL.....: 1.9		
Prep Batch #...: 5265019						
Arsenic	3.9 ~~B,G~~	25.0	ug/L	SW846 6020	09/22/05	HKMA61AL
		Dilution Factor: 5		Analysis Time..: 21:41	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 2.4		
Antimony	1.2 ~~B,G~~	10.0	ug/L	SW846 6020	09/22/05	HKMA61AK
		Dilution Factor: 5		Analysis Time..: 21:41	Analyst ID.....: 001644	
		Instrument ID..: I7		MDL.....: 0.52		
Thallium	~~ND~~	5.0	ug/L	SW846 6020	09/22/05	HKMA61AM
		Dilution Factor: 5		Analysis Time..: [illegible]	Analyst ID.....: [illegible]	
		Instrument ID..: [illegible]		MDL.....: [illegible]		

NOTE(S):

~~B - Estimated result. Result is less than RL.~~

~~G - Elevated reporting limit. The reporting limit is elevated due to matrix interference.~~

ENSR | AECOM

U.S. Locations

AK, Anchorage
(907) 561-5700

AK, Fairbanks
(907) 452-5700

AL, Birmingham
(205) 980-0054

AL, Florence
(256) 767-1210

CA, Alameda
(510) 748-6700

CA, Camarillo
(805) 388-3775

CA, Sacramento
(916) 362-7100

CA, Sanata Ana
(949) 756-2667

CO, Ft. Collins
(970) 493-8878

Ft. Collins Tox Lab
(970) 416-0916

CT, Stamford
(203) 323-6620

CT, Willington
(860) 429-5323

FL. St. Petersburg
(727) 577-5430

FL, Tallahassee
(850) 385-5006

GA, Norcross
(770) 381-1836

IL, Chicago
(630) 836-1700

IL, Collinsville
(618) 344-1545

LA, Baton Rouge
(225) 298-1206

MA, Air Laboratory
(978) 772-2345

MA, Sagamore Beach
(508) 888-3900

MA, Westford
(978) 589-3000

MA, Woods Hole
(508) 457-7900

MD, Columbia
(410) 884-9280

ME, Portland
(207) 773-9501

MI, Detroit
(269) 385-4245

MN, Minneapolis
(952) 924-0117

NC, Charlotte
(704) 529-1755

NC, Raleigh
(919) 872-6600

NH, Gilford
(603) 524-8866

NJ, Piscataway
(732) 981-0200

NY, Albany
(518) 453-6444

NY, Rochester
(585) 381-2210

NY, Syracuse
(315) 432-0506

NY, Syracuse Air Lab
(315) 434-9834

OH, Cincinnati
(513) 772-7800

PA, Langhorne
(215) 757-4900

PA, Pittsburgh
(412) 261-2910

RI, Providence
(401) 274-5685

SC, Columbia
(803) 216-0003

TX, Dallas
(972) 509-2250

TX, Houston
(713) 520-9900

VA, Chesapeake
(757) 312-0063

WA, Redmond
(425) 881-7700

WI, Green Bay
(920) 884-1093

WI, Milwaukee
(262) 523-2040

Headquarters

MA, Westford

(978) 589-3000

Worldwide Locations

Azerbaijan
Belgium
Bolivia
Brazil
Canada
China
France
Germany
Ireland
Italy
Japan
Malaysia
Philippines
Thailand
Turkey
United Kingdom
Venezuela

www.ensr.aecom.com

A Trusted Global Environmental, Health and Safety Partner

CMS Supplemental Groundwater Sampling Results

For the

BASF NORTH WORKS FACILITY
WYANDOTTE, MICHIGAN
USEPA ID NUMBER MID 064197742

Prepared for:

BASF CORPORATION
1609 BIDDLE AVENUE
WYANDOTTE, MICHIGAN

SEPTEMBER 2004

Prepared by:

ENSR International
27755 Diehl Road, Suite 100
Warrenville, Illinois 60555

ENSR Project No. 00760-127-340

INTRODUCTION

The December 2003 Corrective Measures Study (CMS) supplemental groundwater sampling activities included sampling and analysis of select constituents of concern (COCs) performed at BASF North Works Facility, **Figure 1**, Site Location Map. Select COCs included mercury, volatile organic compounds (VOCs), selected metals, and natural attenuation and general water chemistry parameters. CMS supplemental sampling and analysis was conducted in accordance with ENSR's *CMS Supplemental Groundwater Sampling Plan for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID Number MID 064197742, November 2003.*

A total of 25 groundwater monitoring wells were sampled during this activity. Of the 25 wells, one was a new background well located at an upgradient parcel of land owned by BASF and six are located in the region of groundwater inflow onto the site, based on the Waterloo Hydrogeologic Institute (WHI) model. The remaining 18 wells are located in the region of potential groundwater outflow from the site. Seven of the wells are completed in the Fill Unit. The remaining 18 wells are completed in the Native Sand Unit. **Figure 2** shows the location of the monitoring wells sampled as well as ground water elevations.

Previous mercury samples collected during the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) were analyzed using Method 7470A, a cold-vapor atomic absorption technique, which is based on the absorption of radiation at 253.7 nanometers (nm) by mercury vapor. However, when utilizing Method 7470A, samples with elevated chlorides require additional permanganate because chlorides are converted to free chlorine during the oxidation step in the analysis. The chlorine also absorbs radiation of 253.7 nm and may interfere with accurate mercury concentrations.

Field sampling activities were conducted in accordance with the health and safety protocol presented in the RFI Health and Safety Plan (HASP) and the Quality Assurance Plan (QAPP).

The remainder of this letter report presents the results of the groundwater sampling program.

BACKGROUND MONITORING WELL INSTALLATION

One upgradient background monitoring well was installed on the parcel of land owned by BASF as shown on **Figure 2**. The monitoring well was installed on November 25, 2003. The groundwater monitoring well was installed using continuous flight hollow stem augers that were steam cleaned using a pressurized washer prior to installation. The monitoring well was constructed of 2-inch diameter, stainless steel riser with 2 feet of wire-wrapped stainless steel slotted well screen containing 0.010-inch slots. The well screen and riser were pre-cleaned using an Alconox® detergent and distilled water wash, followed by a distilled water rinse. The well screen was installed to intersect the water table. Soil samples were not collected for analysis during installation of the background monitoring well. However, a well construction material blank was collected for total mercury analysis by rinsing the interior well casing with ultrapure deionized water (supplied by the laboratory), prior to installation, and collecting the rinsate in appropriate sample containers.

Within 24 hours after the background monitoring well was constructed, the well was developed to remove any fine-grained materials. Development of the well was performed using surging and bailing techniques.

SAMPLING METHODOLOGY

Groundwater Sampling

Groundwater samples were collected from 25 groundwater monitoring wells. Of the 25 wells sampled, one was the new background well and six others that are located in the region of groundwater inflow to the site (based upon WHI's groundwater model). The remaining eighteen wells are located in the region of potential groundwater outflow from the site. Seven of the wells are screened within the Fill Unit and the remaining eighteen wells are screened in the Native Sand Unit. The sampling locations are shown on **Figure 2**, Site Layout Map and Sampling Locations. Groundwater samples were analyzed for water chemistry and natural attenuation parameters, volatile organic compounds (VOCs), metals, and low level mercury, as shown on **Table 1**.

Groundwater sampling activities were conducted in accordance with the Michigan Department of Environmental Quality (MDEQ) Standard Operating Procedure (SOP) for Groundwater Sampling of Monitoring Wells for Low Level Analysis of Mercury, and SOPs presented in the RFI and CMS Supplemental Work Plans.

Prior to sampling, ENSR obtained water level measurements at the monitoring wells using an electronic water level indicator. The precleaned tubing was slowly lowered to the sampling depth and then connected to the peristaltic pump. After the groundwater stabilized, determined by three consecutive water quality readings within the established limits, the groundwater samples were collected. Groundwater quality parameters (specific conductivity, pH, temperature, oxidation-reduction potential and dissolved oxygen) were measured using a YSI 650XL water quality meter via a flow-through cell. Field measurements were recorded on sample collection sheets. The field water quality parameters are summarized on **Table 2** and included in **Appendix A**. Groundwater samples were collected in laboratory supplied bottles and placed in a cooler containing ice immediately after collection. Sampling equipment was decontaminated between sampling locations using an Alconox® detergent and distilled water wash, followed by a distilled water rinse.

Laboratory Analysis and Sample QA/QC

Groundwater samples were submitted to the following analytical laboratories;

- Frontier Geosciences Inc. in Seattle, Washington for total mercury analysis using Frontier SOPs FGS-012.3 (Oxidation of Aqueous Samples for Total Mercury Analysis) and FGS-069.3 (Total Mercury Analysis by Cold Vapor – Atomic Fluorescence [CV-AFS]), which are based on US EPA Method 1631, Revision E;
- Severn Trent Laboratories (STL) in N. Canton, OH for VOCs by SW-846 Method 8260B and select metal analysis using SW-846 Method 6010B; and

- MicroSeeps in Pittsburgh, PA for water chemistry/monitored natural attenuation parameters utilizing various methods. A summary of the analytical methods is provided below:

COCs and Associated Analytical Methods

Parameter	Methods
Total Mercury	EPA 1631, Revision E
VOCs	EPA 8260B
Metals	EPA 6010B
Hardness	MCAWW 130.2
TOC	EPA 9060
Carbon dioxide and methane	RSK 175
Alkalinity	EPA 310.1
Nitrate, nitrite, sulfate and chloride	EPA 9056
BOD	EPA 405.1
Sulfide	EPA 376.1
COD	Hach 8000

Each cooler submitted to the laboratory was accompanied by at least one Chain of Custody (COC) record. The purpose of this procedure was to document the possession of the sample from the time of collection through laboratory analysis and reporting. Transfer of sample custody is documented on the COC form. Cooler contents and sample temperatures were recorded by the laboratory. All samples were preserved by cooling to 4°C using ice and delivered via FedEx Priority Overnight for laboratory analysis on a standard turnaround basis.

Each sample was assigned a unique sample identification code. The sample identification code for each sample was shown on the COC, sample container label, and field notebook along with the date/time sampled, analysis requested, preservation method, and the sampler's initials.

Throughout the investigation, ENSR collected quality assurance/quality control (QA/QC) samples. The QA/QC samples included field duplicates, field blanks, trip blanks and matrix spike/matrix spike duplicate (MS/MSD) samples. The results of the QA/QC analyses were provided in the laboratory analytical reports. The QA/QC sample identification code for each sample was shown on the COC, sample container label, and field notebook(s) along with the date/time sampled, analysis requested, preservation method, and the sampler's initials.

DATA ASSESSMENT

Groundwater samples were analyzed for water chemistry and natural attenuation parameters, VOCs, metals, and low level mercury.

Laboratory analytical results were compared to MDEQ Part 201 Generic Cleanup Criteria and Screening Levels for Industrial and Commercial II, III and IV Drinking Water Criteria, Groundwater and Surface Water Interface Criteria and Groundwater Contact Criteria. A summary of the compounds detected as part of the CMS supplemental groundwater sampling activities are

presented in **Tables 2** through **5** and are discussed in the following subsections. Laboratory reports are included as **Appendix B**.

Water Chemistry and Natural Attenuation Parameters

- Groundwater sampling results for water chemistry and natural attenuation parameters are summarized on **Table 2**.

VOCs

- VOCs were sampled at 14 locations across the site. Groundwater sampling results for VOCs are summarized on **Table 3**. VOCs were detected in all but one monitoring location. Toluene was most frequently detected, at all but two locations.

Metals

Low-flow sampling was performed to provide more accurate measurements of mobile metal concentrations across the site. Groundwater sampling results for inorganics are summarized on **Table 4**. When compared with historical results, most or all of the most supplemental sample metal concentrations were lower or not detected.

When compared with screening level criteria, the Industrial and Commercial II, III and IV Drinking Water Criteria was the most stringent for metals except for vanadium, for which the MI GSI criteria was more stringent. For several of the metals (barium, beryllium, cadmium, cobalt, copper, silver, tin and zinc) there were no exceedences of any of the screening level criteria. For other metals, (antimony, arsenic, chromium, lead, nickel, selenium and vanadium), there were one to three exceedences of the most stringent criteria in the 14 wells that were sampled. There was no single location or portion of the site where a higher percentage of exceedences occurred. At several locations, including the background well, the thallium concentration exceeded the screening criteria.

Total Mercury

The supplemental groundwater sampling program was designed to provide a reevaluation of mercury sources and background concentrations in groundwater at the site. Groundwater sampling results for total mercury are summarized on **Table 5** and illustrated on **Figure 3**. The results of this sampling were used to update flux estimates previously calculated. The updated flux analysis is presented in **Appendix C**.

At many of the monitoring wells across the site, mercury concentrations from the December 2003 supplemental groundwater sampling round were one to three orders of magnitude lower that those previously measured, with concentrations ranging from 1.4 ng/L to 3,900 ng/L. The highest mercury concentration was detected at CMS-MW-08, which is in the vicinity of the highest historical detection of mercury (WHI9-2F), located in the southwestern region of the property. Both of these wells are screened in the Fill unit. All samples were below the groundwater contact criteria, and all except for one sample were below the Industrial and Commercial II, III and IV Drinking Water

Criteria. All samples, including the background well (where the mercury concentration was 16.2 ng/L), exceeded the MI GSI criteria of 1.3 ng/L.

QUALITY ASSURANCE/ QUALITY CONTROL (QA/QC)

The following discussion summarizes the quality of the analytical data generated during the CMS Supplemental Groundwater Sampling. Data quality was assessed primarily using the results of the data validation process as described in the QAPP. On the basis of this assessment, data were either accepted without qualification, qualified as estimated (assigned a "J" flag), negated (assigned a "U" flag) or rejected ("R"). Data qualifying protocols were based on the US EPA validation guidelines cited in the QAPP. Data validation reports are presented in **Appendix D**.

The elements evaluated during the data quality assessment included the following:

- Conformance to analytical methodologies,
- Adherence to sample holding times and preservation requirements,
- Results of field and laboratory quality control (QC) samples such as blanks, spikes, and duplicates,
- Instrument calibration,
- Analytical performance checks,
- Analytical sensitivity, and
- Completeness of results.

Analytical Methodologies

Analyses were performed according to the methods referenced in the CMS Supplemental Groundwater Sampling Plan with the following exceptions: COD analysis was conducted using method Hach 8000 rather than MCAWW method 410.4 and hardness was analyzed by MCAWW method 130.2 rather than being calculated based on the SW-846 6010B results. These changes in methodologies had no effect on the quality of the data.

Sample Holding Times and Preservation

Holding times and preservation requirements were met for the majority of the samples. One of the mercury equipment blanks (RFIMW-09-G-1203-EB) was analyzed 33 days past the holding time stated in the CMS Supplemental Groundwater Sampling Plan. The mercury result for this sample was qualified as estimated (J). One of the trip blanks (Trip Blank 03-1205-03-TB) exceeded both holding time and temperature limits due to a laboratory error. The results for this sample were rejected if nondetects and qualified as estimated if detected.

The nitrate and nitrite analyses for a number of samples were within holding times for the initial analysis, but outside holding times for the reanalyses that were necessary because of matrix interference. The results of the reanalyses were qualified as estimated.

Holding times were slightly exceeded for several BOD samples; the BOD results for these samples were qualified as estimated. The holding time for one BOD sample, WHI9-2F-G-1203-S, was grossly exceeded in the reanalysis that was necessary due to oxygen depletion in the initial analysis. The BOD result for WHI9-2F-G-1203-S was rejected.

Difficulties in preserving one sample, PM4NA-G-1203-S, to the appropriate pH were encountered in the laboratory. The metals, hardness, and VOC results for this sample were qualified as estimated (J/UJ).

QC Samples

QC samples provide a measure of the accuracy and precision of the sample data. For this program, accuracy was measured using the results of spiked samples and blanks. Precision was measured by laboratory and field duplicate sample results. Spiked sample results are expressed as recoveries, which demonstrate the relationship between the amount spiked into the sample and the amount measured or "recovered". Spiked samples included matrix spikes and/or laboratory control samples (LCSs), which were run at a frequency of one per batch. All LCSs demonstrated acceptable recoveries (i.e., within the control criteria), indicating acceptable method performance.

Acceptable recoveries were also achieved for all matrix spike samples, with the following exceptions. The recoveries of benzene, toluene, and sulfide fell below acceptable limits in one of the matrix spike samples. Sample results for these compounds in associated samples were qualified as estimated (J/UJ). No data were rejected on the basis of matrix spike recoveries.

Blank samples provide a measure of accuracy by monitoring contaminants potentially introduced in the field or in the laboratory. Blanks collected in the field included equipment blanks and field blanks (both for mercury only) and trip blanks (VOCs only). Laboratory blanks included preparation blanks, method blanks, and calibration blanks, as applicable to the method.

Compounds detected in the blanks indicate the possibility of false positives (or false negative in the case of negative contamination). Mercury was detected in the equipment blanks and/or field blanks collected on December 3, 4, and 9, 2003. Trip blanks contained one or more of the following compounds: 2-butanone, 1,1-dichloroethene, methylene chloride, and toluene. Contaminants found in the laboratory blanks are listed in the table below:

VOCs	Acetone, methylene chloride, 1,2,4-trichlorobenzene
Mercury	Mercury
Metals	Negative contamination – antimony, copper, lead, selenium, vanadium, zinc Positive contamination - barium, beryllium, chromium, cobalt, nickel, tin, vanadium
MNA	Negative contamination – TOC Positive contamination - Alkalinity, BOD, sulfide, chloride, COD, sulfate, TOC

In accordance with US EPA validation protocols, the results for the VOCs, and those metals and MNA parameters associated with positive contamination, were qualified as nondetected (U) in the associated samples due to blank contamination, as appropriate. Mercury data was reported by the

laboratory corrected for method blank contamination as per the method. Two samples (RFIMW-09-G-1203-S and RFIMW-11-G-1203-S) were further qualified as estimated, biased high (J+), based on field and equipment blank contamination. Metals and MNA samples associated with negative contamination were qualified as estimated, biased low (J- or J/UJ).

Duplicate samples measure the precision, or variability, of the sample data. Field duplicates measure the variability associated with the both the sampling and analytical processes; laboratory duplicates measure only the variability associated with the sample analyses.

Field duplicates were collected and analyzed for the same parameters as their associated samples. The results of the field duplicates generally demonstrated good agreement (expressed as relative percent difference [RPD]). Parameters that exceeded the acceptance criteria were mercury, chromium, nickel, nitrate, and methane. The positive and nondetected results for these analytes in the samples associated with the nonconforming field duplicates were qualified as estimated (J, UJ).

Laboratory duplicates included both matrix duplicates and matrix spike duplicates. The results of the duplicates indicated good precision in all cases.

Instrument Calibration

In general, initial and continuing instrument calibrations and tunes met the requirements of the analytical methods. VOC results in select samples were qualified as estimated (J/UJ) due to continuing calibration nonconformances. Affected compounds were trichlorofluoromethane, acetone, 1,1,2-trichloro-1,2,2-trifluoromethane, 2-butanone, 4-methyl-2-pentanone, 2-hexanone, and dichlorodifluoromethane. No data was rejected on the basis of instrument calibrations.

Performance Checks

Performance checks such as surrogate recovery (VOCs), internal standard recovery (VOCs), interference check sample results (metals), and serial dilutions (metals) were also reviewed during data validation. All surrogate recoveries, internal standard performance, and serial dilutions met the QC acceptance limits. The results of the interference check sample analyses indicated the possibility of a high bias for arsenic, cadmium, cobalt, copper, nickel, and zinc, and a low bias for vanadium, in select samples. These results were qualified as estimated.

Analytical Sensitivity

Analytical dilutions were necessary for select VOC, hardness, and MNA parameters due to matrix interference or levels of target or non-target analytes that exceeded the instrument calibration range. The detection limits were elevated to reflect any dilutions.

Completeness

Data completeness was evaluated in terms of the number of samples successfully analyzed and the amount of valid data obtained. All samples submitted to the laboratory and authorized for

analysis were analyzed, thereby achieving 100% completeness in sample analysis. The completeness DQO stated in the QAPP of 90% for valid sample data was achieved, with 97% of the data being considered valid and usable.

QA/QC Summary

Overall, the data generated is valid and may be used with confidence for decision-making. Data points qualified with a "J" flag, should be considered estimated because of non-conformance with criteria established in the analytical methods or EPA validation protocols. Approximately 3% of the data (the majority of VOC results for one trip blank and the result for one BOD sample) was deemed to be unusable because of holding time exceedences.

SUMMARY AND CONCLUSIONS

This letter report presents the findings of a CMS Supplemental Groundwater Sampling Program conducted at the BASF North Works facility in Wyandotte, Michigan. The sampling program focused on the installation of an upgradient background monitoring well and collection/analysis of groundwater samples for select COCs including mercury, volatile organic compounds (VOCs), selected metals, natural attenuation and general water chemistry (treatment) parameters using low-flow sampling techniques.

The supplemental investigation was successful in providing a characterization of groundwater COC concentrations across the site, as well as establishing background concentrations for metals. This data set provides current results that were collected using low-flow sampling techniques to ensure accurate concentration measurements. Additionally, the extremely low detection limits resulting from analysis of mercury by Method 1631, revision E, allowed for a more accurate estimate of mercury flux across the site. In general, when compared with historical data, the recent data resulted in measured concentrations one to three orders of magnitude lower, due to the sampling and analysis techniques employed in this investigation.

I trust this evaluation is satisfactory. Do not hesitate to contact our office at (630) 836-1700 if you have any questions.

Sincerely,

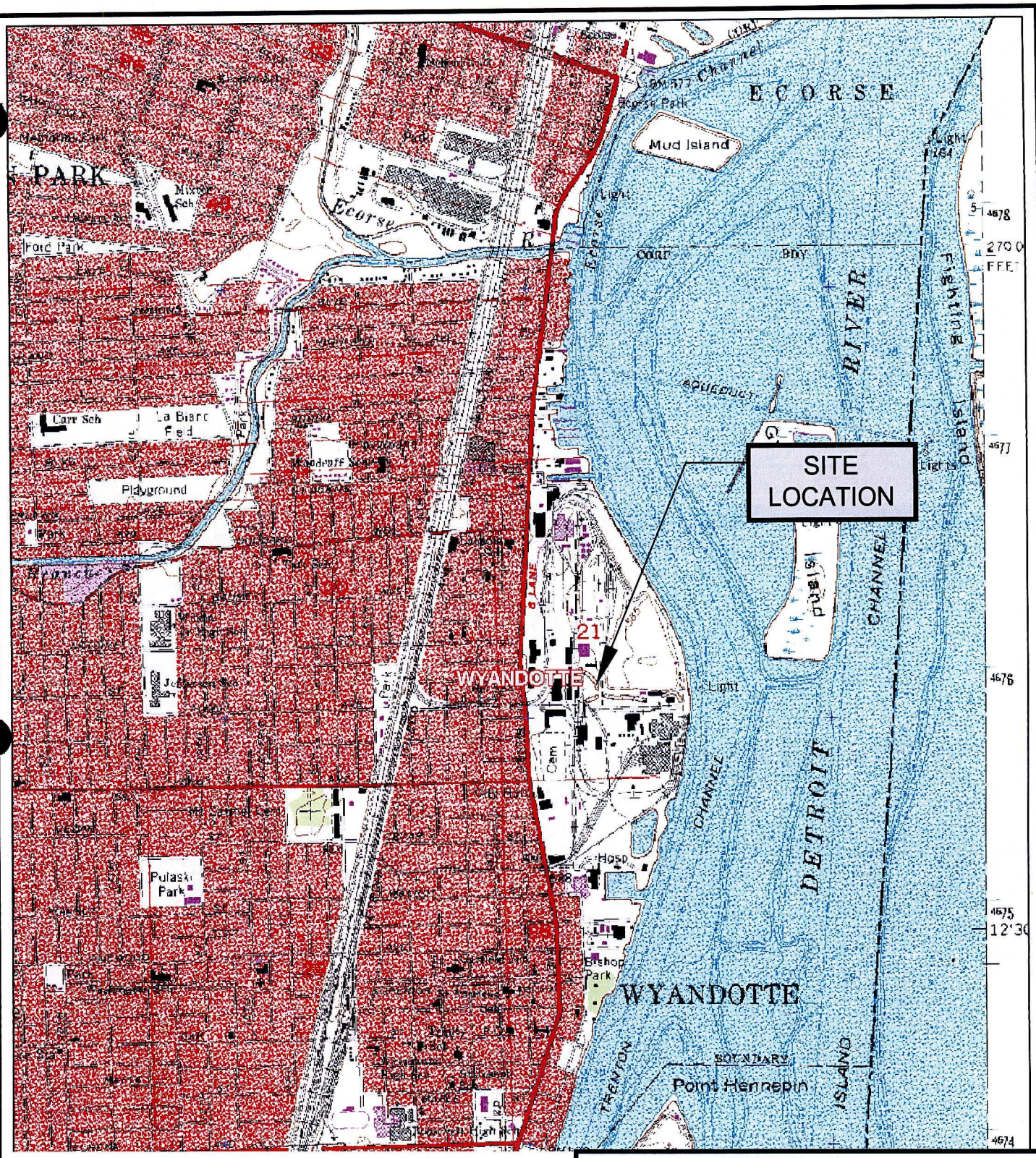
ENSR Corporation

Paytha Elliott
Senior Staff Geologist
Integrated Site Closure

Timothy Adams, PG
Program Manager
Integrated Site Closure

cc: M. Gerath

FIGURES



Source: USGS 7½ Minute Topographic Quadrangle, Wyandotte, Michigan. Dated 1981.

N

0 2000 4000

SCALE IN FEET

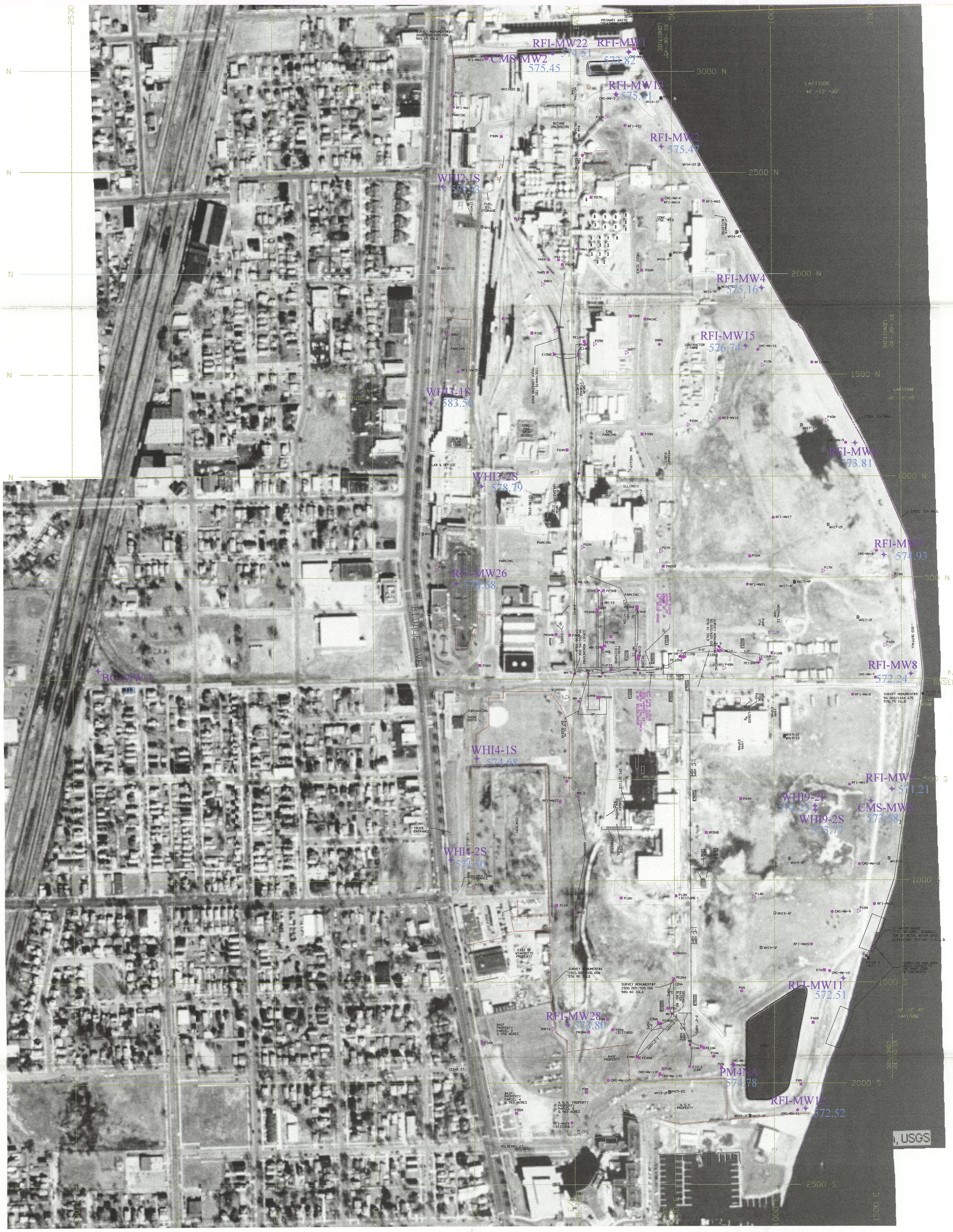
FIGURE 1

ENSR INTERNATIONAL

CONSULTING • ENGINEERING • REMEDIATION

SITE LOCATION MAP
BASF- NORTHWORKS FACILITY
1609 BIDDLE AVENUE
WYANDOTTE, MI 48192

DRAWN BY: JG	DATE: 06/01/04	PROJECT No.:
APPROVED BY: PE	REVISED:	



LEGEND

RFI-MW12 575.45 — MONITORING WELL LOCATIONS (SAMPLED) GROUNDWATER ELEVATIONS (REFERENCED TO IGLD 1985)

WHI9-2F — MONITORING WELL LOCATIONS (NOT SAMPLED)

NOTE: MONITORING WELLS WERE SAMPLED FROM DECEMBER 2 TO 9, 2003 AS PART OF ENSR's CMS SUPPLEMENTAL GROUNDWATER SAMPLING PROGRAM.

N W E S

0 50 100 200 400
SCALE IN FEET

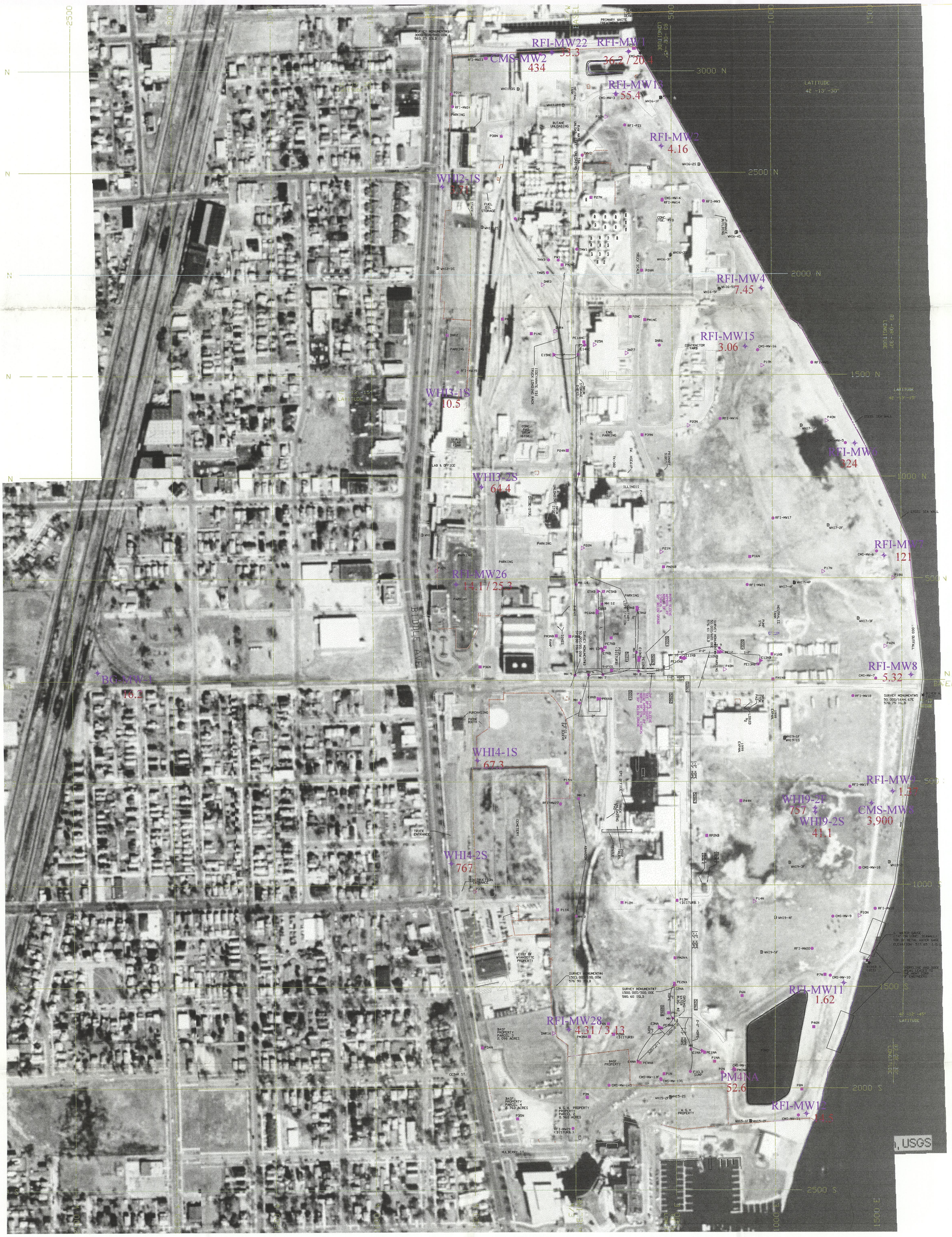
ENSR®
CONSULTING •ENGINEERING •REMEDIATION

FIGURE 2

GROUNDWATER ELEVATIONS
DECEMBER 2003
BASF NORTH WORKS FACILITY
1609 BIDDLE AVENUE
WYANDOTTE, MI

DRAWN BY: PAE	DATE: 05/07/04	PROJECT No.:
APPROVED BY: TVA	REVISED:	00760-127-340

U:\Cad_Drive\00000-00999\0760\127\Fig2-GWE.dwg



LEGEND

RFI-MW12 / 14.5 — MONITORING WELL LOCATIONS (SAMPLED) TOTAL MERCURY CONCENTRATION IN RED (in ng/l)

WHI9-2F — MONITORING WELL LOCATIONS (NOT SAMPLED)

NOTE: MONITORING WELLS WERE SAMPLED FROM DECEMBER 2 TO 9, 2003 AS PART OF ENSR's CMS SUPPLEMENTAL GROUNDWATER SAMPLING PROGRAM.

N W E S

0 50 100 200 400
SCALE IN FEET

ENSR®
CONSULTING • ENGINEERING • REMEDIATION

FIGURE 3

TOTAL MERCURY CONCENTRATIONS
DECEMBER 2003
BASF NORTH WORKS FACILITY
1609 BIDDLE AVENUE
WYANDOTTE, MI

DRAWN BY: PAE	DATE: 05/07/04	PROJECT No.: 00760-127-340
APPROVED BY: TVA	REVISED:	

TABLES

TABLE 1

Proposed Groundwater Monitoring Wells and Analytical Parameters
BASF North Works Facility, Wyandotte, MI

Monitoring Well (In Sequential Sampling Order)	Depth	Stratigraphic Unit	Total Mercury	Metals	VOCs	Water Chemistry, Natural Attenuation Parameters
Background		Native Sand	X	X		X
WHI2-1S		Native Sand	X			
CMSMW-08		Fill	X			
CMSMW-02		Fill	X	X	X	X
RFIMW-28		Native Sand	X			
WHI9-2S		Native Sand	X			
RFIMW-09		Native Sand	X	X	X	X
RFIMW-08		Native Sand	X			
RFIMW-02		Native Sand	X			
RFIMW-01		Native Sand	X	X	X	X
RFIMW-13		Native Sand	X	X	X	X
RFIMW-22		Native Sand	X	X	X	X
RFIMW-04		Fill	X			
RFIMW-07		Fill	X	X	X	X
WHI3-2S		Native Sand	X			
RFIMW-26		Native Sand	X	X	X	X
WHI3-1S		Native Sand	X	X	X	X
WHI4-2S		Native Sand	X			
RFIMW-06		Fill	X			
PM1NA		Native Sand	X	X	X	X
RFIMW-15		Native Sand	X	X	X	X
WHI9-2F		Fill	X	X	X	X
RFIMW-11		Native Sand	X			
RFIMW-12		Fill	X	X	X	X
WHI4-1S		Native Sand	X	X	X	X

TABLE 2
MNA Parameters
December 2003 Sampling
BASF Corporation - Wyandotte, MI

Location ID	INDUSTRIAL & COMMERCIAL II, III & IV DRINKING WATER CRITERIA	GROUNDWATER SURFACE WATER INTERFACE CRITERIA	GROUNDWATER CONTACT CRITERIA		BG-MW-1	CMSMW-02	PM4NA	RFIMW-01	RFIMW-01	RFIMW-07	RFIMW-09	RFIMW-12
Sample ID					BGMW-1-G-1203-S	CMSMW-02-G-1203-S	PM4NA-G-1203-S	RFIMW-01-G-1203-D	RFIMW-01-G-1203-S	RFIMW-07-G-1203-S	RFIMW-09-G-1203-S	RFIMW-12-G-1203-S
Sample Type					sample	sample	sample	duplicate	sample	sample	sample	sample
Sample Date					02-Dec-03	03-Dec-03	08-Dec-03	04-Dec-03	04-Dec-03	08-Dec-03	03-Dec-03	09-Dec-03
ALKALINITY AS $CaCO_3$				mg/l	130	740	7100	720	720	810	760	2500
BIOCHEMICAL OXYGEN DEMAND				mg/l	3.3 U	8.5 U	220	17	17	5.4 UJ	9.3	44
CARBON DIOXIDE				mg/l	6.4	0.60 U	28	120	98	0.60 U	120	0.60 U
CHEMICAL OXYGEN DEMAND				mg/l	5.0 U	26	1200	710	680	44	120	340
CHLORIDE	250 (E)	50	ID	mg/l	180	320	22000	16000	21000	5200	3800	7400
HARDNESS, AS $CaC0_3$				mg/l	1900	590	430	2000	1900	2100	1600	23
METHANE	ID	NA	ID	µg/l	13	16000	6800 J	8200	7300	4800 J	1300	17000 J
NITRATE	10 (A,N)	NA	310,000	mg/l	0.50 U	0.50 U	12 U	2.5 UJ	5.0 UJ	2.5 UJ	25 UJ	25 UJ
NITRITE	1 (A,N)	NA	ID	mg/l	0.50 U	8.2	12 U	2.5 UJ	5.0 UJ	2.5 UJ	25 UJ	25 UJ
SULFATE	250 (E)	NA	ID	mg/l	1800	96	1200	740	710	310	14	1.0 U
SULFIDE				mg/l	2.0 U	2.0 U	110 J	1.8	2.2	2.0 UJ	2.0 U	46 J
TOTAL ORGANIC CARBON				mg/l	2	12	460	86	100	13	10	63

Qualifiers Used:

J = Estimated
J+ = Estimated, Biased High
J- = Estimated, Biased Low
R = Rejected
U = Non-detected
UJ = Non-detected, Estimated detection limit

Color Code:

Exceedances over the most stringent criteria.
Reporting limit above the most stringent criteria.

MDEQ Criteria Qualifiers:

A = Criterion is the state of Michigan drinking water standard established pursuant to section 5 of 1976 PA 399, MCL 325.1005.
E = Criterion is the aesthetic drinking water value, as required by section 20120a(5) of the act.
N = The concentrations of all potential sources of nitrate-nitrogen (e.g., ammonia-N, nitrite-N, nitrate-N) in groundwater that is used as a source of drinking water shall not, when added together, exceed the nitrate drinking water criterion of 10,000 µg/l.
ID = insufficient data to develop criterion.
NA = criterion or value is not available or not applicable.

TABLE 2
MNA Parameters
December 2003 Sampling
BASF Corporation - Wyandotte, MI

Location ID Sample ID Sample Type Sample Date	INDUSTRIAL & COMMERCIAL II, III & IV DRINKING WATER CRITERIA	GROUNDWATER SURFACE WATER INTERFACE CRITERIA	GROUNDWATER CONTACT CRITERIA		RFIMW-13 RFIMW-13-G-1203-S sample 04-Dec-03	RFIMW-15 RFIMW-15-G-1203-S sample 09-Dec-03	RFIMW-22 RFIMW-22-G-1203-S sample 05-Dec-03	RFIMW-26 RFIMW-26-G-1203-D sample 08-Dec-03	RFIMW-26 RFIMW-26-G-1203-S sample 08-Dec-03	WHI3-1S WHI3-1S-G-1203-S sample 09-Dec-03	WHI4-1S WHI4-1S-G-1203-S sample 09-Dec-03	WHI9-2F WHI9-2F-G-1203-S sample 09-Dec-03
ALKALINITY AS $CaCO_3$				mg/l	730	56	2200	660	620	430	180	1300
BIOCHEMICAL OXYGEN DEMAND				mg/l	20	3.0 UJ	67	3.0 UJ	4.5 UJ	2.0 UJ	3.0 UJ	R
CARBON DIOXIDE				mg/l	120	1.2	0.67 J	23	22	76	29	0.60 U
CHEMICAL OXYGEN DEMAND				mg/l	490	89	1400	15 U	5.2 U	27	5.0 U	280
CHLORIDE	250 (E)	50	ID	mg/l	19000	11000	8900	1200	1200	120	140	200
HARDNESS, AS $CaC0_3$				mg/l	2000	9600	40	200	200	650	120	27
METHANE	ID	NA	ID	µg/l	9800	15 J	14000 J	2.9 J	5.9 J	5.6 J	19 J	11000 J
NITRATE	10 (A,N)	NA	310,000	mg/l	5.0 UJ	25 UJ	25 UJ	9.8	8.0	22	0.50 U	0.50 UJ
NITRITE	1 (A,N)	NA	ID	mg/l	5.0 UJ	25 UJ	25 UJ	0.50 UJ	0.50 U	2.8	0.50 U	0.50 UJ
SULFATE	250 (E)	NA	ID	mg/l	680	930	1.0 UJ	73	74	140	67	330
SULFIDE				mg/l	2.2	2.0 UJ	12	2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ	13 J
TOTAL ORGANIC CARBON				mg/l	85	1.7 J	380	7.7	7.8	7.5	2.1 J	57

Qualifiers Used:

J = Estimated
J+ = Estimated, Biased High
J- = Estimated, Biased Low
R = Rejected
U = Non-detected
UJ = Non-detected, Estimated detection limit

Color Code:

Exceedances over the most stringent criteria.
Reporting limit above the most stringent criteria.

MDEQ Criteria Qualifiers:

A = Criterion is the state of Michigan drinking water standard established pursuant to section 5 of 1976 PA 399, MCL 325.
E = Criterion is the aesthetic drinking water value, as required by section 20120a(5) of the act.
N = The concentrations of all potential sources of nitrate-nitrogen (e.g., ammonia-N, nitrite-N, nitrate-N) in groundwater th
ID = insufficient data to develop criterion.
NA = criterion or value is not available or not applicable.

TABLE 3
Volatile Organic Compounds in Groundwater
December 2003 Sampling
BASF Corporation - Wyandotte

Location ID	INDUSTRIAL & COMMERCIAL II, III & IV DRINKING WATER CRITERIA	GROUNDWATER SURFACE WATER INTERFACE CRITERIA	GROUNDWATER CONTACT CRITERIA		CMSMW-02	PM4NA	RFIMW-01	RFIMW-01	RFIMW-07	RFIMW-09	RFIMW-12	RFIMW-13	RFIMW-15	RFIMW-22	RFIMW-26	RFIMW-26	WHI3-1S	WHI4-1S	WHI9-2F
Sample ID					CMSMW-02-G-1203-S	PM4NA-G-1203-S	RFIMW-01-G-1203-D	RFIMW-01-G-1203-S	RFIMW-07-G-1203-S	RFIMW-09-G-1203-S	RFIMW-12-G-1203-S	RFIMW-13-G-1203-S	RFIMW-15-G-1203-S	RFIMW-22-G-1203-S	RFIMW-26-G-1203-D	RFIMW-26-G-1203-S	WHI3-1S-G-1203-S	WHI4-1S-G-1203-S	WHI9-2F-G-1203-S
Sample Type					sample	sample	duplicate	sample	sample	sample	sample	sample	sample	sample	sample	sample	sample	sample	sample
Sample Date				units	03-Dec-03	08-Dec-03	04-Dec-03	04-Dec-03	08-Dec-03	03-Dec-03	09-Dec-03	04-Dec-03	09-Dec-03	05-Dec-03	08-Dec-03	08-Dec-03	09-Dec-03	09-Dec-03	09-Dec-03
ACETONE	2100	1700	3.10E+07	µg/l	48 J	50 U	33 UJ	33 UJ	44	20 UJ	50 U	20 UJ	10 U	5200 J	10 U	10 U	10 U	10 U	100 U
BENZENE	5.0 (A)	200 (X)	11000 (12)	µg/l	5.1	1.1 J	3.3 U	3.3 UJ	0.83 J	2.0 U	5.0 U	2.0 U	1.0 U	2300	1.0 U	1.0 U	1.0 U	1.0 U	10 U
BROMODICHLOROMETHANE	100 (A,W)	ID	14000	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
BROMOFORM	100 (A,W)	ID	1.40E+05	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
BROMOMETHANE	29	35	70000	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
2-BUTANONE	38000	2200	240000000 (S)	µg/l	20 U	50 UJ	33 U	33 U	14 U	20 U	50 U	20 U	10 U	80 J	10 U	10 U	10 U	10 U	100 U
CARBON DISULFIDE	2300	ID	1200000 (S)	µg/l	2.0 U	1.4 J	3.3 U	3.3 U	2.5 U	2.0 U	1.3 J	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
CARBON TETRACHLORIDE	5.0 (A)	45 (X)	4600 (5.6)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
CHLOROBENZENE	100 (A)	47	86000	µg/l	0.94 J	5.0 UJ	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	640	1.0 U	1.0 U	1.0 U	1.0 U	10 U
CHLOROETHANE	1700	ID	4.40E+05	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
CHLOROFORM	100 (A,W)	170 (X)	150000 (77)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
CHLOROMETHANE	1100	ID	4.90E+05	µg/l	0.59 J	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
CYCLOHEXANE				µg/l	2.0 U	5.0 U	3.3 U	3.3 U	1.4 J	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
DIBROMOCHLOROMETHANE	100 (A,W)	100 (A,W)	18000	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	0.2 (A)	NA	390	µg/l	4.0 U	10 U	6.7 U	6.7 U	5.0 U	4.0 U	10 U	4.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	20 U
1,2-DIBROMOMETHANE	230	NA	5.30E+05	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,2-DICHLOROBENZENE	600 (A)	16	160000 (S)	µg/l	1.1 J	5.0 UJ	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,3-DICHLOROBENZENE	19	38	2000	µg/l	2.0 U	5.0 UJ	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,4-DICHLOROBENZENE	75 (A)	13	6400	µg/l	2.0 U	5.0 UJ	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
DICHLORODIFLUOROMETHANE	4800	ID	300000 (S)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,1-DICHLOROETHANE	2500	740	2.40E+06	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	12	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,2-DICHLOROETHANE	5.0 (A)	360 (X)	19000 (6)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	22	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
CIS-1,2-DICHLOROETHENE	70 (A)	620	2.00E+06	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
TRANS-1,2-DICHLOROETHENE	100 (A)	1500	2.20E+05	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,1-DICHLOROETHYLENE	7.0 (A)	65 (X)	11000 (24)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	1.7 J	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,2-DICHLOROPROPANE	5.0 (A)	290 (X)	16000 (9.1)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
CIS-1,3-DICHLOROPROPENE				µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
TRANS-1,3-DICHLOROPROPENE				µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
ETHYLBENZENE	74 (E)	18	170000 (S)	µg/l	2.0 U	5.0 UJ	3.3 U	3.3 U	11	2.0 U	5.0 U	2.0 U	1.0 U	53 J	1.0 U	1.0 U	1.0 U	1.0 U	10 U
2-HEXANONE	2900	NA	5.20E+06	µg/l	20 UJ	50 U	33 U	33 U	1.3 J	20 UJ	50 U	20 U	10 U	1000 U	10 U	10 U	10 U	10 U	100 U
ISOPROPYLBENZENE	2300	ID	56000 (S)	µg/l	2.0 U	5.0 UJ	3.3 U	3.3 U	4.8	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
METHYL ACETATE				µg/l	20 U	50 U	33 U	33 U	25 U	20 U	50 U	20 U	10 U	1000 U	10 U	10 U	10 U	10 U	100 U
METHYL TERT-BUTYL ETHER	40 (E)	730 (X)	6.10E+05	µg/l	10 U	25 U	17 U	17 U	12 U	10 U	25 U	10 U	5.0 U	500 U	5.0 U	5.0 U	5.0 U	5.0 U	50 U
METHYLCYLOHEXANE				µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.8	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
4-METHYL-2-PENTANONE	5200	ID	1.30E+07	µg/l	20 U	50 U	33 U	33 U	0.91 J	20 U	50 U	20 U	10 U	1000 U	10 U	10 U	10 U	10 U	100 U
METHYLENE CHLORIDE	5.0 (A)	940 (X)	220000 (47)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
STYRENE (MONOMER)	100 (A)	80	9700	µg/l	2.0 U	5.0 UJ	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,1,2,2-TETRACHLOROETHANE	35	78 (X)	4700 (3.2)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
TETRACHLOROETHENE	5.0 (A)	45 (X)	12000 (11)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
TOLUENE	790 (E)	140	530000 (S)	µg/l	29	13 J	120	120 J	17	2.0 U	16	76	18	180 U	27	27	35	14	30
1,2,4-TRICHLOROBENZENE	70 (A)	30	19000	µg/l	2.0 U	5.0 UJ	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,1,1-TRICHLOROETHANE	200 (A)	200 (A)	1300000 (S)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	13	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,1,2-TRICHLOROETHANE	5.0 (A)	330 (X)	21000 (12)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
TRICHLOROETHYLENE	5.0 (A)	200 (X)	22000	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
TRICHLOROFLUOROMETHANE	7300	NA	1100000 (S)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
1,1,2-TRICHLORO-1,2,2-TRIFLOUROETHANE	170000 (S)	32	170000 (S)	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U
VINYL CHLORIDE	2.0 (A)	15	1000	µg/l	2.0 U	5.0 U	3.3 U	3.3 U	2.5 U	2.0 U	5.0 U	2.0 U	1.0 U	280	1.0 U	1.0 U	1.0 U	1.0 U	10 U
XYLENES (TOTAL)	280 (E)	35	190000 (S)	µg/l	4.0 U	10 UJ	6.7 U	6.7 U	22	4.0 U	10 U	4.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	20 U

Qualifiers Used:

J = Estimated
J+ = Estimated, Biased High
J- = Estimated, Biased Low
R = Rejected
U = Non-detected
UJ = Non-detected, Estimated detection limit

Color Code:

Exceedances over the most stringent criteria.
Reporting limit above the most stringent criteria.

MDEQ Criteria Qualifiers:

A = Criterion is the state of Michigan drinking water standard established pursuant to section 5 of 1976 PA 399, MCL 325.1005.
E = Criterion is the aesthetic drinking water value, as required by section 20120a(5) of the act.
S = Criterion defaults to the hazardous substance-specific water solubility limit.
W = Concentrations of trihalomethanes in groundwater shall be added together to determine compliance with the Michigan drinking water standard of 100 µg/l.
X = The groundwater surface water interface (GSI) criterion shown in the generic cleanup criteria tables is not protective for surface water that is used as a drinking water source. For a groundwater discharge to the Great Lakes and their connecting waters, the generic GSI criterion shall be the surface water human drinking water value (HDV)(excepted
ID = insufficient data to develop criterion.
NA = criterion or value is not available or not applicable.

TABLE 4
Inorganics in Groundwater
December 2003 Sampling
BASF Corporation - Wyandotte, MI

Location ID		INDUSTRIAL & COMMERCIAL II, III & IV DRINKING WATER CRITERIA	GROUNDWATER SURFACE WATER INTERFACE CRITERIA	GROUNDWATER CONTACT CRITERIA	BG-MW-1	CMSMW-02	PM4NA	RFIMW-01	RFIMW-01	RFIMW-07	RFIMW-09	RFIMW-12
Sample ID					BGMW-1-G-1203-S	CMSMW-02-G-1203-S	PM4NA-G-1203-S	RFIMW-01-G-1203-D	RFIMW-01-G-1203-S	RFIMW-07-G-1203-S	RFIMW-09-G-1203-S	RFIMW-12-G-1203-S
Sample Type					sample	sample	sample	duplicate	sample	sample	sample	sample
Sample Date	units				02-Dec-03	03-Dec-03	08-Dec-03	04-Dec-03	04-Dec-03	08-Dec-03	03-Dec-03	09-Dec-03
ANTIMONY	mg/l	0.006 (A)	0.13 (X)	68	0.0031 U	0.0031 U	0.013 J-	0.0031 U	0.0031 U	0.0031 U	0.0031 U	0.0031 U
ARSENIC	mg/l	0.05 (A)	0.15 (X)	4.3	0.0035 J+	0.0029 U	0.30 J-	0.0029 U	0.0035 J+	0.0029 U	0.023	0.038
BARIUM	mg/l	2 (A)	(G, X)	14,000	0.049	0.23	0.10 J-	0.18	0.19	0.086	0.16	0.078
BERYLLIUM	mg/l	0.004 (A)	(G)	290	0.00047 U	0.00047 U	0.00047 UJ	0.00047 U	0.00047 U	0.00047 U	0.00047 U	0.00047 U
CADMIUM	mg/l	0.005 (A)	(G, X)	190	0.00036 U	0.00036 U	0.00036 UJ	0.00043 J+	0.00036 U	0.00036 U	0.00036 U	0.00064
CHROMIUM	mg/l	0.1 (A)	(G, X)	290,000	0.0021 J	0.0010 UJ	0.041 J	0.0015	0.0021	0.0011 J	0.088 J	0.019 J
COBALT	mg/l	0.1	0.1	2,400	0.0031 J+	0.0011 U	0.0033 J-	0.0011 J+	0.0014 J+	0.0011 U	0.0015 J+	0.0011 U
COPPER	mg/l	1 (E)	(G)	7,400	0.0041 J	0.0018 UJ	0.0047 J-	0.0018 UJ	0.0018 UJ	0.0018 UJ	0.0018 UJ	0.0033 J-
LEAD	mg/l	0.004 (L)	(G, X)	ID	0.0023 U	0.0023 U	0.0023 UJ	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.0023 U
NICKEL	mg/l	0.1 (A)	(G)	74,000	0.044 J	0.0042 J	0.053 J	0.0043 J+	0.0035 J+	0.0036 J	0.048 J	0.046 J
SELENIUM	mg/l	0.05 (A)	0.005	970	0.0039 U	0.0039 UJ	0.0039 UJ	0.0039 UJ	0.0039 UJ	0.0048 J-	0.0039 UJ	0.0039 UJ
SILVER	mg/l	0.098	0.0002 (M)	1,500	0.0011 U	0.0011 U	0.0011 UJ	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U
THALLIUM	mg/l	0.002 (A)	0.0037 (X)	13	0.010	0.0056 U	0.0056 UJ	0.0071	0.0082	0.0056 U	0.0094	0.0059
TIN	mg/l	---	---	---	0.0039 U	0.0039 U	0.0050 UJ	0.0039 U	0.0039 U	0.0039 U	0.0039 U	0.0039 U
VANADIUM (FUME OR DUST)	mg/l	0.062	0.012	970	0.00096 UJ	0.0033	0.066 J-	0.0054 J-	0.0056 J-	0.0013 J-	0.00096 UJ	0.042
ZINC	mg/l	5 (E)	(G)	110,000	0.024 J+	0.049	0.033 J-	0.018 J+	0.016 J+	0.013 UJ	0.014 J+	0.013 UJ

Qualifiers Used:

J = Estimated
J+ = Estimated, Biased High
J- = Estimated, Biased Low
R = Rejected
U = Non-detected
UJ = Non-detected, Estimated detection limit

Color Code:

Exceedances over the most stringent criteria.
Reporting limit above the most stringent criteria.

MDEQ Criteria Qualifiers:

A = Criterion is the state of Michigan drinking water standard established pursuant to section 5 of 1976 PA 399, MCL 325.1005.
E = Criterion is the aesthetic drinking water value, as required by section 20120a(5) of the act.
G = Groundwater surface water interface (GSI) criterion depends on the pH or water hardness, or both, of the receiving water..
L = Criteria for lead are derived using a biologically based model, as allowed for under section 20120a(10) of the act, and are not calculated using the algorithms and assumptions specified in pathway-specific rules.
M = Calculated criterion is below the analytical target detection limit, therefore, the criterion defaults to the target detection limit.
X = The groundwater surface water interface (GSI) criterion shown in the generic cleanup criteria tables is not protective for surface water that is used as a drinking water source. For a groundwater discharge to the Great Lakes and their connecting waters, the generic GSI criterion shall be the surface water
ID = insufficient data to develop criterion.

TABLE 4
Inorganics in Groundwater
December 2003 Sampling
BASF Corporation - Wyandotte, MI

Location ID		INDUSTRIAL & COMMERCIAL II, III & IV DRINKING WATER CRITERIA	GROUNDWATER SURFACE WATER INTERFACE CRITERIA	GROUNDWATER CONTACT CRITERIA	RFIMW-13	RFIMW-15	RFIMW-22	RFIMW-26	RFIMW-26	WHI3-1S	WHI4-1S	WHI9-2F
Sample ID					RFIMW-13-G-1203-S	RFIMW-15-G-1203-S	RFIMW-22-G-1203-S	RFIMW-26-G-1203-D	RFIMW-26-G-1203-S	WHI3-1S-G-1203-S	WHI4-1S-G-1203-S	WHI9-2F-G-1203-S
Sample Type					sample	sample	sample	sample	sample	sample	sample	sample
Sample Date	units				04-Dec-03	09-Dec-03	05-Dec-03	08-Dec-03	08-Dec-03	09-Dec-03	09-Dec-03	09-Dec-03
ANTIMONY	mg/l	0.006 (A)	0.13 (X)	68	0.0031 U	0.0031 U	0.0031 U	0.0031 U	0.0031 U	0.0031 UJ	0.0031 UJ	0.0036
ARSENIC	mg/l	0.05 (A)	0.15 (X)	4.3	0.0048 J+	0.0029 U	0.19	0.0030	0.0056	0.016	0.0029 U	0.041
BARIUM	mg/l	2 (A)	(G, X)	14,000	0.13	0.14	0.11	0.051	0.062	0.11	0.026	0.011
BERYLLIUM	mg/l	0.004 (A)	(G)	290	0.00047 U	0.00047 U	0.0012	0.00047 U	0.00047 U	0.00047 U	0.00047 U	0.00047 U
CADMIUM	mg/l	0.005 (A)	(G, X)	190	0.00036 U	0.00036 U	0.00036 U	0.00036 U	0.00036 U	0.00041	0.00036 U	0.0029
CHROMIUM	mg/l	0.1 (A)	(G, X)	290,000	0.054 J	0.25 J	0.061 J	0.023 J	0.16 J	0.010 J	0.0010 UJ	0.0062 J
COBALT	mg/l	0.1	0.1	2,400	0.0011 U	0.018 J+	0.0038	0.0011 U	0.0015	0.0037 U	0.0011 U	0.0011 U
COPPER	mg/l	1 (E)	(G)	7,400	0.0057 J	0.019 J+	0.017	0.0081 J-	0.0082 J-	0.011 J-	0.019	0.083
LEAD	mg/l	0.004 (L)	(G, X)	ID	0.0032	0.0023 U	0.0028	0.0023 U	0.0023 U	0.023	0.0085	0.14
NICKEL	mg/l	0.1 (A)	(G)	74,000	0.0084 J	1.5 J	0.042 J	0.027 J	0.070 J	0.0092 J	0.0025 UJ	0.011 J
SELENIUM	mg/l	0.05 (A)	0.005	970	0.0039 UJ	0.0039 UJ	0.0039 UJ	0.0039 UJ	0.0051 J-	0.0039 U	0.0039 U	0.0039 UJ
SILVER	mg/l	0.098	0.0002 (M)	1,500	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U
THALLIUM	mg/l	0.002 (A)	0.0037 (X)	13	0.0078	0.0096	0.0056 U	0.0082	0.012	0.0056 U	0.0056 U	0.0056 U
TIN	mg/l	---	---	---	0.0039 U	0.0039 U	0.0039 U	0.0039 U	0.0039 U	0.0039 U	0.0039 U	0.0039 U
VANADIUM (FUME OR DUST)	mg/l	0.062	0.012	970	0.0072 J-	0.00096 UJ	0.50	0.0027	0.0031	0.017	0.00096 UJ	0.052
ZINC	mg/l	5 (E)	(G)	110,000	0.035 J+	0.013 UJ	0.022	0.013 UJ	0.013 UJ	0.046	0.013 UJ	0.10

Qualifiers Used:

J = Estimated
J+ = Estimated, Biased High
J- = Estimated, Biased Low
R = Rejected
U = Non-detected
UJ = Non-detected, Estimated detection limit

Color Code:

Exceedances over the most stringent criteria.
Reporting limit above the most stringent criteria.

MDEQ Criteria Qualifiers:

A = Criterion is the state of Michigan drinking water standard established pursuant to section 5 of 1976 PA 399, M
E = Criterion is the aesthetic drinking water value, as required by section 20120a(5) of the act.
G = Groundwater surface water interface (GSI) criterion depends on the pH or water hardness, or both, of the rec
L = Criteria for lead are derived using a biologically based model, as allowed for under section 20120a(10) of the
M = Calculated criterion is below the analytical target detection limit, therefore, the criterion defaults to the target
X = The groundwater surface water interface (GSI) criterion shown in the generic cleanup criteria tables is not prhuman drinking water value (HDV), noted (xx).
ID = insufficient data to develop criterion.

TABLE 5
Total Mercury in Groundwater
December 2003 Sampling
BASF Corporation - Wyandotte, MI

			INDUSTRIAL & COMMERCIAL II, III & IV DRINKING WATER CRITERIA	ng/l	2,000
			GROUNDWATER SURFACE WATER INTERFACE CRITERIA	ng/l	1.3
			GROUNDWATER CONTACT CRITERIA	ng/l	56,000
Location ID	**Sample ID**	**Sample Type**	**Sample Date**	**units**	**MERCURY**
BG-MW-1	BGMW-1-G-1203-S	sample	02-Dec-03	ng/l	16.2 J
CMSMW-02	CMSMW-02-G-1203-S	sample	03-Dec-03	ng/l	434 J
CMS-MW-08	CMSMW-08-G-1203-S	sample	03-Dec-03	ng/l	3900 J
RFIMW-09	RFIMW-09-G-1203-S	sample	03-Dec-03	ng/l	1.37 J+
WHI2-1S	WHI2-1S-G-1203-S	sample	03-Dec-03	ng/l	3.71 J
RFIMW-09	RFIMW-09-G-1203-EB	equipment blank	03-Dec-03	ng/l	0.30 J
CMSMW-02	CMSMW-02-G-1203-FB	field blank	03-Dec-03	ng/l	0.20
RFIMW-01	RFIMW-01-G-1203-S	sample	04-Dec-03	ng/l	36.2 J
RFIMW-01	RFIMW-01-G-1203-D	duplicate	04-Dec-03	ng/l	20.4 J
RFIMW-02	RFIMW-02-G-1203-S	sample	04-Dec-03	ng/l	4.16 J
RFIMW-08	RFIMW-08-G-1203-S	sample	04-Dec-03	ng/l	5.32 J
RFIMW-13	RFIMW-13-G-1203-S	sample	04-Dec-03	ng/l	55.4 J
RFIMW-28	RFIMW-28-G-1203-S	sample	04-Dec-03	ng/l	4.31 J
RFIMW-28	RFIMW-28-G-1203-D	duplicate	04-Dec-03	ng/l	3.13 J
WHI9-2S	WHI9-2S-G-1203-S	sample	04-Dec-03	ng/l	41.1 J
RFIMW-13	RFIMW-13-G-1203-EB	equipment blank	04-Dec-03	ng/l	0.24
RFIMW-13	RFIMW-13-G-1203-FB	field blank	04-Dec-03	ng/l	0.15
RFIMW-04	RFIMW-04-G-1203-S	sample	05-Dec-03	ng/l	7.45 J
RFIMW-22	RFIMW-22-G-1203-S	sample	05-Dec-03	ng/l	33.3 J
RFIMW-22	RFIMW-22-G-1203-EB	equipment blank	05-Dec-03	ng/l	0.15 U
RFIMW-22	RFIMW-22-G-1203-FB	field blank	05-Dec-03	ng/l	0.15 U
PM4NA	PM4NA-G-1203-S	sample	08-Dec-03	ng/l	52.6 J
RFIMW-06	RFIMW-06-G-1203-S	sample	08-Dec-03	ng/l	324 J
RFIMW-07	RFIMW-07-G-1203-S	sample	08-Dec-03	ng/l	121 J
RFIMW-26	RFIMW-26-G-1203-S	sample	08-Dec-03	ng/l	14.1 J
RFIMW-26	RFIMW-26-G-1203-D	duplicate	08-Dec-03	ng/l	25.3 J
WHI3-2S	WHI3-2S-G-1203-S	sample	08-Dec-03	ng/l	64.4 J
RFIMW-06	RFIMW-06-G-1203-EB	equipment blank	08-Dec-03	ng/l	0.15 U
RFIMW-06	RFIMW-06-G-1203-FB	field blank	08-Dec-03	ng/l	0.15 U
RFIMW-11	RFIMW-11-G-1203-S	sample	09-Dec-03	ng/l	1.62 J+
RFIMW-12	RFIMW-12-G-1203-S	sample	09-Dec-03	ng/l	14.5 J
RFIMW-15	RFIMW-15-G-1203-S	sample	09-Dec-03	ng/l	3.06 J
WHI3-1S	WHI3-1S-G-1203-S	sample	09-Dec-03	ng/l	10.5 J
WHI4-1S	WHI4-1S-G-1203-S	sample	09-Dec-03	ng/l	67.3 J
WHI4-2S	WHI4-2S-G-1203-S	sample	09-Dec-03	ng/l	767 J
WHI9-2F	WHI9-2F-G-1203-S	sample	09-Dec-03	ng/l	757 J
WHI3-1S	WHI3-1S-G-1203-EB	equipment blank	09-Dec-03	ng/l	0.18
WHI4-1S	WHI4-1S-G-1203-FB	field blank	09-Dec-03	ng/l	0.15 U

Qualifiers Used:

J = Estimated
J+ = Estimated, Biased High
J- = Estimated, Biased Low
R = Rejected
U = Non-detected
UJ = Non-detected, Estimated detection limit

Color Codes:

Exceeds GSI Criteria
Equipment Blank
Field Blank

APPENDIX A

FIELD SAMPLE SHEETS

ENSR INTERNATIONAL

WELL NO. BGMW-1

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00760-127 Date: 12/3/03 Start: 0930

Project Name: BASF - WYANDOTTE Finish: 1125

Location: SOF MAINGATE - OFFSITE

Weather Conds.: 25 SUNNY Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: STAINLESS STEEL

Casing dia.: 2 in.

a. Total well depth: 17.74

b. Depth to water: 4.95

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (C)	Sp. Cond	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1040

Number	Container type	Preservation	Filtered?	Analysis
1	1L	NO	NO	BOD
1	125 mL PLASTIC	NO	NO	ALKALINITY
1	500 glass	NONE	NO	MERCURY
2	AMBER VOA 40 mL	NONE	NO	CO_2, METHANE
1	~~125~~ 250 PLASTIC	NONE		TOC
2	AMBER 40 mL	NONE		nitrate, nitrite, SO_4, Cl
1	250 PLASTIC	HNO_3		HARDNESS
1	1L PLASTIC	HNO_3		METAL
4	125 + 90 mL PLASTIC	ZnAc/NaOH	NO	SULFIDE
1	125 mL	H_2SO_4	NO	COD

4. COMMENTS:

∇ 11.72' (SAMPLE)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF - WYANDOTTE

Date: 12/3/03

Well No.: BGMW-1

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 16' Bottom of screen: 18'

Depth of pump intake: 17' bgs

Field Personnel: R. ~~Gregorek~~ / P. Elliott / A. SENN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
						3%	±0.1	10mV	10%		10%	
1015	4.95	2.5	160		12.46	3382	7.19	119.0	7.58	clear	0	very clear, no odor
1020	6.01	1.5	85		11.65	3415	7.47	113.0	7.26		0	
~~1020~~ 1025	6.52	1.5	75		11.00	3409	7.58	109.8	7.42		0	
1030	6.99	1.5	75		11.18	3409	7.59	108.5	7.43		0	
1035	7.42	1.5	75	1.5 gal	11.11	3411	7.60	107.1	7.44		0	

SCREENED 16-18' bgs (2" SCREEN), FLUSH MOUNT

FERROUS IRON - 0.2mg/L (VAP COLORED)

ENSR INTERNATIONAL

WELL NO. CMSMW-02

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: _____ Date: 12/3/03 Start: 1600

Project Name: BASF-WYANDOTTE Finish: _____

Location: ALONG E. FEED LINE, S. OF

Weather Conds.: _____ Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: _____

Casing dia.: _____ in.

a. Total well depth: 8.20

b. Depth to water: 2.53

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	Temp (°C)	Sp.Cond	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1710

Number	Container type	Preservation	Filtered?	Analysis
1	500mL glass	NO	NO	METALS
3	VOAS	HCL	NO	VOCS
2	40mL AMBER			CO_2

4. COMMENTS:

EQUIPMENT @ 1615 (CMSMW-02-G-1203-EB)

FIELD BLANK @ 1620 (CMSMW-02-G-1203-FB)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF- WYANDOTTE

Date: 12/3/03

Well No.: CMSMW-02

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 3.8 Bottom of screen: 8.8

Depth of pump intake: 6.3

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SENN / M. [illegible]

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1630	2.53	2.25	150		9.78	5852	12.45	-289.6	7.17	CLEAR	17.2	SLIGHT SEDIMENT
1635	2.70	1.5	75		10.68	5635	12.67	-328.5	3.36		16.3	
1640	2.86	1.5	75		9.90	5460	12.74	-341.5	2.02		8.7	
1645	2.88	1.5	75	~~0.5gal~~	9.96	5429	12.73	-343.3	1.85		5.6	
1650	2.90	1.5	75	~~0.75~~	10.13	5286	12.72	-344.8	1.62		4.6	
1655												

FERROUS IRON - 0.2 mg/L

ENSR INTERNATIONAL

WELL NO. CMSMW-08

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: _____ Date: 12/3/03 Start: 1350

Project Name: BASF WYANDOTTE Finish: 1500

Location: N SIDE - ALONG DETROIT RIVER, SOUTH OF GRAVELOD

Weather Conds.: _____ Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: _____

Casing dia.: _____ in.

a. Total well depth: 12.62

b. Depth to water: 6.32

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	Temp (°C)	Sp.Cond	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1450

Number	Container type	Preservation	Filtered?	Analysis
1	500 mL GLASS	NO	NO	MERCURY

4. COMMENTS:

COLLECT EQUIP. BLANK (CMSMW-03-G-1203-EB) @ 1405

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-WYANDOTTE

Date: 12/3/03

Well No.: CMSMW-08

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 8.65 Bottom of screen: 12.65

Depth of pump intake: 10.65

Field Personnel: R. ~~Gregorek~~ / P. Elliott / A. SENN / M. [illegible]

						3%		± 10mV	10%		10%	
Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1815	6.32	2	85		10.59	10647	12.71	-195.7	5.57	CLEAR	0	NO SEDIMENT
1820	6.81	2	85		10.44	10732	12.78	-244.4	3.39		0	
1825	6.89	2	100		10.37	10566	12.79	-287.5	2.63		0	
1430	6.90	2	100		10.47	10511	12.77	-318.5	1.84		0	
1435	6.80	1.5	50		10.41	10447	12.72	-355.8	1.15		0	
1440	6.75	1.5	50		9.60	10479	12.69	-361.9	0.66		0	
1445	6.72	1.5	50	~0.75 gal	9.53	10472	12.68	-369.3	0.43	LT. YELLOW	0	

FERROUS IRON — 0.2 mg/L

ENSR INTERNATIONAL

WELL NO. PM4NA

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00760-127 Date: 12/8/03 Start: 1820

Project Name: BASF-WYANDOTTE Finish:

Location:

Weather Conds.: CLOUDY, 35 Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: SS

Casing dia.: 2 in.

a. Total well depth: 23.98 (22 bgs)

b. Depth to water: 4.52

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	Temp (°C)	Sp.Cond	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION: Method: Peristaltic Pump Time: 1910

Number	Container type	Preservation	Filtered?	Analysis
all				

4. COMMENTS:

COLLECTED EQUIP BLANK @ 1800 (PM4NA-G-1203-EB)

DUP @ SAMPLING

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF - WYANDOTTE

Date: 12/8/03

Well No.: PM4NA

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 19.5 (17.5) Bottom of screen: 21.5 (19.5)

Depth of pump intake: 20.5

Field Personnel: R. ~~Gregorek / P.~~ Elliott / A. GENN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1845	4.52	1.5	75		8.06	55559	8.45	-346.8	1.32	~~LT.~~ BROWN	33.8	SULFUR ODOR
1850	5.00	1.5	75		8.72	59089	8.42	-467.7	0.11	TO AMBER	33.9	↓
1855	5.31	1.5	75		8.75	59494	8.42	-486.9	0.02	↓	46.1	↓
1900	5.50	1.5	75		8.88	59699	8.42	-491.9	0.01	↓	41.3	↓
1905	5.72	1.5	75	~1.5 gal	8.92	60011	8.41	-492.7	0.00	↓	27.9	↓

STICK UP - NO STEEL CASING AROUND RISER

FERROUS IRON = COULD NOT DETERMINE - FOAMY REACTION + OFF-COLORING DUE TO EXISTING COLOR IN WATER (AMBER)

ENSR INTERNATIONAL

WELL NO. RFI MW-01

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: _____ Date: _____ Start: 1500

Project Name: _____ Finish: 1620

Location: _____

Weather Conds.: _____ Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: _____

Casing dia.: _____ in.

a. Total well depth: 22.89

b. Depth to water: 3.49

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	Temp	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1565

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS:

COLLECTED EQUIP BLANK @ 1515 (RFIMW-01-0-120X3-EB)

COLLECTED DUP OF ALL ANALYTES.

Y 3.92 (SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-WYANDOTTE

Date: 12/4/03

Well No.: RFIMW-01

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 19 Bottom of screen: 21

Depth of pump intake: 20

Field Personnel: R. ~~Gregorek~~ / P. Elliott / A. SENN / M. [illegible]

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1530	3.49	2	150		11.03	53022	6.82	-163.3	11.15	brown	1393.6	v. silty
1535	3.71	1.5	85		10.69	53961	6.90	-184.7	12.22	↓	1392.3	↓
1540	3.75	1.5	85		10.40	54088	6.90	-187.6	14.00		968.6	
1545	3.76	1.5	85	~~0.5~~ 1.0 gal	10.19	52788	6.92	-186.6	16.27	↓	556.1	

FLUSH MONTH

FERROUS IRON = 8.0 mg/L

ENSR INTERNATIONAL

WELL NO. RFIMW-02

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 0016 087160-127 Date: 12/4/03 Start: 1210

Project Name: BASF - WYANDOTTE Finish: 1305

Location: N

Weather Conds.: 35, WINDY, PARTLY SUNNY Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: _____

Casing dia.: _____ in.

a. Total well depth: 29.32

b. Depth to water: 5.22

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1255

Number	Container type	Preservation	Filtered?	Analysis
1	500 ml glass	NO	NO	Mercury

4. COMMENTS:

COLLECTED EQUIP BLANK @ 1225 (RFIMW-12-G-1204-EB)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-WYANDOTTE

Date: 12/4/03

Well No.: RFIMW-02

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: ~ 26 (23) Bottom of screen: ~28 (25) ↑ bgs.

Depth of pump intake: ~ 27 (24)

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SENN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1235	5.22	2	120		11.19	67343	6.50	-158.0	19.50	CLEAR	~ 0	SOME RED PARTICLES
1240	6.17	1.5	60-70		10.94	67400	6.49	-162.0	19.90	↓	0	↓
1245	6.20	1.8	85		10.83	67065	6.47	-164.1	20.23	↓	0	↓
1250	6.51	1.8	85	~0.5 gal	10.84	67122	6.47	-165.9	21.80	↓	0	↓

- STICK-UP WELL (~2 FT ABOVE g.s.)
- FERROUS IRON ~ 5 mg/L

ENSR INTERNATIONAL

WELL NO. RFIMW-04

GROUND WATER SAMPLE COLLECTION RECORD

Project #: 00160-127 Date: 12/5/03 Time: Start: 0800

Project Name: BASF - NYANDOTTE Finish: 0850

Location:

Weather Conds.: 30s, windy, snow/rain mix Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing) Well casing type: SS

a. Total well depth: 13.88 Casing dia.: 2 in.

b. Depth to water: 5.87

c. Length of water column (a - b): ____ ft.

d. Volume per foot: ____ gal./ft.

e. Calculated purgeable volume (c x d): ____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION: Method: Peristaltic Pump Time: 840

Number	Container type	Preservation	Filtered?	Analysis
1	500mg-glass	NO	NO	Mercury

4. COMMENTS:

COLLECT EQUIPBLANK @ 0810 (RFIMW-04-G-1203-EB)

$6.00 (AT SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: ~~12/5/03~~ ~~BAGF-WYANDOTTE~~

Date: 12/5/03

Well No.: RFMW-04

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: ~10.5 (8) Bottom of screen: ~12.5 (10)

Depth of pump intake: ~11.5 (9)

Field Personnel: R. ~~Gregorek~~ / P. Elliott / A. SENN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
0820	5.87	1.5	80		8.82	10578	6.57	-129.0	2.13	clear	2.2	SOME RED PARTICLE
0825	5.97	1.5	80		8.89	10574	6.60	-145.5	1.67		11.1	
0830	5.97	1.5	80		8.89	10427	6.63	-147.5	1.01		19.8	
0835	5.98	1.5	80	~0.5 gal	9.26	10454	6.61	-149.9	0.91		27.5	

STICK-UP

FERROUS IRON - 4.5 mg/L

ENSR INTERNATIONAL

WELL NO. BEL MW-16

GROUND WATER SAMPLE COLLECTION RECORD

Project #: 00760-127 Date: 12/8/03 Time: Start: 1645

Project Name: BASF-WYANDOTTE Finish:

Location:

Weather Conds.: CLOUDY, 30s Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type:

Casing dia.: in.

a. Total well depth: 14.85

b. Depth to water: 8.13

c. Length of water column (a - b): ft.

d. Volume per foot: gal./ft.

e. Calculated purgeable volume (c x d): gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	Temp. (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1725

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS:

COLLECT FIELD BLANK @ 1645

COLLECT EQUIP BLANK @ 1650

7 8.20 (WHEN SAMPLING

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-WYANDOTTE

Date: 12/8/03

Well No.: RPMW-06

Depth of screened interval below top of casing: ~~14.5~~ 13 / ~~14.83~~ 11 (15)

Purging device: Peristaltic

Top of screen: ~~13.5~~ 10 (13)

Bottom of screen:

Depth of pump intake: ~~13.5~~ 12 (14)

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SENN / M. ACUAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1700	8.13	1.5	90	9.8	~~8.76~~	9149	12.43	-220.9	2.37	clear	4.4	NO SEDIMENT
1705	8.16	1.5	90		9.83	8952	12.46	-256.5	1.42	V. clear	0	
1710	8.19	1.5	90		10.17	8729	12.47	-304.5	1.14	" "	0	
1715	8.19	1.5	90		10.34	8680	12.47	-311.2	0.99	" "	0	
1720	8.20	1.5	90		10.59	8626	12.47	-318.9	0.89	" "	0	
1725	8.20	1.5	90	~0.25 g.	10.63	8603	12.47	-328.0	0.81	" "	0	

STICKUP – ~~HARD BOTTOM~~

FERROUS IRON = 0.2 mg/L

ENSR INTERNATIONAL

WELL NO. PAMW-07

GROUND WATER SAMPLE COLLECTION RECORD

Project #: 00760-127 ~~12/8/03~~ Date: 12/8/03 Start: 1050 Time:

Project Name: BASF-WYANDOTTE Finish:

Location:

Weather Conds.: CLOUDY, 30s Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing) Well casing type:

a. Total well depth: 22.33 Casing dia.: in.

b. Depth to water: 15.10

c. Length of water column (a - b): ft.

d. Volume per foot: gal./ft.

e. Calculated purgeable volume (c x d): gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	Temp (°C)	Sp Cond	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION: Method: Peristaltic Pump Time: 1200

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS:

COLLECTED FIELD BLANK @ 1110 (PAMW-07-G-1203-EB)

▽ 16.11 (AT SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF - WYANDOTTE

Date: 12/8/03

Well No.: RFI MW-07

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: ~18.3 (16) Bottom of screen: ~20.3 (18)

Depth of pump intake: ~19.3 (17)

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SENN / M. ARCHUGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1125	15.10	1.5	80		9.35	21887	12.55	-119.7	3.96	clear	0	
1130	15.53	1.5	80		9.50	22122	12.58	-180.9	2.32		0	
1135	15.60	1.5	75		9.47	22163	12.60	-223.1	1.74		0	
1140	15.73	1.5	75		9.59	22132	12.61	-245.6	1.37		0	
1145	15.89	1.5	75		10.18	21821	12.60	-263.8	1.30		0	
1150	16.00	1.5	75		10.02	21823	12.60	-271.1	1.22		0	
1155	16.09	1.5	75		9.61	21918	12.62	-278.3	1.13		0	
1200	16.11	1.5	75	~1 gal	9.70	21586	12.61	-284.5	1.05		0	

STICK-UP

FERROUS IRON = 0.1 mg/L

ENSR INTERNATIONAL

WELL NO. RFI MW-08

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00160-127 Date: 12/4/03 Start: 1110

Project Name: BASF-WYANDOTTE Finish: 1205

Location: N SIDE OF SITE, ALONG DETROIT RIVER, WOF GRAVEL RD.

Weather Conds.: Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: SS

Casing dia.: 2 in.

a. Total well depth: ~~41.~~ 40.18 (SOFT)

b. Depth to water: 9.35

c. Length of water column (a - b): ft.

d. Volume per foot: gal./ft.

e. Calculated purgeable volume (c x d): gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1155

Number	Container type	Preservation	Filtered?	Analysis
1	500mL-glass	NO	NO	MERCURY

4. COMMENTS:

COLLECTED EQUIP BLANK @ ~~10~~ 1130 (RFIMW-08-G-1204-03)

▽ 9.39 (@ SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF - WYANDOTTE

Date: 12/4/03

Well No.: RFI MW-08

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: ~36.5 (34) Bottom of screen: 38.5 (36)

Depth of pump intake: ~37.5 (35)

Field Personnel: R. ~~Gregorek~~ / P. Elliott / A. SEAN / M. [illegible]

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1135	9.35	1.5	50-60		10.76	~~8220~~ 8490	6.47	-189.1	5.80	lt. yellow-tan	399.8	SOME SEDIMENT, SILTY
1140	9.42	2	85		9.98	9997	6.72	-215.7	5.25	↓	~~200~~ 202.0	↓
1145	9.43	2	85		10.53	10191	6.73	-221.1	5.36		97.3	
1150	9.43	2	85	~0.5 gal	10.57	10137	6.73	-223.3	4.93		56.0	

• STICK-UP ~2.5' above g.s.

• FERROUS IRON - +10 mg/L (DARK ORANGE)

ENSR INTERNATIONAL

WELL NO. RFI MW-09

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: _____ Date: 12/2/03 Start: 1415

Project Name: BASF - WYANDOTTE Finish: _____

Location: ALONG DETROIT RIVER, N. OF GRAVEL RD

Weather Conds.: 20s WINDY Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: STAINLESS STEEL

Casing dia.: 2 in.

a. Total well depth: 42.24

b. Depth to water: 8.52

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1515

Number	Container type	Preservation	Filtered?	Analysis
2	40mL VOA	NONE	NO	methane, CO_2
2	40mL VOA	NONE		nitrate, nitrite, sulfate, chlor
1	250mL	H_2SO_4		TOC
1	125mL	H_2SO_4		COD
1	125	NONE		Alkalinity
1	1L	NONE		BOD
4	125mL	ZINC ACETATE + NaOH		sulfide
3	40mL VOA	HCL		VOCs

4. COMMENTS:

SCREENED 36.5-38.5' bgs (2' screen)

- DTW MEASURED FROM NOTCH ON CASING.
- SEPARATE SAMPLE CONTAINERS FOR METALS + HARDNESS
- EQUIP. BLANK (RFI MW-09-G-1203-EB) @ 1515 ON 12/3/03

MERCURY - 1 - 500mL PLASTIC 12/3/03 1540

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

734
208 7875

Site: BASF - WYANDOTTE

Date: 12/2/03 - 12/3/03

Well No.: RFIMW-09

Depth of screened interval below top of casing:

Purging device:

Top of screen: ~~37~~ 36.5 Bottom of screen: 38.5

Depth of pump intake: 37.5

Field Personnel: ~~R. Gregorek~~ P. Elliott / A. SENN / M. ARDIAGA

	Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
							3%		± 10mv	10%		10%	
12/2/03	1438		4	300 ml/min		11.60	20432	7.34	-233.8	0.81	NONE	47.6	Some sediment
	1443		3	220 ml/min		11.57	21268	7.22	-238.1	0.47	yellowish	22.1	
	1448		3	↓		11.61	21885	7.13	-240.4	0.37		60.9	SEDIMENT CAUSING INFLOW CELL
	1453		2	100 ml/min		11.16	22211	7.11	-243.3	0.36		68.7	
	1458		2			10.58	22189	7.11	-244.3	0.38		43.7	
	1503		2	↓	1.5 gal	10.79	21910	7.10	-246.8	0.38		15.0	
12/3/03	1520		2	100		9.02	20149	7.30	-217.5	8.08		25.5	→ 12/3/03
	1525		2	100		10.37	21986	7.09	-227.7	8.01		13.3	SOME SEDIMENT
	1530		2	100		10.33	22174	7.08	-234.6	7.61		13.9	
	1535		2	100		10.34	22154	7.08	-236.7	7.35		5.5	

FERROUS IRON - + 10mg/L (ORANGE RED THEN CLEAR)

WATER LEVEL NOT WORKING

ENSR INTERNATIONAL

WELL NO RFIMW-11

GROUND WATER SAMPLE COLLECTION RECORD

Project #: 00760-127 Date: 12/9/03 Start: 1420 Time:

Project Name: BASF-WYANDOTTE Finish: 1505

Location:

Weather Conds.: RAINY, 40s Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: SS

Casing dia.: 2 in.

a. Total well depth: 28.92

b. Depth to water: 5.91

c. Length of water column (a - b): ____ ft.

d. Volume per foot: ____ gal./ft.

e. Calculated purgeable volume (c x d): ____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1500

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS:

COLLECT EQUIP BLANK @ 1435

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-WYANDOTTE

Date: 12/9/03

Well No.: RFI MW-11

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: ~25 (23) LOG Bottom of screen: ~27. (25) LOG

Depth of pump intake: 26 (24)

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SENN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1445	5.91	2.0	125		10.13	1397	~~7.45~~ 7.41	-287.9	29.00	CLEAR	0.6	
1450	6.79	2.0	125		10.73	1380	7.54	-309.2	21.83	↓	0.0	
1455	7.37	2.0	125		10.92	1401	7.59	-313.1	17.39		0.0	
1500	7.61	2.0	125	~0.5g	11.05	1416	7.61	-314.0	13.15	↓	0.0	

STICK-UP, NO ~~WELL~~ CASING COVER

FERROUS IRON = +10 (SLIGHTLY DARKER THAN 10 mg/L STANDARD)

ENSR INTERNATIONAL

WELL NO. RFIMW-12

GROUND WATER SAMPLE COLLECTION RECORD

Project #: 60160-127 Date: 12/9/13 Time: Start: 1505/1520

Project Name: BASF-WYANDOTTE Finish: 1610

Location:

Weather Conds.: Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing) Well casing type:

a. Total well depth: 28.93 Casing dia.: in.

b. Depth to water: 8.01

c. Length of water column (a - b): ft.

d. Volume per foot: gal./ft.

e. Calculated purgeable volume (c x d): gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION: Method: Peristaltic Pump Time: 1530

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS:

COLLECT EQUIP BLANK @ 1520 (RFIMW-12-G-1203-EB)
DTW 8.80 (@ SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF - WYANDOTTE

Date: 12/9/03

Well No.: RPI MW-12

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: ~25 (23) LOG

Bottom of screen: ~27 (25) LOG

Depth of pump intake: ~28

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SEVIN / M. ARCIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1525	8.01	2.0	125		9.98	20397	10.08	-361.5	18.56	LT. BROWN	0.0	NO SEDIMENT, SLIGHT ODOR
1530	8.81	2.0	125		10.78	21381	10.16	-392.9	12.91	↓	0.0	↓
1535	9.41	2.0	125		10.71	21490	10.18	-401.7	9.01		0.0	
1540	9.90	2.0	125		10.75	21424	10.18	-404.6	7.12		0.0	
1545	10.48	2.0	125	~0.5 gal	10.87	21393	10.18	-407.2	5.76	↓	0.0	↓

STICK UP

FERROUS IRON = 0.2 mg/L

ENSR INTERNATIONAL

WELL NO. RFMW-13

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00260-127 Date: 12/4/03 Start: 1720

Project Name: BASF-W Finish: 1820

Location:

Weather Conds.: Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: SS

Casing dia.: 2 in.

a. Total well depth: 22.82

b. Depth to water: 3.01

c. Length of water column (a - b): ft.

d. Volume per foot: gal./ft.

e. Calculated purgeable volume (c x d): gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1810

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS:

FIELD BLANK @ 1740

EQUIP BLANK @ 1745

▽ 3.17 (@ SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: ~~BASF~~ WYANDOTTE

Date: 12/4/03

Well No.: RFI MW-13

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 19 Bottom of screen: 21

Depth of pump intake: 20

Field Personnel: R. ~~Gregorek~~ / P. Elliott / A. SENN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1745	3.01	1.5	100		11.20	384838	6.76	-144.6	9.03	clear	187.8	SLIGHTLY TURBID
1750	3.10	1.5	↓		11.46	55432	6.95	-186.5	6.58	↓	197.6	↓
1755	3.16	1.5	↓		11.60	55118	6.97	-192.2	6.25	↓	80.1	↓
1800	3.20	1.5	↓	~1 gal	11.51	54577	6.99	-195.6	6.02	↓	80.0	↓

FLUSH MOUNT

FERROUS IRON: ~~8.0 mg/L~~ +10 mg/L (SLIGHTLY DARKER THAN 10 mg/L STANDARD)

ENSR INTERNATIONAL

WELL NO. RFIMW-15

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00760-127 Date: 12/9/03 Start: 1100

Project Name: BASF-WYANDOTTE Finish: 1230

Location:

Weather Conds.: Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type:

Casing dia.: in.

a. Total well depth: 30.93

b. Depth to water: 8.41

c. Length of water column (a - b): ft.

d. Volume per foot: gal./ft.

e. Calculated purgeable volume (c x d): gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1150

Number	Container type	Preservation	Filtered?	Analysis
all				

4. COMMENTS:

COLLECTED EQUIPBLANK @ 1115

▽ 12.92 (@ SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-WYANDOTTE

Date: 12/9/03

Well No.: RFEMW-15

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: ~26.3 (25) LOG

Bottom of screen: ~28.3 (27) LOG

Depth of pump intake: 25.3 (26)

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SOUN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1130	8.41	1.52.0	125		11.42	26343	7.67	91.4	5.97	CLEAR	31.3	NO SEDIMENT
1135	8.~~80~~ 50	2.0	125		11.53	26465	7.70	86.5	5.84	↓	30.3	↓
1140	8.75	2.0	125		11.72	26454	7.71	82.0	5.69	↓	30.2	↓
1145	9.21	2.0	120		11.90	26655	7.71	74.1	5.21	↓	30.0	↓
1150	9.30	2.0	120	~0.75gal.	11.97	26734	7.70	72.7	5.07	↓	29.6	↓

STICK-UP

FERROUS IRON = 0.4 mg/L

ENSR INTERNATIONAL

WELL NO. RFIMW-22

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00760-127 Date: 12/5/03 Start: 0900

Project Name: ~~RFIMW-22~~ BASF-WYANDOTTE Finish: 1140

Location:

Weather Conds.: 30, WINDY, SNOW/RAIN Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: SS

Casing dia.: 2 in.

a. Total well depth: 17.22

b. Depth to water: 3.28

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION: Method: Peristaltic Pump Time: 1000

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS: BAILER IN WELL – CONTAINED WATER (~1')

COLLECTED FIELD BLANK @ 0910 (RFIMW-22-9-1203-FB)

" " EQUIP BLANK @ 0915 (RFIMW-22-G-1207-EB)

COVERED IN GRAVEL "B" MARKING LOCATION OF BLDG

D3.50 (AISAMPLING)

COLLECTED MS + MSD SAMPLES

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF - WYANDOTTE

Date: 12/5/03

Well No.: RFIMW-22-16

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 14 Bottom of screen: 16

Depth of pump intake: 15

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SENN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
0930	3.28	1.5	65		9.55	17422	9.69	-224.8	0.82	LT. BROWN	7.3	SOME SEDIMENT
0935	3.30	1.5	65		9.80	17410	9.74	-230.6	0.760	AMBER	7.9	
0940	3.35	1.5	65		9.99	17268	9.77	-233.5	0.45		6.5	FROATHY DISCHARGE BUBBLES COLORED
0945	3.35	1.5	65	2 gal	10.11	17290	9.82	-236.2	0.31		7.7	

FLUSH MOUNT

FERROUS IRON - 1.5 mg/L

ENSR INTERNATIONAL

WELL NO. RFIMW-26

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00760-127 Date: 12/8/03 Start: 1350

Project Name: BASF - WYANDOTTE Finish:

Location: PARKING LOT

Weather Conds.: CLOUDY, 30s Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: SS

Casing dia.: 2 in.

a. Total well depth: 8.62

b. Depth to water: ~~3.18~~ 3.92

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION: Method: Peristaltic Pump Time: 1500

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS: VERY RUSTY CASING, WATER IN WELL - PURGED W/ CUP.
COLLECTED EQUIP BLANK @ 1410 (RFIMW-26-G-1203-EB)
▽4.29 @ SAMPLING

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-WYANDOTTE

Date: 12/8/03

Well No.: RFMW-26

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 5 Bottom of screen: 7

Depth of pump intake: 6

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SENN / M. ARMAGA

Time	Water Depth	Pump Setting	Purge Rate ml/min ~~mg/l~~	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1415	3.92	1.5	85		10.49	18185	7.04	14.3	2.84	clear	211.3	some sediment
1420	3.99	1.5	85		10.54	14762	7.15	1.7	3.48	clear	97.6	and rust particles
1425	4.04	1.5	85		10.84	12839	7.20	-3.9	3.27	"	27.1	no more rust
1430	4.05	1.5	85		10.83	11432	7.27	-4.7	2.92	"	15.9	"
1435	4.05	1.5	85		10.85	9756	7.34	-14.4	2.41	"	6.7	"
1440	4.07	1.5	85		10.80	8458	7.43	-26.2	2.08		0.5	
1445	4.09	1.5	75		10.82	7700	7.48	-30.1	1.78		0	
1450	4.09	↓	↓		10.53	6931	7.52	-29.7	1.58		0	
1455	4.09				10.34	6678	7.54	-29.5	1.52		0	
1500	4.09				10.36	6521	7.55	-29.9	1.45		0	
1505	4.09				10.26	6329	7.58	-30.1	1.36		0	
			~1.5 gal →									

FLUSH MONIT.

FERROUS IRON = 0.2 mg/L

ENSR INTERNATIONAL

WELL NO. RFI MW-28

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00760-127 Date: 12/4/03 Start: 0800

Project Name: BASF-WYANDOTTE Finish: 0905

Location: SW SIDE OF PROP NEAR FENCE

Weather Conds.: 20s, WINDY, CLOUDY Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: ~~2~~ SS

Casing dia.: 2 in.

a. Total well depth: 13.89

b. Depth to water: 4.25

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 0840S

Number	Container type	Preservation	Filtered?	Analysis
2 S	500 mL glass	No	No	MERCURY

SAMPLE + DUP

4. COMMENTS:

COLLECTED EQUIP BLANK @ 820 (RFI MW-28-G-~~1203~~ 1204-EB)

▽ 4.54 (@ SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASE NYANDOTTE

Date: 12/4/03

Well No.: RFIMW-28

Depth of screened interval below top of casing:

Purging device: PERISTALTIC PUMP

Top of screen: 9.5 (1) Bottom of screen: 11.5 (9)

Depth of pump intake: 8.5

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SEANN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
						3%		10mV	10%		10%	
0825	4.25	1.5	85		9.06	30526	6.62	-150.5	13.47	LT. ORANGE	163.0	RED PARTICLES
0830	4.51	1.5	85		9.26	30948	6.61	-159.7	12.13		209.5	" "
0835	4.52	1.5	85-90		9.32	30856	6.64	-161.9	12.11		176.5	
0840	4.53	1.5	85-90	~0.5 gal	9.62	31001	6.64	-163.5	11.92	clearer	141.7	

STICK UP

FERROUS IRON +10 mg/L (DARK RED - HIGHER THAN STANDARDS)

ENSR INTERNATIONAL

WELL NO. WHI2-1S

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00760-127 Date: 12/3/03 Start: 1130

Project Name: Finish: 1250

Location: ALONG BIDDLE NEAR STEAM BLDG. INGRASS

Weather Conds.: Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: PVC

Casing dia.: 1 in.

a. Total well depth: 7.45

b. Depth to water: 4.56

c. Length of water column (a - b): ft.

d. Volume per foot: gal./ft.

e. Calculated purgeable volume (c x d): gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION: Method: Peristaltic Pump Time: 1240

Number	Container type	Preservation	Filtered?	Analysis
1	500 glass	NO	NO	MERCURY

4. COMMENTS: EQUIP BLANK (WHI2-1S-G-1203-EB) COLLECTED @ 1150

4.59 (@ SAMPLE)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF- WYANDOTTE

Date: 12/3/03

Well No.: WHI2-1S

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 4 Bottom of screen: 8

Depth of pump intake: 6'

Field Personnel: ~~R. Gregorek~~ / P. Elliott /A. SENN/M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm (3%)	pH ± 0.1	ORP mv (10mV)	DO mg/l (10%)	Color	Turbidity NTU (10%)	Comments
1310	4.56	2	~~110~~ 100		9.71	785	7.18	-118.9	2.86 ~~1.18~~		104.3	some sediment
1315	N/A	1.5	75		9.53	1060	7.13	-186.6	1.61		100.8	↓
1320	N/A	1.5	75		9.50	1062	7.17	-205.3	1.62	lt. yellow	86.9	↓
1325	N/A	1.5	75		9.53	1059	7.19	-211.2	1.47		34.6	↓
1330	N/A	1.5	75		9.64	1060	7.19	-213.8	1.35		40.4	↓
1235	N/A	1.5	75	~0.75 gal	8.87	1078	7.19	-214.4	1.35		19.1	

1" WELL - COULD NOT FIT WATER LEVEL PROBE W/ TUBING

FERROUS IRON - 2 mg/L

ENSR INTERNATIONAL

WELL NO. WHI3-2S

GROUND WATER SAMPLE COLLECTION RECORD

Project #: _____ Date: 12/8/03 Time: Start: 1250

Project Name: BASF-WYANDOTTE Finish: _____

Location: _____

Weather Conds.: _____ Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: PVC

Casing dia.: 1 in.

a. Total well depth: 5.29

b. Depth to water: 2.49

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1340

Number	Container type	Preservation	Filtered?	Analysis
1	500mL glass	NO	NO	MERCURY

4. COMMENTS:

COLLECT EQUIP BLANK @ 1305 (WHI3-~~2S~~ 2S-G-1203-03)

D 3.94 (@ SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-WYANDOTTE

Date: 12/8/03

Well No.: WHI3-25

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 3 Bottom of screen: 6

Depth of pump intake: ~~5.5~~ 4.5

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SENN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1310	2.49	1.5	90		7.74	3059	8.30	-199.6	5.65	LT. BROWN	6.0	NO SEDIMENT
1315	N/A	1.5	90		7.77	3073	8.19	-224.2	2.85		7.5	
1320	N/A	1.2	25		7.56	~~3~~ 3000	8.04	-248.0	2.61		10.5	
1325	N/A	1.2	25		7.19	3077	8.02	-226.7	4.31		12.4	
1330	N/A	1.2	25		7.08	3100	8.01	-219.9	4.96		13.3	
1335	N/A	1.2	25	~0.25 gal	6.99	3151	8.01	-212.3	5.43		11.6	

FLUSH MOUNT

FERROUS IRON = 20 mg/L

COULD NOT FIT WATER LEVEL PROBE W/ TUBING IN 1" WELL

ENSR INTERNATIONAL

WELL NO. WH14-25

GROUND WATER SAMPLE COLLECTION RECORD

Project #: _____ Date: 12/9/03 Start: 1750 (Time:)

Project Name: _____ Finish: _____

Location: NEAR BASEBALL FIELD

Weather Conds.: _____ Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: PVC

Casing dia.: 1 in.

a. Total well depth: 5.4

b. Depth to water: 3.3

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1900

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS:

Collected field blank at 1800
Collected Equipment blank at 1805
Sample collected at 1900

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-W

Date: 12/9/03

Well No.: WH24-25

Depth of screened interval below top of casing:

Purging device: Peristaltic

Top of screen: (4) Bottom of screen: (9)

Depth of pump intake:

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. Senn / M. Arriaga

Time	Water Depth	Pump Setting	Purge Rate ~~mg/l~~ ml/min	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1815		1.5	80		11.11	2650	6.99	-139.2	4.60	Brown	1221.0	turbid
1820		1.5	80		10.69	1940	7.18	-142.5	4.03	Brown	1385.0	some sediment
1825		1.5	80		10.64	1370	7.22	-153.3	4.63	"	927.7	"
1830		1.5	80		10.51	1116	7.22	-164.1	4.92	light brown	222.6	getting clearer
1835		1.5	80		10.66	980	7.20	-169.9	5.00	"	94.8	"
1840		1.5	80		10.74	913	7.19	-173.7	4.48	clear	22.4	"
1845		1.5	80		10.80	898	7.18	-175.8	4.57	"	4.2	clear now
1850		1.5	80	0.5 gal	10.83	879	7.17	-177.5	4.21	"	0	
	3.3' final											

FLUSH MOUNT
1" piezometer

ENSR INTERNATIONAL

WELL NO. WHZ4-2S

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00260-127 Date: 12/9/03 Start: 1000

Project Name: BASF-WYANDOTTE Finish:

Location:

Weather Conds.: Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: PVC

Casing dia.: 1 in.

a. Total well depth: 5.22

b. Depth to water: 3.17

c. Length of water column (a - b): ft.

d. Volume per foot: gal./ft.

e. Calculated purgeable volume (c x d): gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	Temp (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1040

Number	Container type	Preservation	Filtered?	Analysis
1	500mL glass	NO	NO	MERCURY

4. COMMENTS:

COLLECTED EQUIP BLANK @ 1010 (WHZ4-2S-G-1203-EB)

▽ 3.11 (@ SAMPLING)

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF - WYANDOTTE

Date: 12/9/03

Well No.: WHI4-25

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: (3) LOG

Bottom of screen: ~5 (6) LOG

Depth of pump intake:

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SEVIN / M. ARRIBGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1020	3.17	1.5	50		7.34	1427	7.42	93.3	4.67	clear	98.1	
1025	N/A	1.5	50		7.30	1422	7.40	93.1	5.72		67.1	AIR BUBBLES IN LINE
1030	N/A	1.5	100		8.12	1409	7.37	92.9	6.16		103.9	
1035	3.71	1.5	100	~0.5 gal	8.24	1415	7.36	90.2	3.85		148.8	

FLUSH MOUNT — HARD BOTTOM

1" PVC - CAN NOT FIT WATER LEVEL W/ TUBING

FERROUS IRON - 0.4 mg/L

ENSR INTERNATIONAL

WELL NO. WHZ9-2F

GROUND WATER SAMPLE COLLECTION RECORD

Project #: _____ Date: 12/5/03 Time: Start: 1240

Project Name: _____ Finish: _____

Location: _____

Weather Conds.: _____ Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: PVC

Casing dia.: 1 in.

a. Total well depth: 7.84

b. Depth to water: 2.31

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	Temp (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION:

Method: Peristaltic Pump Time: 1340

Number	Container type	Preservation	Filtered?	Analysis

4. COMMENTS:

WELL CASING SLANTED, SAND PACK AND WATER ABOVE WELL SOFT BOTTOM

COLLECT EB @ 1305

P 2.26

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-W

Date: 12/9/03

Well No.: WHZ9-2F

Depth of screened interval below top of casing:

Purging device: PERISTALTIC

Top of screen: 5.8 (5) Bottom of screen: ~7.8 (9)

Depth of pump intake: 6.5

Field Personnel: ~~R. Gregorek~~ / P. Elliott / A. SEVIN / M. ARRIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1310	2.31	1.5	80		8.14	2236	9.13	-288.9	4.03	BROWN	472.1	BLACK ORGANIC
1315	N/A	1.5	80		8.80	2888	10.06	-340.6	1.18		289.5	PARTICLES IN WATER
1320	N/A	1.5	80		8.87	3000	10.16	-347.9	0.95		240.7	
1325	N/A	1.5	80		9.02	3100	10.21	-352.7	0.78		204.1	
1330	2.26	1.5	80	~0.5 gal	9.07	3170	10.25	-356.6	0.66		189.7	

FERROUS IRON = 0.5 mg/L

FLUSHMOUNT

ENSR INTERNATIONAL

WELL NO. WHI9-2S

GROUND WATER SAMPLE COLLECTION RECORD

Time:

Project #: 00760-127 Date: 12/4/03 Start: 0915

Project Name: BASF- WYANDOTTE Finish: 1040

Location: SOUTH OF MW-9

Weather Conds.: 30, WINDY, PARTLY CLOUDY Sampler: P. Elliott

1. WATER LEVEL DATA: (measured from top of casing)

Well casing type: PVC

Casing dia.: 1 in.

a. Total well depth: 21.09

b. Depth to water: 2.69

c. Length of water column (a - b): _____ ft.

d. Volume per foot: _____ gal./ft.

e. Calculated purgeable volume (c x d): _____ gal.

Diameter (in.)	Volume (gal./ft.)
1	0.041
2	0.163
3	0.367
4	0.653

2. WELL PURGEABLE DATA

a. Purge method: Peristaltic Pump

b. Required purge volume (@ 1 well volumes): 0.00 gallons

c. Field testing equipment used: YSI 650XL and turbidity meter

Volume purged	T (°C)	Sp. Cond.	DO	pH	ORP	Turbidity	Color	Other

SEE Separate Field Water Quality Measurement Form

3. SAMPLE COLLECTION: Method: Peristaltic Pump Time: 1036

Number	Container type	Preservation	Filtered?	Analysis
1	500ml GLASS	NO	NO	MERCURY

4. COMMENTS:

COLLECTED EQUIP BLANK @ 0940

ENSR INTERNATIONAL

WELL PURGING
FIELD WATER QUALITY MEASUREMENTS FORM

Site: BASF-WYANDOTTE

Date: 12/4/03

Well No.: WHI9-2S

Depth of screened interval below top of casing:

Purging device: FLOWSTATIC

Top of screen: ~~20~~ 19 Bottom of screen: ~~25~~ 24

Depth of pump intake: ~~22.5~~ 19

Field Personnel: R. ~~Gregorek~~ / P. Elliott / A. SENN / M. ARCIAGA

Time	Water Depth	Pump Setting	Purge Rate mg/l	Cumul. Volume Purged	Temp. °C	Specific Cond. µs/cm	pH ± 0.1	ORP mv	DO mg/l	Color	Turbidity NTU	Comments
1010	2.49	~~3~~ 1.5	85		11.74	12968	6.50	-127.2	8.87		~~10~~ 1897.6	V. TURBID
1015	N/A	1.5	85		11.44	14539	6.66	-179.1	7.29		1388.1	
1020	N/A	15	85		11.55	14806	6.66	-185.0	7.05		718.7	
1025	N/A	1.5	85		11.66	14830	6.65	-187.6	6.99		422.8	

FLUSH MOUNT - 1" (CANNOT FIT WATER LEVEL PROBE W/ TUBING IN WELL)

VERY ~~SILTY~~ SANDY - COULDN'T PUMP FROM MIDDLE OF SCREEN, MOVED PUMP INTAKE TO TOP OF SCREEN

FERROUS IRON ~ * 10 mg/L (DARK ORANGE)

APPENDIX B

LABORATORY ANALYTICAL REPORTS

MICROSEEPS

P0312040

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 1 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Laboratory Results

Total # of pages in client package 85

Lab Sample #	Client Sample ID
P0312040-01	RFIMW-09-G-1203-S

Microseeps test results meet all the requirements of the NELAC standards.

Approved By: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

220 William Pitt Way, Pittsburgh, PA 15238 • Phone (412) 826-5245, Fax (412) 826-3433

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312040-01

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-09-G-1203-S	Water	02 Dec. 03 15:15	03 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	760		4.0	mg/L	310.1	rh	12/4/03	
Biochemical Oxygen Demand	9.3		3.0	mg/L	405.1	tld	12/3/03	15:26
Chemical Oxygen Demand	120		5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	3800	M	1.0	mg/L	9056	md	12/5/03	3:57
Nitrate	< 25	UM	25	mg/L	9056	md	12/5/03	3:57
Nitrite	< 25	UM	25	mg/L	9056	md	12/5/03	3:57
Sulfate	14	M	1.0	mg/L	9056	md	12/3/03	19:08
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/5/03	
Total Organic Carbon	10	M	5.0	mg/L	9060	md	12/12/03	
RiskAnalysis								
Carbon dioxide	120		0.60	mg/L	AM20GAX	rw	12/13/03	
Methane	1300		0.015	ug/L	AM20GAX	rw	12/13/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 3 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Sulfide
Analysis Method: Sulfide

M031208001-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	mg/L		2.0		- NA

M031208001-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	18	mg/L	34.00	53	50 - 87

P0312034-02A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	18	mg/L	34.00	53	52 - 79

P0312034-02A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide	18	mg/L	34.00	53	52 - 79	1.10	0 - 8

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 4 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Five Day Biochemical Oxygen Demand
Analysis Method: Five Day Biochemical Oxygen Demand

M031208009-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Biochemical Oxygen Demand	1.4	mg/L		3.0		- NA

M031208009-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Biochemical Oxygen Demand	140	mg/L	118.00	119	56 - 129

P0312028-07A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Biochemical Oxygen Demand	76	mg/L			- NA	23.26	0 - 30

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 5 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M031208013-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	2.0	mg/L		4.0		- NA

M031208013-LCS

			TrueSpikeConc.		%Recovery	Ctl Limits
Alkalinity as CaCO3	52	mg/L	54.70		95	87 - 113

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 6 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: In House Dissolved Gas Sample Preparation
Analysis Method: Analysis of Dissolved Methane in Water

M031213009-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Methane	< 0.015	ug/L		0.015		- NA

M031213009-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	75	ug/L	71.93	104	75 - 125

M031213009-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	75	ug/L	71.93	104	75 - 125	0.45	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 7 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Analysis of Dissolved Permanent Gases in Water
Analysis Method: Analysis of Dissolved Permanent Gases in Water

M031213010-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	mg/L		0.60		- NA

M031213010-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	120	mg/L	106.20	113	75 - 125

M031213010-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	120	mg/L	106.20	113	75 - 125	3.66	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 8 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M031213011-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 5.0	mg/L		5.0		- NA

M031213011-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	79	mg/L	75.50	105	70 - 130

P0311495-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	0.9	mg/L			- NA	12.15	0 - 20

P0312068-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	1.3	mg/L			- NA	41.36	0 - 20

P0311495-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	46	mg/L	50.00	90	70 - 130

P0312068-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	46	mg/L	50.00	88	70 - 130

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 9 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M031213019-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chloride	< 1.0	mg/L		1.0		- NA
Nitrite	< 0.50	mg/L		0.50		- NA
Nitrate	< 0.50	mg/L		0.50		- NA
Sulfate	< 1.0	mg/L		1.0		- NA

M031213019-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	9.5	mg/L	10.00	95	80 - 120
Nitrite	9.0	mg/L	10.00	90	80 - 120
Nitrate	9.2	mg/L	10.00	92	80 - 120
Sulfate	9.6	mg/L	10.00	96	80 - 120

P0312034-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	160	mg/L			- NA		0 - 20
Nitrite	< 0.50	mg/L			- NA		0 - 20
Nitrate	1600	mg/L			- NA	8.25	0 - 20
Sulfate	46	mg/L			- NA	1.34	0 - 20

P0312034-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	160	mg/L	10.00		70 - 130
Nitrite	< 0.50	mg/L	10.00		70 - 130
Nitrate	1700	mg/L	10.00	2,267	70 - 130
Sulfate	48	mg/L	10.00	26	70 - 130

P0312034-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	160	mg/L	10.00		70 - 130	12.05	0 - 20

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road
Warrenville, IL 60555

Page: Page 10 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

P0312034-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Nitrite	< 0.50	mg/L	10.00		70 - 130	NA	0 - 20
Nitrate	1600	mg/L	10.00	1,267	70 - 130	3.71	0 - 20
Sulfate	48	mg/L	10.00	26	70 - 130	0.73	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 11 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: COD by Reactor digestion/Colorimetric Determination
Analysis Method: COD by Reactor digestion/Colorimetric Determination

M031215015-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chemical Oxygen Demand	< 5.0	mg/L		5.0		- NA

M031215015-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	200	mg/L	191.00	105	73 - 121

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	2200	mg/L	1,000.00	82	51 - 136

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chemical Oxygen Demand	2600	mg/L	1,000.00	122	51 - 136	15.83	0 - 29

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 12 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Case Narrative:The percent recovery for the batch MS/MSD analyses for chloride,nitrate,nitrite and sulfate were outside of control limits. The sample concentration is greater than 4 times the spike added. All other QC analyses are acceptable. No further action taken.
The TOC RPD on the batch duplicate is out of criteria due to the sample concentration being below the PQL.

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Chain-of-Custody Records

P0312040

P0312040

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 **Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238** Fax No. : (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL RD; WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF - WYANDOTTE, MI
Proj. Number:
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Faytha Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
	RF1MW-09-G-1203-S	12/02/03	1515		✓	2	X								
					✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

01

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Faytha Elliott	ENSR	12/02/03	1800	[illegible]	Microseeps	12/3/03	1026
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

P0312068

MICROSEEPS

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 1 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Laboratory Results

Total # of pages in client package 96

Lab Sample #	Client Sample ID
P0312068-01	BGMW-1-G-1203-S

Microseeps test results meet all the requirements of the NELAC standards.

Approved By: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312068-01

Sample Description	Matrix	Sampled Date/Time	Received
BGMW-1-G-1203-S	Water	03 Dec. 03 10:40	04 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	130		4.0	mg/L	310.1	jb	12/5/03	
Biochemical Oxygen Demand	3.3		3.0	mg/L	405.1	tld	12/5/03	10:03
Chemical Oxygen Demand	< 5.0	U	5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	180	M	2.0	mg/L	9056	md	12/6/03	16:46
Nitrate	< 0.50	U	0.50	mg/L	9056	md	12/4/03	17:45
Nitrite	< 0.50	U	0.50	mg/L	9056	md	12/4/03	17:45
Sulfate	1800	M	25	mg/L	9056	md	12/6/03	17:35
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/8/03	
Total Organic Carbon	2.0	J	5.0	mg/L	9060	md	12/12/03	
RiskAnalysis								
Carbon dioxide	6.4		0.60	mg/L	AM20GAX	rw	12/14/03	
Methane	13		0.015	ug/L	AM20GAX	rw	12/14/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 3 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M031208014-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	2.0	mg/L		4.0		- NA

M031208014-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	60	mg/L	61.50	98	87 - 113

P0312068-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	130	mg/L			- NA	0.00	0 - 14

P0312075-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	340	mg/L	100.00	76	69 - 101

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 4 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Sulfide
Analysis Method: Sulfide

M031210012-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	mg/L		2.0		- NA

M031210012-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	19	mg/L	34.00	56	50 - 87

P0312075-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	19	mg/L	34.00	55	52 - 79

P0312075-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide	19	mg/L	34.00	55	52 - 79	0.52	0 - 8

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 5 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Five Day Biochemical Oxygen Demand
Analysis Method: Five Day Biochemical Oxygen Demand

M031210017-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Biochemical Oxygen Demand	1.8	mg/L		3.0		- NA

M031210017-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Biochemical Oxygen Demand	72	mg/L	118.00	61	56 - 129

P0312067-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Biochemical Oxygen Demand	9.3	mg/L			- NA	8.99	0 - 30

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 6 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M031213011-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 5.0	mg/L		5.0		- NA

M031213011-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	79	mg/L	75.50	105	70 - 130

P0311495-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	0.9	mg/L			- NA	12.15	0 - 20

P0312068-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	1.3	mg/L			- NA	41.36	0 - 20

P0311495-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	46	mg/L	50.00	90	70 - 130

P0312068-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	46	mg/L	50.00	88	70 - 130

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 7 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M031213015-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chloride	0.90	mg/L		1.0		- NA
Nitrite	< 0.50	mg/L		0.50		- NA
Nitrate	< 0.50	mg/L		0.50		- NA
Sulfate	< 1.0	mg/L		1.0		- NA

M031213015-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	9.6	mg/L	10.00	96	80 - 120
Nitrite	9.1	mg/L	10.00	91	80 - 120
Nitrate	9.2	mg/L	10.00	92	80 - 120
Sulfate	9.7	mg/L	10.00	97	80 - 120

P0312068-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	180	mg/L			- NA	1.46	0 - 20
Nitrite	< 0.50	mg/L			- NA	0.00	0 - 20
Nitrate	< 0.50	mg/L			- NA	0.00	0 - 20
Sulfate	1800	mg/L			- NA	2.12	0 - 20

P0312068-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	170	mg/L	10.00	-126	70 - 130
Nitrite	9.6	mg/L	10.00	96	70 - 130
Nitrate	8.4	mg/L	10.00	84	70 - 130
Sulfate	1800	mg/L	10.00	-386	70 - 130

P0312068-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	170	mg/L	10.00	-126	70 - 130	0.24	0 - 20

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road
Warrenville, IL 60555

Page: Page 8 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

P0312068-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Nitrite	9.6	mg/L	10.00	96	70 - 130	0.44	0 - 20
Nitrate	8.9	mg/L	10.00	89	70 - 130	5.59	0 - 20
Sulfate	1800	mg/L	10.00	-386	70 - 130	0.31	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 9 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Analysis of Dissolved Permanent Gases in Water
Analysis Method: Analysis of Dissolved Permanent Gases in Water

M031214009-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	mg/L		0.60		- NA

M031214009-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	120	mg/L	106.20	113	75 - 125

M031214009-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	120	mg/L	106.20	113	75 - 125	0.88	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 10 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: COD by Reactor digestion/Colorimetric Determination
Analysis Method: COD by Reactor digestion/Colorimetric Determination

M031215015-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chemical Oxygen Demand	< 5.0	mg/L		5.0		- NA

M031215015-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	200	mg/L	191.00	105	73 - 121

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	2200	mg/L	1,000.00	82	51 - 136

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chemical Oxygen Demand	2600	mg/L	1,000.00	122	51 - 136	15.83	0 - 29

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 11 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: In House Dissolved Gas Sample Preparation
Analysis Method: Analysis of Dissolved Methane in Water

M031217012-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Methane	< 0.015	ug/L		0.015		- NA

M031217012-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	76	ug/L	71.93	106	75 - 125

M031217012-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	74	ug/L	71.93	103	75 - 125	2.06	0 - 20

P0312093-04A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	80	ug/L	65.62	84	70 - 130

P0312093-04A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	77	ug/L	65.62	80	70 - 130	4.53	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 12 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Case Narrative: The percent recovery for the batch MS/MSD analyses for chloride and sulfate was outside the control limits. The concentration of the unspiked sample was greater than 5 times the spike added. No further action required.
The TOC duplicate RPD is out of criteria, due to the sample concentration being below the PQL.

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

P0312068

P0312068

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 | **Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238** | Fax No. : (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL RD; WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF - WYANDOTTE, IL
Proj. Number: C0760-127 / 300
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Paylin Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
01	BGMW-1-G-1203-S	12/3/03	1040		✓	2	X								
					✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paylin Elliott	ENSR	12/3/03	1800	[illegible]	[illegible]	12/4/03	1020
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

MICROSEEPS

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 1 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Laboratory Results

Total # of pages in client package ~~103~~ 104 BH 1/7/04

Lab Sample #	Client Sample ID
P0312113-01	RFIMW-01-G-1203-D
P0312113-02	RFIMW-13-G-1203-S
P0312113-03	RFIMW-01-G-1203-S

Microseeps test results meet all the requirements of the NELAC standards.

Approved By: Rebecca J. Hans

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

220 William Pitt Way, Pittsburgh, PA 15238 • Phone (412) 826-5245, Fax (412) 826-3433

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312113-01

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-01-G-1203-D	Water	04 Dec. 03 15:55	05 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	720		4.0	mg/L	310.1	rh	12/15/03	
Biochemical Oxygen Demand	17		3.0	mg/L	405.1	tld	12/5/03	14:40
Chemical Oxygen Demand	710		50	mg/L	HACH8000	tld	12/15/03	
Chloride	16000	M	500	mg/L	9056	md	12/19/03	18:57
Nitrate	< 2.5	UM	2.5	mg/L	9056	md	12/7/03	2:58
Nitrite	< 2.5	UM	2.5	mg/L	9056	md	12/7/03	2:58
Sulfate	740	M	5.0	mg/L	9056	md	12/7/03	2:58
Sulfide	1.8	J	2.0	mg/L	376.1	tld	12/8/03	
Total Organic Carbon	86		5.0	mg/L	9060	md	12/13/03	
RiskAnalysis								
Carbon dioxide	120		0.60	mg/L	AM20GAX	rw	12/14/03	
Methane	8200		0.015	ug/L	AM20GAX	rw	12/14/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 3 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312113-02

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-13-G-1203-S	Water	04 Dec. 03 18:10	05 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	730		4.0	mg/L	310.1	rh	12/15/03	
Biochemical Oxygen Demand	20		3.0	mg/L	405.1	tld	12/5/03	14:44
Chemical Oxygen Demand	490		50	mg/L	HACH8000	tld	12/15/03	
Chloride	19000	M	200	mg/L	9056	md	12/19/03	20:10
Nitrate	< 5.0	UM	5.0	mg/L	9056	md	12/7/03	3:47
Nitrite	< 5.0	UM	5.0	mg/L	9056	md	12/7/03	3:47
Sulfate	680	M	10	mg/L	9056	md	12/7/03	3:47
Sulfide	2.2		2.0	mg/L	376.1	tld	12/8/03	
Total Organic Carbon	85		5.0	mg/L	9060	md	12/13/03	
RiskAnalysis								
Carbon dioxide	120		0.60	mg/L	AM20GAX	rw	12/14/03	
Methane	9800		0.015	ug/L	AM20GAX	rw	12/14/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 4 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312113-03

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-01-G-1203-S	Water	04 Dec. 03 15:55	05 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	720		4.0	mg/L	310.1	rh	12/15/03	
Biochemical Oxygen Demand	17		3.0	mg/L	405.1	tld	12/5/03	14:47
Chemical Oxygen Demand	680		50	mg/L	HACH8000	tld	12/15/03	
Chloride	21000	M	250	mg/L	9056	md	12/19/03	20:35
Nitrate	< 5.0	UM	5.0	mg/L	9056	md	12/7/03	4:36
Nitrite	< 5.0	UM	5.0	mg/L	9056	md	12/7/03	4:36
Sulfate	710	M	10	mg/L	9056	md	12/7/03	4:36
Sulfide	2.2		2.0	mg/L	376.1	tld	12/8/03	
Total Organic Carbon	100		5.0	mg/L	9060	md	12/13/03	
RiskAnalysis								
Carbon dioxide	98		0.60	mg/L	AM20GAX	rw	12/14/03	
Methane	7300		0.015	ug/L	AM20GAX	rw	12/14/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 5 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Sulfide
Analysis Method: Sulfide

M031210012-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	mg/L		2.0		- NA

M031210012-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	19	mg/L	34.00	56	50 - 87

P0312075-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	19	mg/L	34.00	55	52 - 79

P0312075-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide	19	mg/L	34.00	55	52 - 79	0.52	0 - 8

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 6 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Five Day Biochemical Oxygen Demand
Analysis Method: Five Day Biochemical Oxygen Demand

M031210017-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Biochemical Oxygen Demand	1.8	mg/L		3.0		- NA

M031210017-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Biochemical Oxygen Demand	72	mg/L	118.00	61	56 - 129

P0312067-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Biochemical Oxygen Demand	9.3	mg/L			- NA	8.99	0 - 30

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 7 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M031213020-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chloride	0.88	mg/L		1.0		- NA
Nitrite	< 0.50	mg/L		0.50		- NA
Nitrate	< 0.50	mg/L		0.50		- NA
Sulfate	< 1.0	mg/L		1.0		- NA

M031213020-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	9.5	mg/L	10.00	95	80 - 120
Nitrite	9.0	mg/L	10.00	90	80 - 120
Nitrate	9.2	mg/L	10.00	92	80 - 120
Sulfate	9.6	mg/L	10.00	96	80 - 120

P0312109-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	13000	mg/L			- NA	3.09	0 - 20
Nitrite	< 2.5	mg/L			- NA	0.00	0 - 20
Nitrate	< 2.5	mg/L			- NA	0.00	0 - 20
Sulfate	6300	mg/L			- NA	0.43	0 - 20

P0312109-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	13000	mg/L	10.00	3,951	70 - 130
Nitrite	< 0.50	mg/L	10.00	0	70 - 130
Nitrate	< 0.50	mg/L	10.00	0	70 - 130
Sulfate	6300	mg/L	10.00	-272	70 - 130

P0312109-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	13000	mg/L	10.00	3,951	70 - 130	200.00	0 - 20

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road
Warrenville, IL 60555

Page: Page 8 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

P0312109-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Nitrite	< 0.50	mg/L	10.00	0	70 - 130	NA	0 - 20
Nitrate	< 0.50	mg/L	10.00	0	70 - 130	NA	0 - 20
Sulfate	6300	mg/L	10.00	-272	70 - 130	200.00	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 9 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Analysis of Dissolved Permanent Gases in Water
Analysis Method: Analysis of Dissolved Permanent Gases in Water

M031214009-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	mg/L		0.60		- NA

M031214009-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	120	mg/L	106.20	113	75 - 125

M031214009-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	120	mg/L	106.20	113	75 - 125	0.88	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 10 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: COD by Reactor digestion/Colorimetric Determination
Analysis Method: COD by Reactor digestion/Colorimetric Determination

M031215015-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chemical Oxygen Demand	< 5.0	mg/L		5.0		- NA

M031215015-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	200	mg/L	191.00	105	73 - 121

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	2200	mg/L	1,000.00	82	51 - 136

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chemical Oxygen Demand	2600	mg/L	1,000.00	122	51 - 136	15.83	0 - 29

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 11 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M031216015-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	2.0	mg/L		4.0		- NA

M031216015-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	50	mg/L	54.70	91	87 - 113

P0312295-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	390	mg/L			- NA	1.55	0 - 14

P0312295-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	460	mg/L	100.00	76	69 - 101

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 12 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M031216017-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 5.0	mg/L		5.0		- NA

M031216017-LCS

			TrueSpikeConc.		%Recovery	Ctl Limits
Total Organic Carbon	71	mg/L	75.50		94	70 - 130

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 13 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Prep Method: In House Dissolved Gas Sample Preparation
Analysis Method: Analysis of Dissolved Methane in Water

M031217012-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Methane	< 0.015	ug/L		0.015		- NA

M031217012-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	76	ug/L	71.93	106	75 - 125

M031217012-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	74	ug/L	71.93	103	75 - 125	2.06	0 - 20

P0312093-04A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	80	ug/L	65.62	84	70 - 130

P0312093-04A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	77	ug/L	65.62	80	70 - 130	4.53	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 14 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Case Narrative: The anions MS/MSD out of criteria due to the high sample concentration.

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

P0312113

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 **Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238** Fax No. : (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL ROAD, WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASE - WYANDOTTE, MI
Proj. Number: 00760-127/300
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Paylla Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
	RFI MW-13-G-1203-S	12/04/03	1810		✓	2	X								
	↓	↓	↓		✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

62

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paylla Elliott	ENSR	12/04/03	2000	[illegible]	[illegible]	12/5/03	1040
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

5

PO 312113

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 — **Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238** — Fax No. : (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL ROAD, WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF - WYANDOTTE, MI
Proj. Number:
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Paytha Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
	RFIMW-01-G-1203-D	12/04/03	1555		✓	2	X								
	↓	↓	↓		✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

01

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paytha Elliott	ENSR	12/04/03	2000	[illegible]	[illegible]	[illegible]	1640
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples — YELLOW COPY : Laboratory File — PINK COPY : Submitter

19

P0312113

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 | **Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238** | Fax No. : (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL RD; WARRENVILLE IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF - WYANDOTTE MI
Proj. Number:
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Paylla Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
	RFI MW-01-G-1203-S	12/4/03	1555		✓	2	X								
					✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

03

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paylla Elliott	ENSR	12/4/03	2000	[illegible]	[illegible]	12/5/03	1040
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

17

MICROSEEPS

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 1 of 13
Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Laboratory Results

Total # of pages in client package 13

Lab Sample #	Client Sample ID
P0312193-01	RFIMW-22-G-1203-S
P0312193-02	RFIMW-22-G-1203-S MS
P0312193-03	RFIMW-22-G-1203-S MSD

Microseeps test results meet all the requirements of the NELAC standards

Approved By: Rebecca J. Adams

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service Unless otherwise specified, all results are reported on a wet weight basis.

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312193-01

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-22-G-1203-S	Water	05 Dec. 03 10:00	08 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	2200		4.0	mg/L	310.1	rh	12/11/03	
Chemical Oxygen Demand	1400		50	mg/L	HACH8000	tld	12/15/03	
Chloride	8900	M	100	mg/L	9056	md	12/11/03	23:39
Sulfate	< 1.0	UM	1.0	mg/L	9056	md	12/11/03	23:39
Sulfide	12		10	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	380		120	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	0.67	M	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	14000	M	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312193-02

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-22-G-1203-S MS	Water	05 Dec. 03 10:00	08 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	2300		4.0	mg/L	310.1	rh	12/11/03	
Chemical Oxygen Demand	2200		120	mg/L	HACH8000	tld	12/15/03	
Chloride	4300	M	1.0	mg/L	9056	md	12/10/03	21:51
Sulfate	44	M	1.0	mg/L	9056	md	12/10/03	21:51
Sulfide	100		10	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	1800		120	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	1.4	M	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	16000	M	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery. M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312193-03

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-22-G-1203-S MSD	Water	05 Dec. 03 10:00	08 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	2300		4.0	mg/L	310.1	rh	12/11/03	
Chemical Oxygen Demand	2600		120	mg/L	HACH8000	tld	12/15/03	
Chloride	4300	M	1.0	mg/L	9056	md	12/10/03	8:40
Sulfate	46	M	1.0	mg/L	9056	md	12/10/03	8:40
Sulfide	100		10	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	1800		120	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	< 0.60	UM	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	18000	M	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank. S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Sulfide
Analysis Method: Sulfide

M031212017-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	mg/L		2.0		- NA

M031212017-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	18	mg/L	34.00	53	50 - 87

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	100	mg/L	170.00	55	52 - 79

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide	100	mg/L	170.00	55	52 - 79	0	0 - 8

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank. S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: COD by Reactor digestion/Colorimetric Determination
Analysis Method: COD by Reactor digestion/Colorimetric Determination

M031215015-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chemical Oxygen Demand	< 5.0	mg/L		5.0		- NA

M031215015-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	200	mg/L	191.00	105	73 - 121

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	2200	mg/L	1,000.00	84	51 - 136

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chemical Oxygen Demand	2600	mg/L	1,000.00	118	51 - 136	14.22	0 - 29

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value. U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank. S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 7 of 13
Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Analysis of Dissolved Permanent Gases in Water
Analysis Method: Analysis of Dissolved Permanent Gases in Water

M031218018-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	mg/L		0.60		- NA

M031218018-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	120	mg/L	106.20	113	75 - 125

M031218018-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	120	mg/L	106.20	113	75 - 125	0.0	0 - 20

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	1.4	mg/L	29.95	2	70 - 130

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	< 0.60	mg/L	29.95	-2	70 - 130	200	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Methane in Water

M031218019-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Methane	< 0.015	ug/L		0.015		- NA

M031218019-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	71	ug/L	71.93	99	75 - 125

M031218019-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	73	ug/L	71.93	101	75 - 125	2.0	0 - 20

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	14000	ug/L	65.62	0	70 - 130

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	14000	ug/L	65.62	0	70 - 130	0	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M031221018-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 5.0	mg/L		5.0		- NA

M031221018-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	65	mg/L	75.50	86	70 - 130

P0312174-02A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	13	mg/L			- NA	4.1	0 - 20

P0312174-02A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	54	mg/L	50.00	80	70 - 130

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	1800	mg/L	1,250.00	112	70 - 130

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	1800	mg/L	1,250.00	110	70 - 130	1.24	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M031229026-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chloride	0.92	mg/L		1		- NA
Sulfate	< 1.0	mg/L		1		- NA

M031229026-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	9.7	mg/L	10.00	97	80 - 120
Sulfate	9.1	mg/L	10.00	91	80 - 120

P0312202-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	7400	mg/L			- NA	0.36	0 - 20
Sulfate	< 1.0	mg/L			- NA	0	0 - 20

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	4300	mg/L	10.00	0	70 - 130
Sulfate	44	mg/L	10.00	440	70 - 130

P0312202-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	6500	mg/L	10.00	0	70 - 130
Sulfate	6.1	mg/L	10.00	61	70 - 130

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	4300	mg/L	10.00	0	70 - 130	0.23	0 - 20
Sulfate	46	mg/L	10.00	460	70 - 130	4.4	0 - 20

P0312202-01A-MSD

	TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Page: Page 11 of 13
Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

P0312202-01A-MSD Warrenville, IL 60555

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	6500	mg/L	10.00	0	70 - 130	0	0 - 20
Sulfate	7.5	mg/L	10.00	75	70 - 130	10.3	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Alkalinity Titrametric

Analysis Method: Alkalinity Titrametric

M031230011-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	< 4 0	mg/L		4.0		- NA

M031230011-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	66	mg/L	61.50	107	87 - 113

P0312049-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	150	mg/L			- NA	1.34	0 - 14

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	2300	mg/L	100.00	100	69 - 101

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	2300	mg/L	100.00	100	69 - 101	0	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name:	ENSR	Page:	Page 13 of 13
Contact:	Tim Adams	Lab Project #:	P0312193
Address:	27755 Diehl Road	Report Date:	01/08/04
		Client Proj Name:	BASF Wyandotte MI
		Client project #:	00760127300
	Warrenville, IL 60555		

Case Narrative:Samples were received on 12/8/03 but not logged in until 12/9/03 because of a nonconformance. The percent recovery for the MS/MSD analyses for anions was outside of control limits, due to the high sample concentration. The percent recoveries for the permanent gas analyses were outside of the laboratory's control limits. The sample pH was approximately 10. At this pH level the release of methane and carbon dioxide is affected. All other QC analyses were acceptable.

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank. S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

MICROSEEPS

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 1 of 15
Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Laboratory Results

Total # of pages in client package 15

Lab Sample #	Client Sample ID
P0312174-01	PM4NA-G-1203-S
P0312174-02	RFIMW-07-G-1203-S
P0312174-03	RFIMW-26-G-1203-S
P0312174-04	RFIMW-26-G-1203-D

Microseeps test results meet all the requirements of the NELAC standards

Approved By: Rebecca J. Adams

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312174-01

Sample Description	Matrix	Sampled Date/Time	Received
PM4NA-G-1203-S	Water	08 Dec. 03 19:10	09 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	7100		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Demand	220		3.0	mg/L	405.1	tld	12/10/03	14:37
Chemical Oxygen Demand	1200		50	mg/L	HACH8000	tld	12/15/03	
Chloride	22000	M	200	mg/L	9056	md	12/10/03	23:05
Nitrate	< 12	U	12	mg/L	9056	md	12/9/03	20:27
Nitrite	< 12	UM	12	mg/L	9056	md	12/9/03	20:27
Sulfate	1200	M	25	mg/L	9056	md	12/9/03	20:27
Sulfide	110		10	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	460		120	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	28		0.60	mg/L	AM20GAX	jl	12/17/03	
Methane	6800		0.015	ug/L	AM20GAX	jl	12/17/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312174-02

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-07-G-1203-S	Water	08 Dec. 03 12:00	09 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	810		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Demand	5.4		3 0	mg/L	405.1	tld	12/10/03	14:40
Chemical Oxygen Demand	44		5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	5200	M	25	mg/L	9056	md	12/11/03	0:18
Nitrate	< 2.5	U	2.5	mg/L	9056	md	12/10/03	23:29
Nitrite	< 2.5	UM	2.5	mg/L	9056	md	12/10/03	23:29
Sulfate	310	M	5.0	mg/L	9056	md	12/10/03	23:29
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	13		5.0	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	< 0.60	U	0.60	mg/L	AM20GAX	jl	12/17/03	
Methane	4800		0 015	ug/L	AM20GAX	jl	12/17/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery. M - Recovery/RPD poor for MS/MSD, SAMP/DUP. B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 4 of 15
Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312174-03

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-26-G-1203-S	Water	08 Dec. 03 15:00	09 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	620		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Demand	4.5		3.0	mg/L	405.1	tld	12/10/03	14:43
Chemical Oxygen Demand	5.2		5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	1200	M	10	mg/L	9056	md	12/11/03	2:45
Nitrate	8.0		0.50	mg/L	9056	md	12/9/03	18:49
Nitrite	< 0.50	UM	0.50	mg/L	9056	md	12/9/03	18:49
Sulfate	74	M	1.0	mg/L	9056	md	12/9/03	18:49
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	7.8		5.0	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	22		0.60	mg/L	AM20GAX	jl	12/17/03	
Methane	5.9		0.015	ug/L	AM20GAX	jl	12/17/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312174-04

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-26-G-1203-D	Water	08 Dec. 03 15:00	09 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	660		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Demand	<3.0	U	3.0	mg/L	405.1	tld	12/10/03	14:47
Chemical Oxygen Demand	15		5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	1200	M	10	mg/L	9056	md	12/10/03	20:04
Nitrate	9.8		0.50	mg/L	9056	md	12/9/03	19:14
Nitrite	< 0.50	UM	0 50	mg/L	9056	md	12/9/03	19:14
Sulfate	73	M	1.0	mg/L	9056	md	12/9/03	19:14
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	7.7		5.0	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	23		0.60	mg/L	AM20GAX	jl	12/17/03	
Methane	2.9		0.015	ug/L	AM20GAX	jl	12/17/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery. M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M031211005-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chloride	0.90	mg/L		1.0		- NA
Nitrite	< 0.50	mg/L		0.50		- NA
Nitrate	< 0.50	mg/L		0.50		- NA
Sulfate	< 1.0	mg/L		1.0		- NA

M031211005-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	9.2	mg/L	10.00	92	80 - 120
Nitrite	9.4	mg/L	10.00	94	80 - 120
Nitrate	9.1	mg/L	10.00	91	80 - 120
Sulfate	9.1	mg/L	10.00	91	80 - 120

P0312174-02A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	5500	mg/L			- NA	4.6	0 - 20
Nitrite	< 2.5	mg/L			- NA	0	0 - 20
Nitrate	< 2.5	mg/L			- NA	0	0 - 20
Sulfate	310	mg/L			- NA	0	0 - 20

P0312174-02A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	5300	mg/L	10.00	0	70 - 130
Nitrite	< 0.50	mg/L	10.00	0	70 - 130
Nitrate	12	mg/L	10.00	122	70 - 130

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 7 of 15
Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

P0312174-02A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfate	320	mg/L	10.00	100	70 - 130

P0312174-02A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	5300	mg/L	10.00	0	70 - 130	0	0 - 20
Nitrite	< 0.50	mg/L	10.00	0	70 - 130	0	0 - 20
Nitrate	12	mg/L	10.00	124	70 - 130	1.2	0 - 20
Sulfate	320	mg/L	10.00	100	70 - 130	0	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 8 of 15
Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Sulfide

Analysis Method: Sulfide

M031212017-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	mg/L		2.0		- NA

M031212017-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	18	mg/L	34.00	53	50 - 87

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	100	mg/L	170.00	55	52 - 79

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide	100	mg/L	170.00	55	52 - 79	0	0 - 8

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: Five Day Biochemical Oxygen Demand
Analysis Method: Five Day Biochemical Oxygen Demand

M031215010-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Biochemical Oxygen Demand	1.1	mg/L		3.0		- NA

M031215010-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Biochemical Oxygen Demand	130	mg/L	118.00	107	56 - 129

P0312174-03A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Biochemical Oxygen Demand	4.5	mg/L			- NA	0	0 - 30

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: COD by Reactor digestion/Colorimetric Determination

Analysis Method: COD by Reactor digestion/Colorimetric Determination

M031215015-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chemical Oxygen Demand	< 5.0	mg/L		5.0		- NA

M031215015-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	200	mg/L	191.00	105	73 - 121

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	2200	mg/L	1,000.00	84	51 - 136

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chemical Oxygen Demand	2600	mg/L	1,000.00	118	51 - 136	14.22	0 - 29

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Methane in Water

M031217018-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Methane	< 0.015	ug/L		0 015		- NA

M031217018-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	74	ug/L	71.93	103	75 - 125

M031217018-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	76	ug/L	71.93	106	75 - 125	2.9	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Analysis of Dissolved Permanent Gases in Water

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M031217019-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	mg/L		0.60		- NA

M031217019-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	110	mg/L	106.20	106	75 - 125

M031217019-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	110	mg/L	106.20	104	75 - 125	1.94	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP. B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M031221018-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 5.0	mg/L		5.0		- NA

M031221018-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	65	mg/L	75.50	86	70 - 130

P0312174-02A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	13	mg/L			- NA	4.1	0 - 20

P0312174-02A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	54	mg/L	50.00	80	70 - 130

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	1800	mg/L	1,250.00	112	70 - 130

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	1800	mg/L	1,250.00	110	70 - 130	1.24	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M031230011-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	< 4.0	mg/L		4.0		- NA

M031230011-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	66	mg/L	61.50	107	87 - 113

P0312049-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	150	mg/L			- NA	1.34	0 - 14

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	2300	mg/L	100.00	100	69 - 101

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	2300	mg/L	100.00	100	69 - 101	0	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Case Narrative: The percent recoveries for the batch MS/MSD analyses for chloride, nitrite and sulfate were outside of control limits, due to the high sample concentration. Several of the samples have been reported with higher detection limits because of the interference.
This report is being reissued with the corrected QA/QC tables for anions and alkalinity.

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

MICROSEEPS

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 1 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Laboratory Results

Total # of pages in client package 148

Lab Sample #	Client Sample ID
P0312202-01	RFIMW-12-G-1203-S
P0312202-02	RFIMW-15-G-1203-S
P0312202-03	WHI3-1S-G-1203-S
P0312202-04	WHI4-1S-G-1203-S
P0312202-05	WHI9-2F-G-1203-S
P0312202-06	RFIMW-22-G-1203-S

Microseeps test results meet all the requirements of the NELAC standards

Approved By: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

220 William Pitt Way, Pittsburgh, PA 15238 • Phone (412) 826-5245, Fax (412) 826-3433

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-01

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-12-G-1203-S	Water	09 Dec. 03 15:50	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	2500		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Deman	44		3.0	mg/L	405.1	tld	12/11/03	14:04
Chemical Oxygen Demand	340		25	mg/L	HACH8000	tld	12/15/03	
Chloride	7400	M	50	mg/L	9056	md	12/11/03	17:32
Nitrate	< 25	UM	25	mg/L	9056	md	12/11/03	17:32
Nitrite	< 25	UM	25	mg/L	9056	md	12/11/03	17:32
Sulfate	< 1.0	UM	1.0	mg/L	9056	md	12/11/03	17:32
Sulfide	46		2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	63	M	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	< 0.60	UM	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	17000	M	0.015	ug/L	AM20GAX	jl	12/18/03	

ata Qualifiers: J - estimated value. U - Non detect. R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as ieet NELAC sample acceptance criteria, L - Subcontracted Lab used

_- NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 3 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-02

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-15-G-1203-S	Water	09 Dec. 03 11:50	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	56		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Deman	< 3.0	U	3.0	mg/L	405.1	tld	12/11/03	14:07
Chemical Oxygen Demand	89		10	mg/L	HACH8000	tld	12/15/03	
Chloride	11000	M	100	mg/L	9056	md	12/11/03	20:23
Nitrate	< 25	UM	25	mg/L	9056	md	12/11/03	20:23
Nitrite	< 25	UM	25	mg/L	9056	md	12/11/03	20:23
Sulfate	930	M	50	mg/L	9056	md	12/11/03	20:23
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	1.7	JM	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	1 2	M	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	15	M	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP. B - detected in blank. S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

1 - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 4 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-03

Sample Description	Matrix	Sampled Date/Time	Received
WHI3-1S-G-1203-S	Water	09 Dec. 03 8:40	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	430		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Deman	2.0	J	3.0	mg/L	405.1	tld	12/11/03	14:10
Chemical Oxygen Demand	27		5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	120	M	1.0	mg/L	9056	md	12/10/03	19:00
Nitrate	22	M	0.50	mg/L	9056	md	12/10/03	19:00
Nitrite	2.8	M	0.50	mg/L	9056	md	12/10/03	19:00
Sulfate	140	M	1.0	mg/L	9056	md	12/10/03	19:00
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	7.5	M	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	76	M	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	5.6	M	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value. U - Non detect. R - Poor surrogate recovery. M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank. S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 5 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-04

Sample Description	Matrix	Sampled Date/Time	Received
WHI4-1S-G-1203-S	Water	09 Dec. 03 19:00	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	180		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Deman	< 3 0	U	3.0	mg/L	405.1	tld	12/11/03	14:01
Chemical Oxygen Demand	< 5.0	U	5 0	mg/L	HACH8000	tld	12/15/03	
Chloride	140	M	1.0	mg/L	9056	md	12/10/03	19:24
Nitrate	< 0.50	UM	0.50	mg/L	9056	md	12/10/03	19:24
Nitrite	< 0.50	UM	0.50	mg/L	9056	md	12/10/03	19:24
Sulfate	67	M	1 0	mg/L	9056	md	12/10/03	19:24
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	2.1	JM	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	29	M	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	19	M	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 6 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-05

Sample Description	Matrix	Sampled Date/Time	Received
WHI9-2F-G-1203-S	Water	09 Dec. 03 13:40	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	1300		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Deman	12		3.0	mg/L	405.1	tld	12/17/03	13:34
Chemical Oxygen Demand	280		25	mg/L	HACH8000	tld	12/15/03	
Chloride	200	M	2.0	mg/L	9056	md	12/11/03	22:01
Nitrate	< 0.50	UM	0.50	mg/L	9056	md	12/11/03	22:01
Nitrite	< 0.50	UM	0.50	mg/L	9056	md	12/11/03	22:01
Sulfate	330	M	5.0	mg/L	9056	md	12/11/03	22:01
Sulfide	13		2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	57	M	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	< 0.60	UM	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	11000	M	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value. U - Non detect. R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP. B - detected in blank. S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 7 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-06

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-22-G-1203-S	Water	09 Dec. 03 17:10	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Biochemical Oxygen Deman	67		3.0	mg/L	405.1	tld	12/10/03	14:55
Nitrate	< 25	UM	25	mg/L	9056	md	12/11/03	22:26
Nitrite	< 25	UM	25	mg/L	9056	md	12/11/03	22:26

Data Qualifiers: J - estimated value, U - Non detect. R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP. B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 8 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Prep Method: Sulfide
Analysis Method: Sulfide

M031212017-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	mg/L		2.0		- NA

M031212017-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	18	mg/L	34.00	53	50 - 87

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfide	100	mg/L	170.00	55	52 - 79

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide	100	mg/L	170.00	55	52 - 79	0	0 - 8

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank. S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 9 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: Five Day Biochemical Oxygen Demand
Analysis Method: Five Day Biochemical Oxygen Demand

M031215010-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Biochemical Oxygen Demand	1.1	mg/L		3.0		- NA

M031215010-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Biochemical Oxygen Demand	130	mg/L	118.00	107	56 - 129

P0312174-03A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Biochemical Oxygen Demand	4.5	mg/L			- NA	0	0 - 30

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria. L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 10 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: COD by Reactor digestion/Colorimetric Determinatior
Analysis Method: COD by Reactor digestion/Colorimetric Determinatior

M031215016-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chemical Oxygen Demand	< 5.0	mg/L		5.0		- NA

M031215016-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	160	mg/L	191.00	84	73 - 121

P0312258-11A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chemical Oxygen Demand	140	mg/L	40.00	110	51 - 136

P0312258-11A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chemical Oxygen Demand	150	mg/L	40.00	124	51 - 136	3.7	0 - 29

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value. U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 11 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: Five Day Biochemical Oxygen Demand
Analysis Method: Five Day Biochemical Oxygen Demand

M031217003-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Biochemical Oxygen Demand	2.2	mg/L		3.0		- NA

M031217003-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Biochemical Oxygen Demand	99	mg/L	118.00	84	56 - 129

P0312202-04A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Biochemical Oxygen Demand	< 3.0	mg/L			- NA	0	0 - 30

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect. R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP. B - detected in blank. S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 12 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: Analysis of Dissolved Permanent Gases in Water
Analysis Method: Analysis of Dissolved Permanent Gases in Water

M031218018-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	mg/L		0.60		- NA

M031218018-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	120	mg/L	106.20	107	75 - 125

M031218018-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	120	mg/L	106.20		75 - 125		0 - 20

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	1.4	mg/L	29.95	2	70 - 130

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	< 0.60	mg/L	29.95	-2	70 - 130	200	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery. M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 13 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: In House Dissolved Gas Sample Preparation
Analysis Method: Analysis of Dissolved Methane in Water

M031218019-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Methane	< 0 015	ug/L		0.015		- NA

M031218019-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	71	ug/L	71.93	99	75 - 125

M031218019-LCSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	73	ug/L	71.93	101	75 - 125	2.0	0 - 20

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Methane	14000	ug/L	65.62	0	70 - 130

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	14000	ug/L	65 62	0	70 - 130	0	0 - 20

Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank. S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 14 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: Five Day Biochemical Oxygen Demand
Analysis Method: Five Day Biochemical Oxygen Demand

M031222017-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Biochemical Oxygen Demand	2.0	mg/L		3.0		- NA

M031222017-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Biochemical Oxygen Demand	72	mg/L	118.00	61	56 - 129

P0312362-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Biochemical Oxygen Demand	5.6	mg/L			- NA	0	0 - 30

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria. L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 15 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M031224005-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 5 0	mg/L		5.0		- NA

M031224005-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	74	mg/L	75.50	94	70 - 130

P0312202-02A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	2.2	mg/L			- NA	29.26	0 - 20

P0312338-07A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	3.6	mg/L			- NA	1.93	0 - 20

P0312202-02A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	46	mg/L	50.00	89	70 - 130

P0312338-07A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Total Organic Carbon	48	mg/L	50.00	89	70 - 130

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 16 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M031229026-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Chloride	0.92	mg/L		1		- NA
Nitrite	< 0.50	mg/L		0.5		- NA
Nitrate	< 0.50	mg/L		0.5		- NA
Sulfate	< 1.0	mg/L		1		- NA

M031229026-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	9.7	mg/L	10.00	97	80 - 120
Nitrite	9.5	mg/L	10.00	95	80 - 120
Nitrate	8.8	mg/L	10.00	88	80 - 120
Sulfate	9.1	mg/L	10.00	91	80 - 120

P0312202-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	7400	mg/L			- NA	0.36	0 - 20
Nitrite	< 25	mg/L	0.00		- NA	0	0 - 20
Nitrate	< 25	mg/L	0.00		- NA	0	0 - 20
Sulfate	< 1.0	mg/L			- NA	0	0 - 20

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	4300	mg/L	10.00	0	70 - 130
Sulfate	44	mg/L	10.00	440	70 - 130

P0312202-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Chloride	6500	mg/L	10.00	0	70 - 130
Nitrite	< 25	mg/L	10.00	0	70 - 130
Nitrate	< 25	mg/L	10.00	0	70 - 130

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road
Warrenville, IL 60555

Page: Page 17 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

P0312202-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Sulfate	6.1	mg/L	10.00	61	70 - 130

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	4300	mg/L	10 00	0	70 - 130	0.23	0 - 20
Sulfate	46	mg/L	10.00	460	70 - 130	4.4	0 - 20

P0312202-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	6500	mg/L	10.00	0	70 - 130	0	0 - 20
Nitrite	< 25	mg/L	10.00	0	70 - 130	0	0 - 20
Nitrate	< 25	mg/L	10.00	0	70 - 130	0	0 - 20
Sulfate	7.5	mg/L	10 00	75	70 - 130	10.3	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect. R - Poor surrogate recovery. M - Recovery/RPD poor for MS/MSD. SAMP/DUP. B - detected in blank, S - field sample as meet NELAC sample acceptance criteria. L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 18 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300
Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M031230011-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	< 4.0	mg/L		4.0		- NA

M031230011-LCS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	66	mg/L	61.50	107	87 - 113

P0312049-01A-DUP

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	150	mg/L			- NA	1.34	0 - 14

P0312193-01A-MS

			TrueSpikeConc.	%Recovery	Ctl Limits
Alkalinity as CaCO3	2300	mg/L	100.00	100	69 - 101

P0312193-01A-MSD

			TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	2300	mg/L	100.00	100	69 - 101	0	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 19 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

*Case Narrative:*The percent recoveries for the batch MS/MSD analyses for anions were outside of control limits, due to the hi sample concentration. Several of the samples have been reported with higher detection limits because of the interference Th BOD analyses for sample P0312202-05 was performed outside of holding time. The original analyses failed QC criteria for oxygen depletion and the analyses were repeated. The percent recoveries for the permanent gas analyses were outside of the laboratory's control limits. The sample pH was approximately 10. At this pH level the release of methane and carbon dioxide i affected. All other QC analyses were acceptable. The TOC duplicate RPD is out of criteria due to the sample concentration being below the PQL.

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Chain of Custody Documents

P0312202

P0312202

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 — Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 — Fax No. : (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL ROAD; WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF - WYANDOTTE, MI
Proj. Number: 00760-127
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature :

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
01	REI MW-12-G-1203-S	12/09/03	1550		✓	2	X								
					✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paytha Elliott	ENSR	12/09/03	2000	R. Welsh	Microseeps	12/10/03	1165
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

21

P0312202

P0312202

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 — Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 — Fax No. : (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL ROAD; WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF-WYANDOTTE, MT
Proj. Number: 00760-127
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Paytha Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
02	RFIMW-15-G-1203-S	12/09/03	1150		✓	2	X								
					✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paytha Elliott	ENSR	12/09/03	2000	R. Welsh	Microseeps	12/10/03	1105
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples — YELLOW COPY : Laboratory File — PINK COPY : Submitter

P0312202

23

P0312202

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 **Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238** Fax No. : (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL ROAD; WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF - WYANDOTTE, MI
Proj. Number: 00760-127
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Paytha Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
03	WHI3-1S-G-1203-S	12/09/03	0840		✓	2	X								
	↓	↓	↓		✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paytha Elliott	ENSR	12/09/03	2000	R. Welsh	Microseeps	12/10/03	1105
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

P0312202

24

P0312202

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 — Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 — Fax No.: (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL ROAD; WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF - WYANDOTTE, MI
Proj. Number: 00760 - 127
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Paytha Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
04	WHI4-1S-G-1203-S	12/09/03	1900		✓	2	X								
	↓	↓	↓		✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paytha Elliott	ENSR	12/09/03	2000	R. Welsh	Microseeps	12/10/03	1105
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples — YELLOW COPY : Laboratory File — PINK COPY : Submitter

P0312202

P0312202

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 — Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 — Fax No.: (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL ROAD; WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF - WYANDOTTE, MI
Proj. Number: 00760-127
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Paytha Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Carbon dioxide, methane	Nitrate, nitrite, sulfate, chloride	Sulfide	Alkalinity	TOC	BOD	COD		Remarks
05	WHI9-2F-G-1203-S	12/09/03	1340		✓	2	X								
					✓	2		X							
					✓	4			X						
					✓	1				X					
					✓	1					X				
					✓	1						X			
					✓	1							X		

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paytha Elliott	ENSR	12/09/03	0000	R. Welsh	Microseeps	12/10/03	1105
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

P0312202

P0312202

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 — **Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238** — Fax No.: (412) 826-3433

Company : ENSR
Co. Address : 27755 DIEHL ROAD, WARRENVILLE, IL 60555
Proj. Manager: TIM ADAMS
Proj. Location: BASF - WYANDOTTE, MI
Proj. Number: 00760-127
Phone # : 630-836-1700 **Fax # :** 630-836-1711

Sampler's signature : Paytha Elliott

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.	Nitrate, nitrite	BOD							Remarks
06	RFI MW-22-G-1203-S	12/09/03	1710		✓	2	X								
	↓	↓	↓		✓	1		X							

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Paytha Elliott	ENSR	12/09/03	2000	R. Welsh	Microseeps	12/10/03	1105
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

Table of Contents

Analytical Report Cover Page SDG 3L04249 1
Case Narrative 2
Analytical Method Summary 7
Analytical Sample Summary 13
Shipping and Receiving Documents 19
GC/MS Volatile Data 50
QC Summary Data 51
Sample Data 117
Standard Data 319
Raw QC Data 583
Miscellaneous Data 780
Inorganic/Metals Data 798
Forms Data 799
Instrument Printouts 864
Miscellaneous Data 1019
General Chemistry Data 1024
QC Summary Data 1025
Sample Data 1031
Supportive Raw Data 1048

Total # of Pages in this Document 1059

Return to Navigator

SEVERN TRENT STL

ANALYTICAL REPORT

BASF - WYANDOTTE, MI
SDG #: 3L04249

Tim Adams

ENSR Consulting & Engineering
27755 Diehl Road
Warrenville, IL 60555

SEVERN TRENT LABORATORIES, INC.

Denise Pohl
Project Manager

January 8, 2004

Severn Trent Laboratories, Inc.
STL North Canton • 4101 Shuffel Drive NW, North Canton, OH 44720
Tel 330 497 9396 Fax 330 497 0772 • www.stl-inc.com

A part of Severn Trent plc

SEVERN TRENT STL

CASE NARRATIVE

CASE NARRATIVE
SDG 3L04249

The following report contains the analytical results for sixteen water samples and five quality control samples submitted to STL North Canton by ENSR Consulting & Engineering from the BASF - Wyandotte, MI Site. The samples were received December 04, 2003, December 05, 2003, December 06, 2003, December 09, 2003 and December 10, 2003, according to documented sample acceptance procedures.

This SDG consists of five (5) laboratory ID's: A3L040249, A3L050302, A3L060156, A3L090272 and A3L100288.

STL utilizes USEPA approved methods in all analytical work. The samples presented in this report were analyzed for the parameter(s) listed on the analytical methods summary page in accordance with the method(s) indicated. A summary of QC data for these analyses is included at the back of the report.

STL North Canton attests to the validity of the laboratory data generated by STL facilities reported herein. All analyses performed by STL facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the applicable methods. STL's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

This report is sequentially paginated. The final page of the report is labeled as "END OF REPORT."

SUPPLEMENTAL QC INFORMATION

SAMPLE RECEIVING

The temperature of the coolers upon sample receipt was 1.6, 3.9, 2.9, 2.7 and 2.3°C.

See STL's Cooler Receipt Form for additional information.

GC/MS VOLATILES

The sample(s) that contained concentrations of target analyte(s) at a reportable level in the associated Method Blank(s) were flagged with "B". All target analytes in the Method Blank must be below the reporting limit (RL) or the associated sample(s) must be ND with the exception of common laboratory contaminants.

CASE NARRATIVE (continued)

GC/MS VOLATILES (continued)

The sample(s) that contain results between the MDL and the RL were flagged with "J". There is a possibility of false positive or mis-identification at these quantitation levels. In analytical methods requiring confirmation of the analyte reported, confirmation was performed only down to the standard reporting limit (SRL). The acceptance criteria for QC samples may not be met at these quantitation levels.

Samples RFIMW-09-G-1203-S, PM4NA-G-1203-S, WHI9-2F-G-1203-S and RFIMW-12-G-1203-S had elevated reporting limits due to matrix interference and sample RFIMW-07-G-1203-S due to TICs.

The matrix spike/matrix spike duplicate(s) for RFIMW-01-G-1203-S had RPD's and/or recoveries outside acceptance limits. However, since the associated method blank(s) and laboratory control sample(s) were in control, no corrective action was necessary.

The pH of the sample was greater than 2. The sample(s) was analyzed within the normal 14 day holding time; however, experimental evidence suggests that some aromatic compounds in wastewater samples, notably Benzene, Toluene, and Ethylbenzene are susceptible to biological degradation if samples are not preserved to a pH of 2.

Sample TRIP BLANK-03-120503-TB was marked off of our internal tracking sheets as having been analyzed, however it had not been run. Because it was marked as analyzed, the vials were removed from the refrigerator on 12/19/03. This error was not discovered until holding time had expired.

METALS

The sample(s) that contain results between the MDL and the RL were flagged with "B". There is the possibility of false positive of mis-identification at these quantitation levels. The acceptance criteria for the ICB, CCB, and Method Blank are +/- the standard reporting limit (SRL).

GENERAL CHEMISTRY

The analytical results met the requirements of the laboratory's QA/QC program.

QUALITY CONTROL ELEMENTS OF SW-846 METHODS

STL North Canton conducts a quality assurance/quality control (QA/QC) program designed to provide scientifically valid and legally defensible data. Toward this end, several types of quality control indicators are incorporated into the QA/QC program, which is described in detail in QA Policy, QA-003. These indicators are introduced into the sample testing process to provide a mechanism for the assessment of the analytical data.

QC BATCH

Environmental samples are taken through the testing process in groups called QUALITY CONTROL BATCHES (QC batches). A QC batch contains up to twenty environmental samples of a similar matrix (water, soil) that are processed using the same reagents and standards. STL North Canton requires that each environmental sample be associated with a QC batch.

Several quality control samples are included in each QC batch and are processed identically to the twenty environmental samples. These QC samples include a METHOD BLANK (MB), a LABORATORY CONTROL SAMPLE (LCS) and, where appropriate, a MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) pair or a MATRIX SPIKE/SAMPLE DUPLICATE (MS/DU) pair. If there is insufficient sample to perform an MS/MSD or an MS/DU, then a LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) is included in the QC batch.

LABORATORY CONTROL SAMPLE

The Laboratory Control Sample is a QC sample that is created by adding known concentrations of a full or partial set of target analytes to a matrix similar to that of the environmental samples in the QC batch. The LCS analyte recovery results are used to monitor the analytical process and provide evidence that the laboratory is performing the method within acceptable guidelines. All control analytes indicated by a bold type in the LCS must meet acceptance criteria. Failure to meet the established recovery guidelines requires the repreparation and reanalysis of all samples in the QC batch. The only exception is that if the LCS recoveries are biased high and the associated sample is ND (non-detected) for the parameter(s) of interest, the batch is acceptable.

At times, a Laboratory Control Sample Duplicate (LCSD) is also included in the QC batch. An LCSD is a QC sample that is created and handled identically to the LCS. Analyte recovery data from the LCSD is assessed in the same way as that of the LCS. The LCSD recoveries, together with the LCS recoveries, are used to determine the reproducibility (precision) of the analytical system. Precision data are expressed as relative percent differences (RPDs). If the RPD fails for an LCS/LCSD and yet the recoveries are within acceptance criteria, the batch is still acceptable.

METHOD BLANK

The Method Blank is a QC sample consisting of all the reagents used in analyzing the environmental samples contained in the QC batch. Method Blank results are used to determine if interference or contamination in the analytical system could lead to the reporting of false positive data or elevated analyte concentrations. All target analytes must be below the reporting limits (RL) or the associated sample(s) must be ND except under the following circumstances:

- Common organic contaminants may be present at concentrations up to 5 times the reporting limits. Common metals contaminants may be present at concentrations up to 2 times the reporting limit, or the reported blank concentration must be twenty fold less than the concentration reported in the associated environmental samples. (See common laboratory contaminants listed below.)

Volatile (GC or GC/MS)	Semivolatile (GC/MS)	Metals
Methylene chloride	Phthalate Esters	Copper
Acetone		Iron
2-Butanone		Zinc
		Lead*

- *for analyses run on TJA Trace ICP, ICPMS or GFAA only*

- Organic blanks will be accepted if compounds detected in the blank are present in the associated samples at levels 10 times the blank level. Inorganic blanks will be accepted if elements detected in the blank are present in the associated samples at 20 times the blank level.

- Blanks will be accepted if the compounds/elements detected are not present in any of the associated environmental samples.

Failure to meet these Method Blank criteria requires the repreparation and reanalysis of all samples in the QC batch.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

A Matrix Spike and a Matrix Spike Duplicate are a pair of environmental samples to which known concentrations of a full or partial set of target analytes are added. The MS/MSD results are determined in the same manner as the results of the environmental sample used to prepare the MS/MSD. The analyte recoveries and the relative percent differences (RPDs) of the recoveries are calculated and used to evaluate the effect of the sample matrix on the analytical results. Due to the potential variability of the matrix of each sample, the MS/MSD results may not have an immediate bearing on any samples except the one spiked; therefore, the associated batch MS/MSD may not reflect the same compounds as the samples contained in the analytical report. When these MS/MSD results fail to meet acceptance criteria, the data is evaluated. If the LCS is within acceptance criteria, the batch is considered acceptable. The acceptance criteria do not apply to samples that are diluted for organics if the native sample amount is 4x the concentration of the spike.

For certain methods, a Matrix Spike/Sample Duplicate (MS/DU) may be included in the QC batch in place of the MS/MSD. For the parameters (i.e. pH, ignitability) where it is not possible to prepare a spiked sample, a Sample Duplicate may be included in the QC batch. However, a Sample Duplicate is less likely to provide usable precision statistics depending on the likelihood of finding concentrations below the standard reporting limit. When the Sample Duplicate result fails to meet acceptance criteria, the data is evaluated.

SURROGATE COMPOUNDS

In addition to these batch-related QC indicators, each organic environmental and QC sample is spiked with surrogate compounds. Surrogates are organic chemicals that behave similarly to the analytes of interest and that are rarely present in the environment. Surrogate recoveries are used to monitor the individual performance of a sample in the analytical system.

If surrogate recoveries are biased high in the LCS, LCSD, or the Method Blank, and the associated sample(s) are ND, the batch is acceptable. Otherwise, if the LCS, LCSD, or Method Blank surrogate(s) fail to meet recovery criteria, the entire sample batch is reprepped and reanalyzed. If the surrogate recoveries are outside criteria for environmental samples, the samples will be reprepped and reanalyzed unless there is objective evidence of matrix interference or if the sample dilution is greater than the threshold outlined in the associated method SOP.

For the GC/MS BNA methods, the surrogate criterion is that two of the three surrogates for each fraction must meet acceptance criteria. The third surrogate must have a recovery of ten percent or greater.

For the Pesticide, PCB, PAH, and Herbicide methods, the surrogate criterion is that one of two surrogate compounds must meet acceptance criteria.

STL North Canton Certifications and Approvals:

Alabama (#41170), California (#2157), Connecticut (#PH-0590), Florida (#E87225), Illinois (#100439), Kansas (#E10336), Kentucky (#90021), Massachusetts (#M-OH048), Maryland (#272), Minnesota (#39-999-348), Missouri (#6090), New Jersey (#74001), New York (#10975), North Dakota (#R-156), Ohio (#6090), OhioVAP (#CL0024), Pennsylvania (#68-340), Rhode Island (#237), South Carolina (#92007001, #92007002, #92007003), Tennessee (#02903), West Virginia (#210), Wisconsin (#999518190),NAVY, ARMY, USDA Soil Permit, ACIL Seal of Excellence – Participating Lab Status Award (#82)

Y:\HerrenD\Narrative\QCinsSW846.doc, Revised: 07/24/01

SEVERN TRENT STL

METHOD SUMMARY

ANALYTICAL METHODS SUMMARY

A3L040249

PARAMETER	ANALYTICAL METHOD
Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Total Hardness (Titrimetric, EDTA)	MCAWW 130.2
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Volatile Organics by GC/MS	SW846 8260B

References:

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

ANALYTICAL METHODS SUMMARY

A3L050302

PARAMETER	ANALYTICAL METHOD
Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Total Hardness (Titrimetric, EDTA)	MCAWW 130.2
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Volatile Organics by GC/MS	SW846 8260B

References:

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

ANALYTICAL METHODS SUMMARY

A3L060156

PARAMETER	ANALYTICAL METHOD
Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Total Hardness (Titrimetric, EDTA)	MCAWW 130.2
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Volatile Organics by GC/MS	SW846 8260B

References:

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

ANALYTICAL METHODS SUMMARY

A3L090272

PARAMETER	ANALYTICAL METHOD
Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Total Hardness (Titrimetric, EDTA)	MCAWW 130.2
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Volatile Organics by GC/MS	SW846 8260B

References:

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

ANALYTICAL METHODS SUMMARY

A3L100288

PARAMETER	ANALYTICAL METHOD
Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Total Hardness (Titrimetric, EDTA)	MCAWW 130.2
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B
Volatile Organics by GC/MS	SW846 8260B

References:

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SEVERN TRENT STL

SAMPLE SUMMARY

SAMPLE SUMMARY

A3L040249

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
F51XJ	001	BGMW-1-G-1203-S	12/03/03	10:40
F51XR	002	RFIMW-09-G-1203-S	12/03/03	15:15
F51X2	003	CMSMW-02-G-1203-S	12/03/03	17:10
F51X9	004	TRIP BLANK-01-120303-TB	12/03/03	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SAMPLE SUMMARY

A3L050302

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
F540M	001	RFIMW-01-G-1203-S	12/04/03	15:55
F542A	002	RFIMW-01-G-1203-D	12/04/03	15:55
F542D	003	RFIMW-13-G-1203-S	12/04/03	18:10
F542G	004	TRIPBLANK-02-120403-TB	12/04/03	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SAMPLE SUMMARY

A3L060156

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
F56G5	001	RFIMW-22-G-1203-S	12/05/03	10:00
F56G6	002	TRIP BLANK-03-120503-TB	12/05/03	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SAMPLE SUMMARY

A3L090272

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
F6ARF	001	RFIMW-26-G-1203-S	12/08/03	15:00
F6ARJ	002	RFIMW-26-G-1203-D	12/08/03	15:00
F6ARM	003	TRIPBLANK04-120803-TB	12/08/03	
F6ARQ	004	RFIMW-07-G-1203-S	12/08/03	12:00
F6ARX	005	PM4NA-G-1203-S	12/08/03	19:10

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SAMPLE SUMMARY

A3L100288

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
F6DV5	001	WHI9-2F-G-1203-S	12/09/03	13:40
F6DWH	002	RFIMW-12-G-1203-S	12/09/03	15:50
F6DWL	003	RFIMW-15-G-1203-S	12/09/03	11:50
F6DWP	004	WHI3-1S-G-1203-S	12/09/03	08:40
F6DWV	005	WHI4-1S-G-1203-S	12/09/03	19:00
F6DW2	006	TRIP BLANK05-120903-TB	12/09/03	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SEVERN TRENT STL

SHIPPING AND RECEIVING DOCUMENTS

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/3/03	Chain of Custody Number: 161936
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number	Page 1 of 1
City: WARRENVILLE; State: IL; Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF - WYANDOTTE, MI	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): Metals 6010B	hardness	Special Instructions/ Conditions of Receipt
BGMW-1-G-1203-S	12/3/03	1640		X					X				X		
BGMW-1-G-1203-S	↓	↓		X					X					X	

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

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other per quote

QC Requirements (Specify)

1. Relinquished By: Paytha Elliott	Date: 12/3/03	Time: 1800	1. Received By: [signature]	Date: 12/4/03	Time: 9:35
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL North Canton

20

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/03/03	Chain of Custody Number: 161989
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number	Page 1 of 1
City: WARRENVILLE; State: IL; Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: ~~T. ADAMS~~ D. POHL	
Project Name and Location (State): BASF-WYANDOTTE, MI	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	Metals 6010B	Hardness	Special Instructions/ Conditions of Receipt
RFIMW-09-G-1203-S	12/02/03	1515								3			X			
↓	↓	↓							1					X		
									1						X	

Possible Hazard Identification: [X] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown

Sample Disposal: [ ] Return To Client [X] Disposal By Lab [ ] Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: [ ] 24 Hours [ ] 48 Hours [ ] 7 Days [ ] 14 Days [ ] 21 Days [X] Other per quote

QC Requirements (Specify)

1. Relinquished By: Paytha Elliott	Date: 12/03/03	Time: 1800	1. Received By: [signature]	Date: 12/4/03	Time: 9:35
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL North Canton

21

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/3/03	Chain of Custody Number: 161987
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number:	Page 1 of 1
City: WARRENVILLE; State: IL; Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: ~~T. ADAMS~~ PC D. POHL	
Project Name and Location (State): BASF-WYANDOTTE, MI	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: VOCs 8260B	metals 6010B	hardness	Special Instructions/ Conditions of Receipt
CMGMW-02-G-1203-S	12/3/03	1710		X						3			X			
↓	↓	↓		X					1					X		
				X					1						X	
TRIP BLANK-01-120303-TB	12/03/03						2						X			

Possible Hazard Identification: [X] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown

Sample Disposal: [ ] Return To Client [X] Disposal By Lab [ ] Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: [ ] 24 Hours [ ] 48 Hours [ ] 7 Days [ ] 14 Days [ ] 21 Days [X] Other per quote

QC Requirements (Specify):

1. Relinquished By: Paytha Elliott	Date: 12/3/03	Time: 1800	1. Received By: [signature]	Date: 12/4/03	Time: 9:35
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL North Canton

22

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/4/03	Chain of Custody Number: 161990
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number:	Page 1 of 1
City: WARRENVILLE; State: IL; Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF - WYANDOTTE, MI	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	metals 6010B	hardness	Special Instructions/ Conditions of Receipt
RFIMW-01-G-1203-S	12/4/03	1555		X							3			X			
↓	↓	↓		X						1					X		
				X						1						X	

Possible Hazard Identification: [X] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown

Sample Disposal: [ ] Return To Client [X] Disposal By Lab [ ] Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: [ ] 24 Hours [ ] 48 Hours [ ] 7 Days [ ] 14 Days [ ] 21 Days [X] Other per quote

QC Requirements (Specify):

1. Relinquished By: Paytha Elliott	Date	Time	1. Received By: [illegible]	Date: 12/5/03	Time: 9:45
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL North Canton

23

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/04/03	Chain of Custody Number: 119037
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number	Page 1 of 1
City: WARRENVILLE; State: IL; Zip Code: 60555	Site Contact: B. ROBERTS; Lab Contact: D. POHL		
Project Name and Location (State): BASF-WYANDOTTE, MI	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	metals 6010B	hardness	Special Instructions/ Conditions of Receipt
RFIMW-01-G-1203-D	12/04/03	1555		X						3			X			
↓	↓	↓		X					1					X		
				X					1						X	

Possible Hazard Identification: [X] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown

Sample Disposal: [ ] Return To Client [X] Disposal By Lab [ ] Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: [ ] 24 Hours [ ] 48 Hours [ ] 7 Days [ ] 14 Days [ ] 21 Days [X] Other per quote

QC Requirements (Specify)

1. Relinquished By: Paytha Elliott	Date: 12/04/03	Time: 2000	1. Received By: [signature]	Date: 12/5/03	Time: 9:45
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL North Canton

24

Chain of Custody Record

SEVERN TRENT SERVICES — Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: ENSR	Project Manager: TIM ADAMS.	Date: 12/04/03	Chain of Custody Number: 151991
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number:	Page 1 of 1
City: WARRENVILLE State: IL Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF - WYANDOTTE, MI	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	metals 6010B	hardness	Special Instructions/ Conditions of Receipt
RFIMW-13-G-1203-S	12/04/03	1810		X						3			X			
↓	↓	↓		X					1					X		
				X					1						X	
TRIPBLANK-02-120403-TB	12/04/03	—		X						2			X			

Possible Hazard Identification: [X] Non Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown

Sample Disposal: [ ] Return To Client [X] Disposal By Lab [ ] Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: [ ] 24 Hours [ ] 48 Hours [ ] 7 Days [ ] 14 Days [ ] 21 Days [X] Other per quote

QC Requirements (Specify):

1. Relinquished By: Paytha Elliott	Date	Time	1. Received By: [signature]	Date: 12/5/03	Time: 9:45
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL North Canton

25

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/05/03	Chain of Custody Number: 161992
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number:	Page 1 of 1
City: WARRENVILLE State: IL Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF - WYAN DOTTE, MI	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	metals 6010B	hardness	Special Instructions/ Conditions of Receipt
RFIMW-22-G-1203-S	12/05/03	1000		X						3			X			Please perform MS/MSD on these samples.
↓	↓	↓		X					3					X		
				X					3						X	
TRIPBLANK-03-120503-TB	12/05/03	—		X						2			X			

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

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other per quote

QC Requirements (Specify):

1. Relinquished By: Paytha Elliott	Date: 12/05/03	Time: 1300	1. Received By: [signature]	Date: 12/6/03	Time: 9:40
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL North Canton

26

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0700)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/08/03	Chain of Custody Number: 035475
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number	Page 1 of 1
City: WARRENVILLE State: IL Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF - WYANDOTTE, MI	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	Metals 6010B	Hardness	Special Instructions/ Conditions of Receipt
RFIMW-26-G-1203-S	12/08/03	1500		X						3			X	X		
↓	↓	↓		X					1					X		
↓	↓	↓		X					1						X	
RFIMW-26-G-1203-D	12/08/03	1500		X						3			X	X		
↓	↓	↓		X					1					X		
↓	↓	↓		X					1						X	
TRIPBLANK 04-120803 TB	12/08/03	—		X						2			X			

Possible Hazard Identification: [X] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown

Sample Disposal: [ ] Return To Client [X] Disposal By Lab [ ] Archive For ____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: [ ] 24 Hours [ ] 48 Hours [ ] 7 Days [ ] 14 Days [ ] 21 Days [X] Other per quote

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: Faytha Elliott	12/08/03	2000	1. Received By: [signature]	12/9/03	9:40
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Stays with the Sample. CANARY - Returned to Client with Report; PINK - Field Copy

STL North Canton

27

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/08/03	Chain of Custody Number: 119036
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number:	Page 1 of 1
City: WARRENVILLE State: IL Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF-WYANDOTTE, MI	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	metals 6010B	hardness	Special Instructions/ Conditions of Receipt
RFIMW-07-G-1203-S	12/08/03	1200		X						3			X			
↓	↓	↓		X					1					X		
				X					1						X	

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

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other per quote

QC Requirements (Specify):

1. Relinquished By: Paytha Elliott	Date: 12/08/03	Time: 2000	1. Received By: [illegible]	Date: 12/9/03	Time: 9:40
2. Relinquished By:	Date:	Time:	2. Received By:	Date:	Time:
3. Relinquished By:	Date:	Time:	3. Received By:	Date:	Time:

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL North Canton

28

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0700)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/08/03	Chain of Custody Number: 035477
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number:	Page 1 of 1
City: WARRENVILLE; State: IL; Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. BOHL	
Project Name and Location (State): BASF - WYANDOTTE, MI	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNOS	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	metals 6010B	hardness	Special Instructions/ Conditions of Receipt
PM4NA-G-1203-S	12/08/03	1910		X						3			X			
↓	↓	↓		X					1					X		
				X					1						X	

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

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other per quote

QC Requirements (Specify):

1. Relinquished By: Paytha Elliott	Date: 12/08/03	Time: 2000	1. Received By: [signature]	Date: 12/9/03	Time: 9:40
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

29

STL North Canton

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0700)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/09/03	Chain of Custody Number: 035479
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number	Page 1 of 1
City: WARRENVILLE State: IL Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. BOHL	
Project Name and Location (State): BASF - WYANDOTTE, MI	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis (Attach list if more space is needed): VOCs 8260B	Metals 6010B	Mercury	Special Instructions/ Conditions of Receipt
WHI9-2F-G-1203-S	12/09/03	1340		X							3				X			
↓	↓	↓		X						1						X		
				X						1							X	

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

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other per quote

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: Paytha Elliott	12/09/03	2000	1. Received By: [signature]	12/10/03	9:40
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Stays with the Sample. CANARY - Returned to Client with Report; PINK - Field Copy

STL North Canton

30

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0700)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/09/03	Chain of Custody Number: 035480
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number:	Page 1 of 1
City: WARRENVILLE State: IL Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF - WYANDOTTE, MI	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	metals 6010B	Mercury	Special Instructions/ Conditions of Receipt
RFIMW-12-G-1203-S	12/09/03	1530		X						3			X			
↓	↓	↓		X					1					X		
				X					1						X	

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

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other per quote

QC Requirements (Specify):

1. Relinquished By: Purtha Elliott	Date: 12/09/03	Time: 2000	1. Received By: [illegible]	Date: 12/10/03	Time: 9:40
2. Relinquished By:	Date:	Time:	2. Received By:	Date:	Time:
3. Relinquished By:	Date:	Time:	3. Received By:	Date:	Time:

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

STL North Canton

31

Chain of Custody Record

SEVERN TRENT SERVICES **Severn Trent Laboratories, Inc.**

STL-4124 (0700)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/09/03	Chain of Custody Number: 035478
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number:	Page 1 of 1
City: WARRENVILLE State: IL Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF-WYANDOTTE, MI	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs 8260B	Metals 6010B	Mercury	Special Instructions/ Conditions of Receipt
RFIMW-15-G-1203-S	12/09/03	1150		X						3			X			
↓	↓	↓		X					1					X		
				X					1						X	

Possible Hazard Identification: [X] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown

Sample Disposal: [ ] Return To Client [X] Disposal By Lab [ ] Archive For ____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: [ ] 24 Hours [ ] 48 Hours [ ] 7 Days [ ] 14 Days [ ] 21 Days [X] Other per quote

QC Requirements (Specify):

1. Relinquished By: Paytha Elliott	Date: 12/09/03	Time: 2000	1. Received By: [signature]	Date: 12/10/03	Time: 9:40
2. Relinquished By:	Date:	Time:	2. Received By:	Date:	Time:
3. Relinquished By:	Date:	Time:	3. Received By:	Date:	Time:

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

STL North Canton

32

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0700)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/09/03	Chain of Custody Number: 035476
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number	Page 1 of 1
City: WARRENVILLE; State: IL; Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF - WYANDOTTE, MI	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis (Attach list if more space is needed): VOCs 8260B	metals 6010B	hardness	Special Instructions/ Conditions of Receipt
WHI3-1S-G-1203-S	12/09/03	0840		X							3				X			
↓	↓	↓		X						1						X		
				X						1							X	

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

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other per quote

QC Requirements (Specify)

1. Relinquished By: Paytha Elliott	Date: 12/09/03	Time: 2000	1. Received By: [illegible]	Date: 12/10/03	Time: 9:40
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

STL North Canton

33

Chain of Custody Record

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0700)

Client: ENSR	Project Manager: TIM ADAMS	Date: 12/09/03	Chain of Custody Number: 035481
Address: 27755 DIEHL ROAD	Telephone Number (Area Code)/Fax Number: 630-836-1700 / 630-836-1711	Lab Number	Page 1 of 1
City: WARRENVILLE; State: IL; Zip Code: 60555	Site Contact: B. ROBERTS	Lab Contact: D. POHL	
Project Name and Location (State): BASF - WYANDOTTE, MI	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: VOCs 8260B	metals 6010B	hardness
WHI4-1S-G-1203-S	12/09/03	1400		X						3			X		
↓	↓	↓		X					1					X	
				X					1						X
TRIPBLANK05-120903-TB	12/09/03	—		X						2			X		

Special Instructions/ Conditions of Receipt

Possible Hazard Identification: [X] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown

Sample Disposal: [ ] Return To Client [X] Disposal By Lab [ ] Archive For ____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: [ ] 24 Hours [ ] 48 Hours [ ] 7 Days [ ] 14 Days [ ] 21 Days [X] Other per quote

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: Paytha Elliott	12/09/03	2000	1. Received By: [signature]	12/10/03	9:40
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments: PACKED WITH WET ICE.

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

STL North Canton

34

RSR280

Severn Trent Laboratories, Inc.
Sample Control Record

Client: 8977

Lot #: A3L040249

Case Number/SDG:

Storage Location: C93 S56/C93 S56 MS/MS

Laboratory Sample I.D.	Transferred By	Date	Entered	Removed	Reason	Date Returned
F51XJ	EZZOL	12/04/03	Yes		Storage	
F51XR	EZZOL	12/04/03	Yes		Storage	
F51X2	EZZOL	12/04/03	Yes		Storage	

RSR280

Severn Trent Laboratories, Inc.
Sample Control Record

Client: 8977

Lot #: A3L050302

Case Number/SDG:

Storage Location: C102 S58 MS/MS

Laboratory Sample I.D.	Transferred By	Date	Entered	Removed	Reason	Date Returned
F540M	SANDERSA	12/05/03	Yes		Storage	
F542A	SANDERSA	12/05/03	Yes		Storage	
F542D	SANDERSA	12/05/03	Yes		Storage	
F542G	SANDERSA	12/05/03	Yes		Storage	

RSR280

Severn Trent Laboratories, Inc.
Sample Control Record

Client: 8977

Lot #: A3L060156

Case Number/SDG:

Storage Location: C108 S55 MS/MS

Laboratory Sample I.D.	Transferred By	Date	Entered	Removed	Reason	Date Returned
F56G5	EARLES	12/06/03	Yes		Storage	
F56G6	EARLES	12/06/03	Yes		Storage	

RSR280

Severn Trent Laboratories, Inc.
Sample Control Record

Client: 8977

Lot #: A3L090272

Case Number/SDG:

Storage Location: C114 S60 MS/MS

Laboratory Sample I.D.	Transferred By	Date	Entered	Removed	Reason	Date Returned
F6ARF	EZZOL	12/09/03	Yes		Storage	
F6ARJ	EZZOL	12/09/03	Yes		Storage	
F6ARM	EZZOL	12/09/03	Yes		Storage	
F6ARQ	EZZOL	12/09/03	Yes		Storage	
F6ARX	EZZOL	12/09/03	Yes		Storage	

RSR280

Severn Trent Laboratories, Inc.
Sample Control Record

Client: 8977

Lot #: A3L100288

Case Number/SDG:

Storage Location: C119 S61 MS/MS

Laboratory Sample I.D.	Transferred By	Date	Entered	Removed	Reason	Date Returned
F6DV5	SANDERSA	12/10/03	Yes		Storage	
F6DWH	SANDERSA	12/10/03	Yes		Storage	
F6DWL	SANDERSA	12/10/03	Yes		Storage	
F6DWP	SANDERSA	12/10/03	Yes		Storage	
F6DWV	SANDERSA	12/10/03	Yes		Storage	
F6DW2	SANDERSA	12/10/03	Yes		Storage	

STL Cooler Receipt Form/Narrative
North Canton Facility

Lot Number: A3L040249

Client: ENSR Project: BASF Quote#: [illegible]
Cooler Received on: 12/4/03 Opened on: 12/4/03 by: [illegible] (Signature)

Fedx ☒ Client Drop Off ☐ UPS ☐ Airborne ☐ FAS ☐ Other: _____
Cooler ☐ Safe ☐ Foam Box ☐ Client Cooler ☒ Other: _____
STL Cooler No#: NA

1. Were custody seals on the outside of the cooler? Yes ☒ No ☐ Intact? Yes ☒ No ☐ NA ☐
   If YES, Quantity 2
   Were the custody seals signed and dated? Yes ☒ No ☐ NA ☐
2. Shipper's packing slip attached to this form? Yes ☒ No ☐ NA ☐
3. Were custody papers included inside the cooler and relinquished? Yes ☒ No ☐
4. Did you sign the custody papers in the appropriate place? Yes ☒ No ☐
5. Packing material used:
   Peanuts ☐ Bubble Wrap ☒ Vermiculite ☐ Foam ☒ None ☐ Other: _____
6. Cooler temperature upon receipt 1.6 °C (see back of form for multiple coolers/temp)
   METHOD: Temp Vial ☐ Coolant & Sample ☐ Against Bottles ☐ IR ☒ ICE/H_2O Slurry ☐
   COOLANT: Wet Ice ☒ Blue Ice ☐ Dry Ice ☐ Water ☐ None ☐
7. Did all bottles arrive in good condition (Unbroken)? Yes ☒ No ☐
8. Did all bottle labels and tags agree with the custody papers? Yes ☒ No ☐
9. Were samples at the correct pH? (record on back) Yes ☐ No ☒ NA ☐
10. Were correct bottles used for the tests indicated? Yes ☒ No ☐
11. Were air bubbles >6 mm in any VOA vials? Yes ☐ No ☒ NA ☐
12. Was a sufficient amount of sample sent in each bottle? Yes ☒ No ☐

Contacted PM _____ Date: _____ by: _____ via Voice Mail ☐ Verbal ☐ Other ☐
Concerning: _____

√	MACRO	MACRO
1. CHAIN OF CUSTODY		
	SR1A	The chain of custody and sample bottles did not agree. The following discrepancies occurred _____
2. SAMPLE CONDITION		
	SR2A	Sample(s) _____ were received or requested after the recommended holding time had expired.
	SR2B	Sample(s) were received with insufficient volume.
	SR2C	Sample(s) were received in a broken container.
3. SAMPLE PRESERVATION		
	SR3A	Sample(s) RFIMW-09-9-1700-S were further preserved in sample receiving ~~to meet recommended~~ pH level(s). metals (lw) *Nitric Acid Lot #101503-HNO3; Sulfuric Acid Lot # 112801-H2SO4; Sodium Hydroxide Lot # 101503-NaOH; Hydrochloric Acid Lot # 100902-HCl; Sodium Hydroxide and Zinc Acetate Lot # 112801-CH3COO2ZN/NaOH*
	SR3B	Sample(s) _____ were received with bubble > 6 mm in diameter (cc: PM)
4. Other (see below or back)		
		VOC = tol per DOP (lw)

STL Cooler Receipt Form/Narrative
North Canton Facility

Client ID	pH	Date	Initials
BGMW	<2	12/4/07	SGW
RFPMW	<2	12/4/07	
CMSMW	<2		

Cooler	Temp	Method	Coolant

Discrepancies Cont.

Macro Name:

Macro Name:

Macro Name:

Other Anomalies:

STL Cooler Receipt Form/Narrative
North Canton Facility

Lot Number: 1305030Q

Client: ENSR Project: BASF Quote#:
Cooler Received on: 12/5/03 Opened on: 12/5/03 by: (Signature)

Fedx ☒ Client Drop Off ☐ UPS ☐ Airborne ☐ FAS ☐ Other:
Cooler ☐ Safe ☐ Foam Box ☐ Client Cooler ☒ Other:
STL Cooler No#: 43-5

1. Were custody seals on the outside of the cooler? Yes ☒ No ☐ Intact? Yes ☒ No ☐ NA ☐
   If YES, Quantity
   Were the custody seals signed and dated? Yes ☒ No ☐ NA ☐
2. Shipper's packing slip attached to this form? Yes ☒ No ☐ NA ☐
3. Were custody papers included inside the cooler and relinquished? Yes ☒ No ☐
4. Did you sign the custody papers in the appropriate place? Yes ☒ No ☐
5. Packing material used:
   Peanuts ☐ Bubble Wrap ☒ Vermiculite ☐ Foam ☐ None ☐ Other :
6. Cooler temperature upon receipt 3.7 °C (see back of form for multiple coolers/temp)
   METHOD: Temp Vial ☐ Coolant & Sample ☐ Against Bottles ☐ IR ☒ ICE/H_2O Slurry ☐
   COOLANT: Wet Ice ☒ Blue Ice ☐ Dry Ice ☐ Water ☐ None ☐
7. Did all bottles arrive in good condition (Unbroken)? Yes ☒ No ☐
8. Did all bottle labels and tags agree with the custody papers? Yes ☒ No ☐
9. Were samples at the correct pH? (record on back) Yes ☒ No ☐ NA ☐
10. Were correct bottles used for the tests indicated? Yes ☒ No ☐
11. Were air bubbles >6 mm in any VOA vials? Yes ☐ No ☒ NA ☐
12. Was a sufficient amount of sample sent in each bottle? Yes ☒ No ☐

Contacted PM _____ Date: _____ by: _____ via Voice Mail ☐ Verbal ☐ Other ☐
Concerning:

√	MACRO	MACRO
1. CHAIN OF CUSTODY		
	SR1A	The chain of custody and sample bottles did not agree. The following discrepancies occurred
2. SAMPLE CONDITION		
	SR2A	Sample(s) were received or requested after the recommended holding time had expired.
	SR2B	Sample(s) were received with insufficient volume.
	SR2C	Sample(s) were received in a broken container.
3. SAMPLE PRESERVATION		
✓	SR3A	Sample(s) 01-G-1203-D, 13-G-1203-S, 01-G-1203-S were further preserved in sample receiving to meet recommended pH level(s). Metals Cu *Nitric Acid Lot #101503-HNO3; Sulfuric Acid Lot # 112801-H2SO4; Sodium Hydroxide Lot # 101503-NaOH; Hydrochloric Acid Lot # 100902-HCl; Sodium Hydroxide and Zinc Acetate Lot # 112801-CH3COO2ZN/NaOH*
	SR3B	Sample(s) were received with bubble > 6 mm in diameter (cc: PM)
4. Other (see below or back)		

STL Cooler Receipt Form/Narrative
North Canton Facility

Client ID	pH	Date	Initials
01-G-1203-D	<2 <2	12/4/03	KW
13-G-1203-S	<2 <2	✓	✓
01-G-1203-S	<2 <2		

Cooler	Temp	Method	Coolant

Discrepancies Cont.

Macro Name:

Macro Name:

Macro Name:

Other Anomalies:

STL Cooler Receipt Form/Narrative **Lot Number:** A3L060156

North Canton Facility

Client: ENSR Project: BASF Quote#: 55960

Cooler Received on: 12/6/03 Opened on: 12/6/03 by: [signature] (Signature)

Fedx ☒ Client Drop Off ☐ UPS ☐ Airborne ☐ FAS ☐ Other:_____

Cooler ☒ Safe ☐ Foam Box ☐ Client Cooler ☐ Other:_____

STL Cooler No#: J117

1. Were custody seals on the outside of the cooler? Yes ☒ No ☐ Intact? Yes ☐ No ☐ NA ☐
   If YES, Quantity_____
   Were the custody seals signed and dated? Yes ☒ No ☐ NA ☐
2. Shipper's packing slip attached to this form? Yes ☒ No ☐ NA ☐
3. Were custody papers included inside the cooler and relinquished? Yes ☒ No ☐
4. Did you sign the custody papers in the appropriate place? Yes ☒ No ☐
5. Packing material used:

Peanuts ☐ Bubble Wrap ☒ Vermiculite ☐ Foam ☐ None ☐ Other :_____

6. Cooler temperature upon receipt 2.9 °C (see back of form for multiple coolers/temp)

METHOD: Temp Vial ☐ Coolant & Sample ☐ Against Bottles ☐ IR ☒ ICE/H_2O Slurry ☐

COOLANT: Wet Ice ☒ Blue Ice ☐ Dry Ice ☐ Water ☐ None ☐

7. Did all bottles arrive in good condition (Unbroken)? Yes ☒ No ☐
8. Did all bottle labels and tags agree with the custody papers? Yes ☒ No ☐
9. Were samples at the correct pH? (record on back) Yes ☐ No ☒ NA ☐
10. Were correct bottles used for the tests indicated? Yes ☒ No ☐
11. Were air bubbles >6 mm in any VOA vials? Yes ☒ No ☒ NA ☐
12. Was a sufficient amount of sample sent in each bottle? Yes ☒ No ☐

Contacted PM _____ Date:_____ by:_____ via Voice Mail ☐ Verbal ☐ Other ☐

Concerning:_____

√	MACRO	MACRO
1. CHAIN OF CUSTODY		
	SR1A	The chain of custody and sample bottles did not agree. The following discrepancies occurred_____
2. SAMPLE CONDITION		
	SR2A	Sample(s)_____ were received or requested after the recommended holding time had expired.
	SR2B	Sample(s) were received with insufficient volume.
	SR2C	Sample(s) were received in a broken container.
3. SAMPLE PRESERVATION		
	SR3A	Sample(s) 1203-S 3x1L metals were further preserved in sample receiving to meet recommended pH level(s). *Nitric Acid Lot #101503-HNO3; Sulfuric Acid Lot # 112801-H2SO4; Sodium Hydroxide Lot # 101503-NaOH; Hydrochloric Acid Lot # 100902-HCl; Sodium Hydroxide and Zinc Acetate Lot # 112801-CH3COO2ZN/NaOH*
	SR3B	Sample(s)_____ were received with bubble > 6 mm in diameter (cc: PM)
4. Other (see below or back)		

SOP: NC-SC-0005, Sample Receiving
N:\QAQC\NARRATIVES\STL\Cooler Receipt STL\COOLER_STL_Rev31 112603.doc

STL Cooler Receipt Form/Narrative
North Canton Facility

Client ID	pH	Date	Initials
1203-5	<2 <2 <2 <2 <2 <2	12/6/03	KV

Cooler	Temp	Method	Coolant

Discrepancies Cont.

Macro Name:

Macro Name:

Macro Name:

Other Anomalies:

STL Cooler Receipt Form/Narrative
North Canton Facility

Lot Number: A3L090272

Client: Ensr Project: BASF Quote#:
Cooler Received on: 12-9-03 Opened on: 12-9-03 by: George Wilson / [signature] (Signature)

Fedx [X] Client Drop Off [ ] UPS [ ] Airborne [ ] FAS [ ] Other:
Cooler [ ] Safe [ ] Foam Box [ ] Client Cooler [X] Other:
STL Cooler No#: 2

1. Were custody seals on the outside of the cooler? Yes [X] No [ ] Intact? Yes [X] No [ ] NA [ ]
   If YES, Quantity
   Were the custody seals signed and dated? Yes [X] No [ ] NA [ ]
2. Shipper's packing slip attached to this form? Yes [X] No [ ] NA [ ]
3. Were custody papers included inside the cooler and relinquished? Yes [X] No [ ]
4. Did you sign the custody papers in the appropriate place? Yes [X] No [ ]
5. Packing material used:
   Peanuts [ ] Bubble Wrap [ ] Vermiculite [ ] Foam [ ] None [ ] Other: plastic bags
6. Cooler temperature upon receipt 2.7 °C (see back of form for multiple coolers/temp)
   METHOD: Temp Vial [ ] Coolant & Sample [ ] Against Bottles [ ] IR [X] ICE/H_2O Slurry [ ]
   COOLANT: Wet Ice [X] Blue Ice [ ] Dry Ice [ ] Water [ ] None [ ]
7. Did all bottles arrive in good condition (Unbroken)? Yes [X] No [ ]
8. Did all bottle labels and tags agree with the custody papers? Yes [ ] No [X]
9. Were samples at the correct pH? (record on back) Yes [ ] No [X] NA [ ]
10. Were correct bottles used for the tests indicated? Yes [X] No [ ]
11. Were air bubbles >6 mm in any VOA vials? Yes [ ] No [X] NA [ ]
12. Was a sufficient amount of sample sent in each bottle? Yes [X] No [ ]

Contacted PM NJP Date: 12/9/03 by: ide via Voice Mail [ ] Verbal [✓] Other [ ]
Concerning: SR1A

√	MACRO	MACRO
1. CHAIN OF CUSTODY		
	SR1A	The chain of custody and sample bottles did not agree. The following discrepancies occurred ~~COC = MW-26-D~~ ~~Vial = MW-26-S (time matches MW-26-D)~~ (1a) ~~Will log MS-26-S vial @ time 1500 as MW-26-D~~ (1a) Received 4 vials RF1MW-26-G-1203-S Received 2 vials RF1MW-26-G-1203-D, COC = 3 vials each (1a) - logged per received (1)
2. SAMPLE CONDITION		
	SR2A	Sample(s) were received or requested after the recommended holding time had expired.
	SR2B	Sample(s) were received with insufficient volume.
	SR2C	Sample(s) were received in a broken container.
3. SAMPLE PRESERVATION		
	SR3A	Sample(s) PM4NA, RF1MW (metals) were further preserved in sample receiving to meet recommended pH level(s). *Nitric Acid Lot #101503-HNO3; Sulfuric Acid Lot # 112801-H2SO4; Sodium Hydroxide Lot # 101503-NaOH; Hydrochloric Acid Lot # 100902-HCl; Sodium Hydroxide and Zinc Acetate Lot # 112801-CH3COO2ZN/NaOH*
	SR3B	Sample(s) were received with bubble > 6 mm in diameter (cc: PM)
4. Other (see below or back)		
		Unable to preserve PM4NA-G-1203-S (1a)

SOP: NC-SC-0005, Sample Receiving
N:\QAQC\NARRATIV\STL\Cooler Receipt STL\COOLER_STL_Rev31 112603.doc

STL Cooler Receipt Form/Narrative
North Canton Facility

Client ID	pH	Date	Initials
26-S	<2 <2	12/9/03	ldo
26-D	<2 <2		
07-G	<2 <2		
PM4NA	unable to pres		

Cooler	Temp	Method	Coolant

Discrepancies Cont.

Macro Name:

Macro Name:

Macro Name:

Other Anomalies:

STL Cooler Receipt Form/Narrative **Lot Number:** 43410288
North Canton Facility

Client: ENSR Project: BASF Quote#: _____
Cooler Received on: 12/10/03 Opened on: 12/10/03 by: [signature] (Signature)

Fedx ☒ Client Drop Off ☐ UPS ☐ Airborne ☐ FAS ☐ Other: _____
Cooler ☐ Safe ☐ Foam Box ☐ Client Cooler ☒ Other: _____
STL Cooler No#: _____

1. Were custody seals on the outside of the cooler? Yes ☒ No ☐ Intact? Yes ☒ No ☐ NA ☐
   If YES, Quantity 2
   Were the custody seals signed and dated? Yes ☒ No ☐ NA ☐
2. Shipper's packing slip attached to this form? Yes ☒ No ☐ NA ☐
3. Were custody papers included inside the cooler and relinquished? Yes ☒ No ☐
4. Did you sign the custody papers in the appropriate place? Yes ☒ No ☐
5. Packing material used:
   Peanuts ☐ Bubble Wrap ☒ Vermiculite ☐ Foam ☐ None ☐ Other: _____
6. Cooler temperature upon receipt 2.3 °C (see back of form for multiple coolers/temp)
   METHOD: Temp Vial ☐ Coolant & Sample ☐ Against Bottles ☐ IR ☒ ICE/H_2O Slurry ☐
   COOLANT: Wet Ice ☒ Blue Ice ☐ Dry Ice ☐ Water ☐ None ☐
7. Did all bottles arrive in good condition (Unbroken)? Yes ☒ No ☐
8. Did all bottle labels and tags agree with the custody papers? Yes ☒ No ☐
9. Were samples at the correct pH? (record on back) Yes ☐ No ☒ NA ☐
10. Were correct bottles used for the tests indicated? Yes ☒ No ☐
11. Were air bubbles >6 mm in any VOA vials? Yes ☐ No ☒ NA ☐
12. Was a sufficient amount of sample sent in each bottle? Yes ☒ No ☐

Contacted PM _____ Date: _____ by: _____ via Voice Mail ☐ Verbal ☐ Other ☐
Concerning: _____

√	MACRO	MACRO
1. CHAIN OF CUSTODY		
	SR1A	The chain of custody and sample bottles did not agree. The following discrepancies occurred _____
2. SAMPLE CONDITION		
	SR2A	Sample(s) _____ were received or requested after the recommended holding time had expired.
	SR2B	Sample(s) were received with insufficient volume.
	SR2C	Sample(s) were received in a broken container.
3. SAMPLE PRESERVATION (metals) (metals)		
✓	SR3A	Sample(s) 1xL RFIWW-12, 1xL WHI9 were further preserved in sample receiving to meet recommended pH level(s). *Nitric Acid Lot #101503-HNO3; Sulfuric Acid Lot # 112801-H2SO4; Sodium Hydroxide Lot # 101503-NaOH; Hydrochloric Acid Lot # 100902-HCl; Sodium Hydroxide and Zinc Acetate Lot # 112801-CH3COO2ZN/NaOH*
	SR3B	Sample(s) _____ were received with bubble > 6 mm in diameter (cc: PM)
4. Other (see below or back)		

SOP: NC-SC-0005, Sample Receiving
N:\QAQC\NARRATIV\STL\Cooler Receipt STL\COOLER_STL_Rev31 112603.doc

STL Cooler Receipt Form/Narrative
North Canton Facility

Client ID	pH	Date	Initials
WH19	<2 <2	12/10/03	KW
RFIMW-12	<2 <2	↓	↓
RFIMW-15	<2 <2		
WHI3	<2 <2		
WHI4	<2 <2		

Cooler	Temp	Method	Coolant

Discrepancies Cont.

Macro Name:

Macro Name:

Macro Name:

Other Anomalies:

Frontier Geosciences Inc.
Environmental Research & Specialty Analytical Laboratory
414 Pontius Ave N · Seattle WA 98109

Paytha Elliott
ENSR
27755 Diehl Road
Warrenville, IL 60555

February 2, 2004

SUBJECT: Total mercury analysis of water samples for BASF-Wyandotte, MI Project.

Dear Ms. Elliott,

Enclosed please find our report concerning total mercury in the water samples collected on December 2, 2003 through December 9, 2003, for the BASF-Wyandotte, MI project. Samples were received in good condition December 1, 2003 through December 10, 2003.

We had no significant analytical difficulties and all quality control data were within control limits. Please feel free to call (206) 622-6960 or e mail if you have any questions or concerns regarding this report.

Sincerely,

M. Kennard

Misty Kennard
Senior Project Manager
MistyK@frontiergeosciences.com

206 622 6960
fax 206 622 6870
www.FrontierGeosciences.com
email: info@FrontierGeosciences.com

Report to Paytha Elliot
ENSR

Total Mercury in Water Samples
BASF-Wyandotte, MI

Prepared by
Misty Kennard
Frontier Geosciences Inc.
414 Pontius Avenue North
Seattle, WA 98109
(206) 622-6960

February 2, 2004

Table of Contents

Item	Page Number
Table of Contents	1
Case Narrative	2-5
Sample Results	6-7
Quality Control Summary Tables	8-12
Chain-of-Custody Forms	13-38
Total Mercury Raw Data: THG11-031215-1	39-45
Total Mercury Raw Data: THG12-031215-1	46-50
Total Mercury Raw Data: THG08-040202-1	51-56

Total Number of Pages: 56

Total Mercury in Water Samples
ENSR

February 2, 2004

Frontier Geosciences Inc.
414 Pontius Ave. N
Seattle, WA 98109

1. Scope of Work

Sixty-three (63) samples in glass bottles were submitted for total mercury analysis using cold vapor atomic fluorescence spectrometry (CVAFS) on December 1, 2003 through December 9, 2003.

2. Sample Receipt

All samples identified above were logged in according to Frontier's protocols on the day of receipt and were received secure and in good condition in sealed coolers with temperatures of –0.4 °C, 0.0 °C and ambient. Please note the following samples were received and placed on hold by the client. According to the EPA method 1631 revision E, the holding time following preservation is 6 months. Please notify us ASAP if we should proceed with analysis of these samples.

Sample ID	Receipt Date	Analysis
WHI2-1S-G-1203-EB	December 4, 2003	ON HOLD
CMSMW-08-G-1203-EB	December 4, 2003	ON HOLD
CMSMW-02-G-1203-EB	December 4, 2003	ON HOLD
RFIMW-28-G-1203-EB	December 5, 2003	ON HOLD
WHI9-2S-G-1203-EB	December 5, 2003	ON HOLD
RFIMW-08-G-1203-EB	December 5, 2003	ON HOLD
RFIMW-02-G-1203-EB	December 5, 2003	ON HOLD
RFIMW-01-G-1203-EB	December 5, 2003	ON HOLD
RFIMW-04-G-1203-EB	December 6, 2003	ON HOLD
RFIMW-07-1203-EB	December 9, 2003	ON HOLD
WHI3-2S-G-1203-EB	December 9, 2003	ON HOLD
RFIMW-26-G-1203-EB	December 9, 2003	ON HOLD

Sample ID	Receipt Date	Analysis
PM4NA-G-1203-EB	December 9, 2003	ON HOLD
WHI4-2S-G-1203-EB	December 10, 2003	ON HOLD
RFIMW-15-G-1203-EB	December 10, 2003	ON HOLD
WHI9-2F-G-1203-EB	December 10, 2003	ON HOLD
RFIMW-11-G-1203-EB	December 10, 2003	ON HOLD
RFIMW-12-G-1203-EB	December 10, 2003	ON HOLD
WHI4-1S-G-1203-EB	December 10, 2003	ON HOLD
WHI4-2S-G-1203-EB	December 10, 2003	ON HOLD

3. Analysis

General. All samples were received and logged in according to FGS protocols on the day of receipt. Samples were processed using ultra-clean sample handling techniques in a laboratory known to be low in atmospheric Hg and presumably all other trace metals as well. Reagents, gases, and DI water are all reagent or ultra-pure grade, and previously analyzed for Hg to ensure negligible blanks. All Hg analyses were performed using cold vapor atomic fluorescence spectrometry (CVAFS) as a detector (Bloom and Fitzgerald, 1988), with dual pen chart recorders or integrators as output devices. Total Hg (THg) standards are prepared by direct dilution of NIST certified NBS-3133 10.00 mg/mL Hg standard solution, and results independently verified by the analysis of NIST-1641d (water CRM; 1,590 ± 18 μg/g THg).

Total Hg analysis. For preservation/oxidation, 0.2 N BrCl in 11.6 N HCl was added to the sample in the original bottle at a level of 1 mL per 100 mL of sample. The samples were then allowed to digest overnight at room temperature.

Oxidized water samples were analyzed for total Hg in accordance with the Frontier SOP FGS-069 on December 15, 2003 and February 2, 2004. Aliquots of each digest were reduced in pre-purged DDW, first with HN_2OH to destroy free halogens, and then to Hg^0 with $SnCl_2$. The Hg^0 is then purged onto gold traps as a preconcentration step. The Hg contained on the gold traps was then analyzed by thermal desorption into a cold vapor atomic fluorescence detector (CVAFS), using the dual amalgamation technique. Peak areas are accessed by integrator, and recorded on bench sheets in "chart units" to the nearest 0.1 unit. Net THg concentrations were calculated according to the following formula, where **PH** is the chart recorder peak height, **bb** is the mean bubbler blank, **V** is the digest, **B** is the mean BrCl method blank (ng/L) (corresponding to the

appropriate level of oxidation), **S** is the calibration curve slope in units/ng, for the set of samples, and F_D is the dilution correction factor, calculated similarly:

$$[THg]\ (ng/L) = \frac{([(PH-bb/S)/(V)] - B)}{F_D}$$

4. Analytical Issues

There were no significant analytical issues associated with these samples and all QC were within control limits with the exceptions of those listed below.

- Analysis of the sample RFIMW-22-G-1203-S and its matrix duplicate yielded an elevated RPD at 52.1%. Investigation of the sample was performed showing large amounts of suspended particulate in the sample, which contributed to the failure of the RPD. Reanalysis of the native sample was performed yielding an RPD within control limits of 25% at 24.8%. As all other QC points (CRM, CCV, MS/MSD) were well within control limits, no further corrective action was done and Frontier maintains confidence in the results achieved.
- CCV5 yielded a low result of 57.9%. Reanalysis was performed on the corresponding trap/bubbler yielded a result within control limits of 75%-125% at 97.9%. As there were no additional issues that arose, no further corrective action was taken.

Please feel free to contact me with any questions or concerns regarding this report.

ENSR
Results
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Sample ID	Analytical Batch	THg (ng/L) Total
BGMW-1	A	3.53
BGMW-1-G-1203-S	B	16.2
WHI2-1S-G-1203-S	A	3.71
WHI2-1S-G-1203-EB	ON HOLD	ON HOLD
CMSMW-08-G-1203-S	A	3900
CMSMW-08-G-1203-EB	ON HOLD	ON HOLD
RFIMW-09-G-1203-S	A	1.37
RFIMW-09-G-1203-EB	C	0.30
CMSMW-02-G-1203-S	A	434
CMSMW-02-G-1203-EB	ON HOLD	ON HOLD
CMSMW-02-G-1203-FB	A	0.20
RFIMW-28-G-1203-S	A	4.31
RFIMW-28-G-1203-EB*	ON HOLD	ON HOLD
RFIMW-28-G-1203-D	A	3.13
WHI9-2S-G-1203-S	A	41.1
WHI9-2S-G-1203-EB	ON HOLD	ON HOLD
RFIMW-08-G-1203-S	A	5.32
RFIMW-08-G-1203-EB	ON HOLD	ON HOLD
RFIMW-02-G-1203-S	A	4.16
RFIMW-02-G-1203-EB	ON HOLD	ON HOLD
RFIMW-01-G-1203-S	A	36.2
RFIMW-01-G-1203-EB	ON HOLD	ON HOLD
RFIMW-01-G-1203-D	A	20.4
RFIMW-13-G-1203-S	A	55.4
RFIMW-13-G-1203-EB	A	0.24
RFIMW-13-G-1203-FB	A	0.15
RFIMW-04-G-1203-S	A	7.45
RFIMW-04-G-1203-EB	ON HOLD	ON HOLD
RFIMW-22-G-1203-S	A	33.3
RFIMW-22-G-1203-EB	A	< 0.15
RFIMW-22-G-1203-FB	A	< 0.15
RFIMW-07-1203-S	B	121
RFIMW-07-1203-EB	ON HOLD	ON HOLD
WHI3-2S-G-1203-S	B	64.4
WHI3-2S-G-1203-EB	ON HOLD	ON HOLD
RFIMW-26-G-1203-S	A	14.1
RFIMW-26-G-1203-EB	ON HOLD	ON HOLD
RFIMW-26-G-1203-D	B	25.3

ENSR
Results
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Sample ID	Analytical Batch	THg (ng/L) Total
RFIMW-06-G-1203-S	B	324
RFIMW-06-G-1203-EB	B	< 0.15
RFIMW-06-G-1203-FB	B	< 0.15
PM4NA-G-1203-S	B	52.6
PM4NA-G-1203-EB	ON HOLD	ON HOLD
WHI3-1S-G-1203-S	B	10.5
WHI3-1S-G-1203-EB	B	0.18
WHI4-2S-G-1203-S	B	767
WHI4-2S-G-1203-EB	ON HOLD	ON HOLD
RFIMW-15-G-1203-S	B	3.06
RFIMW-15-G-1203-EB	ON HOLD	ON HOLD
WHI9-2F-G-1203-S	B	757
WHI9-2F-G-1203-EB	ON HOLD	ON HOLD
RFIMW-11-G-1203-S	B	1.62
RFIMW-11-G-1203-EB	ON HOLD	ON HOLD
RFIMW-12-G-1203-S	B	14.5
RFIMW-12-G-1203-EB	ON HOLD	ON HOLD
WHI4-1S-G-1203-S	B	67.3
WHI4-1S-G-1203-EB	ON HOLD	ON HOLD
WHI4-1S-G-1203-FB	B	< 0.15

ENSR
Method/Prep Blanks
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	THg (ng/L)	THg (ng/L)	THg (ng/L)
Analytical Batch	A	B	C
PB1	-0.01	0.03	0.03
PB2	-0.05	-0.07	0.06
PB3	-0.02	-0.03	0.07
Mean	-0.03	-0.02	0.05
St Dev	0.02	0.05	0.02
EMDL	0.07	0.14	0.05
Reporting Limit	0.15	0.15	0.15

ENSR

Certified Reference Material Report

BASF-Wyandotte, MI

Frontier Geosciences

February 2, 2004

Analyte	THg (ng/L)	THg (ng/L)	THg (ng/L)
Analytical Batch	A	B	C
CRM Identity	NIST 1641d	NIST 1641d	NIST 1641d
Cert Value	1601000	1601000	1601000
Obs Value	1521000	1604000	1563000
% Rec	95.0	100.2	97.6

ENSR
Replicates
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	Analytical Batch	Sample ID	Sample	Duplicate	Mean	RPD
THg (ng/L)	A	RFIMW-22-G-1203-S	33.35	42.81	38.08	24.8
THg (ng/L)	B	WH13-15-G-1203-S	10.50	9.53	10.02	9.7
THg (ng/L)	C	Batch QC	0.67	0.74	0.70	9.9

ENSR
Spikes
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	Analytical Batch	Sample ID	Mean	Spike TV	Obs Spike Value	Spike %Rec	Spike Dup TV	Obs Spike Dup Value	Spike Dup %Rec	RPD
THg (ng/L)	A	RFIMW-22-G-1203-S	38.08	105.3	140.7	97.5	105.3	130.1	87.4	11.0
THg (ng/L)	B	WH13-15-G-1203-S	10.02	41.24	44.13	82.7	41.24	48.31	92.9	11.6
THg (ng/L)	C	Batch QC	0.68	5.05	6.07	106.9	5.05	6.03	106.0	0.8

ENSR
Calibration Blanks
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	Analytical Batch	ICB	CCB1	CCB2	CCB3	CCB4	CCB5
THg (ng/L)	A	0.02	0.03	0.00	0.06	0.03	0.06
THg (ng/L)	B	0.02	0.07	0.13	0.07	0.21	-
THg (ng/L)	C	0.04	0.04	0.06	0.02	0.01	-

ENSR
Calibration Verification
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	Analytical Batch	ICV-TV	ICV-Obs	ICV-Rec	CCV1-TV	CCV1-Obs	CCV1-Rec	CCV2-TV	CCV2-Obs	CCV2-Rec
THg (ng/L)	A	15.00	14.58	97.2	20.00	23.26	116.3	20.00	20.25	101.3
THg (ng/L)	B	15.00	14.56	97.1	20.00	19.94	99.7	20.00	19.79	99.0
THg (ng/L)	C	15.00	15.06	100.4	20.00	20.21	101.0	20.00	20.21	101.0

Analyte	Analytical Batch	CCV3-TV	CCV3-Obs	CCV3-Rec	CCV4-TV	CCV4-Obs	CCV4-Rec	CCV5-TV	CCV5-Obs	CCV5-Rec
THg (ng/L)	A	20.00	18.58	92.9	20.00	19.42	97.1	20.00	19.59	97.9
THg (ng/L)	B	20.00	19.79	99.0	20.00	20.23	101.1	-	-	-
THg (ng/L)	C	20.00	19.95	99.8	20.00	20.12	100.6	-	-	-

Frontier Geosciences Inc.
Environmental Research & Specialty Analytical Laboratory
414 Pontius Avenue North • Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@FrontierGeosciences.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12.1.03 Page: 01 of 01

Client Company: ENSR
Address: 27755 Diehl Road Ste. 100
Warrenville IL 60555
CONTACT:
Phone: Fax:
Email:
Project Name:
Contract/PO #:

Frontier Project Manager: Misty
Guaranteed Turnaround Time:
Confirmation of Sample Arrival at Frontier: ☐ YES ☐ NO
Quality Assurance Level: ☐ Standard ☐ High
Disposal*: ☐ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 7904 8237 5358

Laboratory Bottle ID	Sample ID	Matrix	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
glass 250	BGMW-1	H2O	01				

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: Ambient °C
Comments: ice melted
VTSR: 1015

Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by:		Relinquished by:	
Print name:	internal C.O.C.	Print name:	
Company:		Company:	
Date:	Time:	Date:	Time:
Received by: Chr F		Received by:	
Print name: Christabel Fowler		Print name:	
Company: FGS		Company:	
Date: 12.1.3	Time: 1115	Date:	Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7283

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	WHI2-1S-G-1203-S	FW	1	12/3/03 1240	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	WHI2-1S-G-1203-EB	FW	1	12/3/03 1150	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/3/03 Time: 1800	Date: Time:
Received by: Barry Hodges	Received by:
Print name: BARRY HODGES	Print name:
Company: Frontier Geosciences	Company:
Date: 12-4-03 Time: 1200	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 ~~1~~ ACS of 1

Client Company: ENSR	Frontier Project Manager: MISTY KENNARD
Address: 27755 DIEHL ROAD WARRENVILLE, IL 60555	Guaranteed Turnaround Time: 30 days
CONTACT: PAYTHA ELLIOTT	Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Phone: 630-836-1700 Fax: 630-836-1711	Quality Assurance Level: ☐ Standard ☒ High
Email: pelliott@ensr.com	Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
Project Name: BASF - WYANDOTTE, MI	*All samples are held for at least 2 months after date of receipt. Please note that after this time they are disposed of or returned to the client. Clients may request a longer holding time by writing to the Frontier Project Manager. **Please discuss this with the Frontier Project Manager.
Contract/PO #:	Carrier Information: FED EX ☒ UPS ☐ Other ☐
	Tracking # 9413 1567 7283

Engraved Bottle ID	Sample ID	Matrix	Bottle	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	BGMW-1-G-1203-S	FW	1	12/02/03 1040	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	~~BGMW-1-G-1203-EB~~	~~FW~~	~~1~~	~~12/02/03~~	~~P. Elliott~~	~~NONE~~	~~HOLD~~ ACS

Sample Receipt	[1]Matrix Codes:	Relinquished by: Paytha Elliott	Relinquished by:
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A	FW = fresh water (salinity < 0.5 ppth)	Print name: PAYTHA ELLIOTT	Print name:
Cooler Temperature: 0.0 °C	BW = brackish water	Company: ENSR	Company:
Comments:	SW = seawater	Date: 12/3/03 Time: 1800	Date: Time:
	WW = wastewater	Received by: Barry Hodges	Received by:
	SE = sediment	Print name: BARRY HODGES	Print name:
	SO = soil	Company: Frontier Geosciences	Company:
VTSR: 1000	AT = animal tissue	Date: 12-4-03 Time: 1200	Date: Time:
	PT = plant tissue		
	TR = trap		
	PP = petroleum product		
	OT = other		

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7283

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	CMSMW-08-G-1203-S	FW	1	12/3/03 ~~1250~~ 1450	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	CMSMW-08-G-1203-DUP	FW	1	12/3/03 1405	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☒ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/3/03 Time: 1800	Date: Time:
Received by: Barry Hodges	Received by:
Print name: BARRY HODGES	Print name:
Company: Frontier Geosciences	Company:
Date: 12-4-03 Time: 1200	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7283

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	~~GMS~~ RFIMW-09-6-1203-S	FW	1	12/3/03 1540	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFIMW-09-6-1203-EB	FW	1	12/3/03 1515	P. ELLIOTT	NONE	TOTAL Hg: 1631 REVE

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/3/03 Time: 1800	Date: Time:
Received by: Barry Hodges	Received by:
Print name: BARRY HODGES	Print name:
Company: Frontier Geosciences	Company:
Date: 12-4-03 Time: 1200	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7283

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	CMS MW-02-G-1203-S	FW	1	12/3/03 1710	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	CMS MW-02-GW-1203-EQ	FW	1	12/3/03 1615	P. Elliott	NONE	HOLD
	CMS MW-02-G-1203-FB	FW	1	12/3/03 1620	P. ELLIOTT	NONE	TOTAL Hg: 1631 REV E

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other_____

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/3/03 Time: 1800	Date: Time:
Received by: Barry Hodges	Received by:
Print name: BARRY HODGES	Print name:
Company: Frontier Geosciences	Company:
Date: 12-4-03 Time: 1200	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-28-G-1203-S	FW	1	12/04/03 0845	P. Elliott	NONE	TOTAL Hg: 1631 REVE
*	RFIMW-28-G-1203-EB	FW	1	12/04/03 0845	P. Elliott	NONE	HOLD
	RFIMW-28-G-1203-D	FW	1	12/04/03 0845	P. Elliott	NONE	TOTAL Hg: 1631 REVE

Sample Receipt
C.O.C. Seal Intact? ☑ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments: * There was no bottle with this ID incl. in shipment. There was one extra bottle in shipment. This one is labeled RFIMW-8-G-1203-EB
VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by: A. Malaika Chafeety	Received by:
Print name: A. Malaika Chafeety	Print name:
Company: FRONTIER	Company:
Date: 12.5.03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
*	WHIG-25-G-1203-3	FW	1	12/4/2003 1030	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	WHIG-25-G-1203-3B	FW	1	12/4/2003 0900	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments:
* Bottle was packaged in a single bubble bag.

VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by: A. Malaika Lafferty	Received by:
Print name: A. Malaika Lafferty	Print name:
Company: FRONTIER	Company:
Date: 12.5.03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-08-G-1203-S	FW	1	12/04/03 1155	P. Elliott	NONE	TOTAL Hg: 1631 REVE
*	RFIMW-08-G-1203-EB	FW	1	12/04/03 1130	P. ELLIOTT	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments: * PLEASE SEE NOTE REGARDING SAMPLE RFIMW-08-G-1203-EB. THERE IS ONE EXTRA SAMPLE INCL. IN SHIPMENT, IT IS LABELED RFIMW-8-G-1203-EB
VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by: A. Malaika Lafferty	Received by:
Print name: A. Malaika Lafferty	Print name:
Company: FRONTIER	Company:
Date: 12.5.03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFI MW-02-G-1203-S	FW	1	12/4/03 1255	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFI MW-02-G-1203-EB	FW	1	12/4/03 1225	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments:

VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by: A. Malaika Lafferty	Received by:
Print name: A. Malaika Lafferty	Print name:
Company: Frontier	Company:
Date: 12.5.03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/4/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-01-G-1203-S	FW	1	12/4/03 1555	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFIMW-01-G-1203-EB	FW	1	12/4/03 1515	P. Elliott	NONE	HOLD
	RFIMW-01-G-1203-D	FW	1	12/4/03 1555	P. Elliott	NONE	TOTAL Hg: 1631 REVE

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments:

VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by: A. Malaika Lafferty	Received by:
Print name: A. Malaika Lafferty	Print name:
Company: Frontier	Company:
Date: 12-5-03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-13-G-1203-S	FW	1	12/04/03 1810	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFIMW-13-G-1203-EB	FW	1	12/04/03 1745	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFIMW-13-G-1203-FB	FW	1	12/04/03 1740	P. Elliott	NONE	TOTAL Hg: 1631 REVE

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments:
VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by: A. Malaka Lafferty	Received by:
Print name: A. Malaka Lafferty	Print name:
Company: Frontier	Company:
Date: 12-5-03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/05/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: ~~MISTY KENNARD~~ FRUSS
Guaranteed Turnaround Time: 30 days
Confirmat on of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7261

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-04-G-1203-S	FW	1	12/05/03 840	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFIMW-04-G-1203-EB	FW	1	12/05/03 810	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 2.0 °C
Comments:
VTSR: 10:00

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/05/03 Time: 1300	Date: Time:
Received by: Brian Setzer	Received by:
Print name: B. Setzer	Print name:
Company: FGS	Company:
Date: 12/6/03 Time: 11:00	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/05/03 Page: 2 of 2

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: ~~MISTY KENNARD~~ FRUSS
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-22-G-1203-S	FW	1	12/05/03 1000	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	RFIMW-22-G-1203-EB	FW	1	12/05/03 915	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	RFIMW-22-G-1203-FB	FW	1	12/05/03 910	P. Elliott	NONE	TOTAL Hg: 1631 REV E
							Perform MS/MSD on this sample

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: Time:	Date: Time:
Received by:	Received by:
Print name:	Print name:
Company:	Company:
Date: Time:	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/8/03 Page: 4 of 5

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-07-G-1203-S	FW	1	12/8/03 1200	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	RFIMW-07-G-1203-EB	FW	1	12/8/03 1118	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/08/03 Time: 2000	Date: Time:
Received by: A. Mahalik	Received by:
Print name: A. Mahalik	Print name:
Company: Frontier	Company:
Date: 12.9.03 Time: 1100	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/8/03 Page: 1 of X5

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	WHI3-2S-G-1203-S	FW	1	12/8/03 1340	P. Elliott	NONE	TOTAL Hg: 1631 RevE
	WHI3-2S-G-1203-EB	FW	1	12/8/03 1305	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:

VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/06/03 Time: 2000	Date: Time:
Received by: A. Malaika [illegible]	Received by:
Print name: A. Malaika [illegible]	Print name:
Company: Frontier	Company:
Date: 12.9.03 Time: 1100	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/08/03 Page: 3 of 5

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled		Collected by	Preservation	Analysis Required/Comments
	RFIMW-26-G-1203-S	FW	1	12/08/03	1500	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFIMW-26-G-1203-B	FW	1	12/08/03	1410	P. Elliott	NONE	HOLD
	RFIMW-26-G-1203-D	FW	1	12/08/03	1500	P. Elliott	NONE	TOTAL Hg: 1631 REVE

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/08/03 Time: 2000	Date: Time:
Received by: A. Malanka LaFferty	Received by:
Print name: A. Malanka LaFferty	Print name:
Company: FRONTIER	Company:
Date: 12.9.03 Time: 1100	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/8/03 Page: 5 of 5

Client Company: ENSR	Frontier Project Manager: MISTY KENNARD
Address: 27755 DIEHL ROAD WARRENVILLE, IL 60555	Guaranteed Turnaround Time: 30 days
CONTACT: PAYTHA ELLIOTT	Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Phone: 630-836-1700 Fax: 630-836-1711	Quality Assurance Level: ☐ Standard ☒ High
Email: pelliott@ensr.com	Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
Project Name: BASF - WYANDOTTE, MI	*All samples are held for at least 2 months after date of receipt. Please note that after this time they are disposed of or returned to the client. Clients may request a longer holding time by writing to the Frontier Project Manager. **Please discuss this with the Frontier Project Manager.
Contract/PO #:	Carrier Information: FED EX ☒ UPS ☐ Other ☐
	Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-06-G-1203-S	FW	1	12/8/03 1725	P. Elliott	NONE	TOTAL Hg: 1631 Rev E
	RFIMW-06-G-1203-EB	FW	1	12/8/03 1650	P. Elliott	NONE	TOTAL Hg: 1631 Rev E
	RFIMW-06-G-1203-FB	FW	1	12/8/03 1645	P. ELLIOTT	NONE	TOTAL Hg: 1631 REV E

Sample Receipt	[1]Matrix Codes:		
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A	FW = fresh water (salinity < 0.5 ppth)	Relinquished by: Paytha Elliott	Relinquished by:
Cooler Temperature: 0.0 °C	BW = brackish water	Print name: PAYTHA ELLIOTT	Print name:
Comments:	SW = seawater	Company: ENSR	Company:
	WW = wastewater	Date: 12/08/03 Time: 2000	Date: Time:
	SE = sediment	Received by: [signature]	Received by:
	SO = soil	Print name: A. Malaika Lafferty	Print name:
	AT = animal tissue	Company: FRONTIER	Company:
VTSR: 1000	PT = plant tissue	Date: 12-9-03 Time: 1100	Date: Time:
	TR = trap		
	PP = petroleum product		
	OT = other		

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/08/03 Page: 2 of 15

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	PM4NA-G-1203-S	FW	1	12/08/03 1910	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	PM4NA-G-1203-EB	FW	1	12/08/03 1840	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/08/03 Time: 2000	Date: Time:
Received by: [illegible]	Received by:
Print name: A. Malaika Lafferty	Print name:
Company: FRONTIER	Company:
Date: 12.9.03 Time: 1100	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	WHI3-1S-G-1203-S	FW	1	12/09/03 0840	P. Elliott	NONE *	TOTAL Hg: 1631 REVE *
	WHI3-1S-G-1203-EB	FW	1	12/09/03 0745	P. Elliott	NONE	TOTAL Hg: 1631 REVE
						*	Please perform MS/MSD analyses for this sample.

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: [signature]	Received by:
Print name: M. Wisdom	Print name:
Company: FGS	Company:
Date: 12.10.03 Time: 1050	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/9/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	WHI4-2S-G-1203-S	FW	1	12/9/03 1040	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	WHI4-2S-G-1203-EB	FW	1	12/9/03 1010	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: Michael C. Wisdom	Received by:
Print name: M WISDOM	Print name:
Company: FGS	Company:
Date: 12.10.03 Time: 1050	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR	Frontier Project Manager: MISTY KENNARD
Address: 27755 DIEHL ROAD WARRENVILLE, IL 60555	Guaranteed Turnaround Time: 30 days
CONTACT: PAYTHA ELLIOTT	Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Phone: 630-836-1700 Fax: 630-836-1711	Quality Assurance Level: ☐ Standard ☒ High
Email: pelliott@ensr.com	Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
Project Name: BASF - WYANDOTTE, MI	*All samples are held for at least 2 months after date of receipt. Please note that after this time they are disposed of or returned to the client. Clients may request a longer holding time by writing to the Frontier Project Manager. **Please discuss this with the Frontier Project Manager.
Contract/PO #:	Carrier Information: FED EX ☒ UPS ☐ Other ☐ Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
●	RFIMW-15-G-1203-S	FW	1	12/09/03 1150	P. Elliott	NONE	TOTAL Hg: 1631 Rev E
●	RFIMW-15-G-1203-EB	FW	1	12/09/03 1115	P. Elliott	NONE	HOLD

Sample Receipt	[1]Matrix Codes:		
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A	FW = fresh water (salinity < 0.5 ppth)	Relinquished by: Paytha Elliott	Relinquished by:
Cooler Temperature: °C	BW = brackish water	Print name: PAYTHA ELLIOTT	Print name:
Comments:	SW = seawater	Company: ENSR	Company:
	WW = wastewater	Date: 12/09/03 Time: 2000	Date: Time:
	SE = sediment	Received by: [signature]	Received by:
	SO = soil	Print name: M WISDOM	Print name:
	AT = animal tissue	Company: FGS	Company:
VTSR:	PT = plant tissue	Date: 12.10.03 Time: 1050	Date: Time:
	TR = trap		
	PP = petroleum product		
	OT = other		

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
•	WHI9-2F-G-1203-S	FW	1	12/09/03 1340	P. Elliott	NONE	TOTAL Hg: 1631 RevE
•	WHI9-2F-G-1203-EB	FW	1	12/09/03 1305	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: Stephanie C. Wisdom	Received by:
Print name: M WISDOM	Print name:
Company: FGS	Company:
Date: 12-10-03 Time: 1050	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/9/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 3413 1567 7240

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
•	RFIMW-11-G-1203-S	FW	1	12/9/03 1500	P. Elliott	NONE	TOTAL Hg: 1631 REV E
•	RFIMW-11-G-1203-EB	FW	1	12/9/03 1435	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: Melanie C. Wisdom	Received by:
Print name: M. WISDOM	Print name:
Company: FGS	Company:
Date: 12.10.03 Time: 1050	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
•	RFI MW-12-G-1203-S	FW	1	12/09/03 1550	P. Elliott	NONE	TOTAL Hg: 1631 REV E
•	RFIMW-12-G-1203-EB	FW	1	12/09/03 1520	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: Mylinie Wisdom	Received by:
Print name: M. WISDOM	Print name:
Company: FGS	Company:
Date: 12.10.03 Time: 1050	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
•	WHI4-1S-G-1203-S	FW	1	12/09/03 1900	P. Elliott	NONE	TOTAL Hg: 1631 RevE
•	WHI4-1S-G-1203-EB	FW	1	12/09/03 1805	P. Elliott	NONE	HOLD
•	WHI4-1S-G-1203-FB	FW	1	12/09/03 1800	P. Elliott	NONE	TOTAL Hg: 1631 RevE

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: Stephanie C. Wisdom	Received by:
Print name: M WISDOM	Print name:
Company: FGS	Company:
Date: 12.10.03 Time: 1050	Date: Time:

Frontier Geosciences

Dataset for CV.AFS Analysis

Analysis Method: FGS-069

THg

Dataset ID: **THg11-031215-1**
Analyst: **jacobm**
Data Prep: **jacobm**
Analysis Date: **12/15/2003**

Project List:

No:	HiQA	Sample Group		Corrections: Inst. Blank	Prep. Blank	MSA	Effic. Factor
2	☑	ENSR 12/1		Yes-1	Yes-3	No	No
		*Prep Method:	THg BrCl Oxidation				
4	☑	ENSR 12/4		Yes-1	Yes-3	No	No
		*Prep Method:	THg BrCl Oxidation				
5	☑	ENSR 12/5		Yes-1	Yes-3	No	No
		*Prep Method:	THg BrCl Oxidation				
6	☑	ENSR 12/6		Yes-1	Yes-3	No	No
		*Prep Method:	THg BrCl Oxidation				

Analytical Remarks:

12 (BGWW-1-EB): RR TO CONFIRM-RR#42
14 (CMSMW-08-G-1203-S): TH-RR#57, T5 REBURN ON R15-16
17 (RFIMW-09-G-1203-S): TL-RR#43
18 (CMSMW-02-G-1203-S): TH-RR#48, T7 REBURN ON R19
23 (WH12-15-G-1203-S): SUSPECT BUBBLER-RR#60
30 (RFIMW-02-G-1203-S): TL-RR#51
31 (RFIMW-08-G-1203-S): TL-RR#50
36 (RFIMW-28-G-1203-D): TL-RR#62
37 (RFIMW-28-G-1203-S): TL-RR#63
41 (RFIMW-22-G-1203-S): POOR RPD- RR#61
44 (CMSMW-08-G-1203-S): TH-RR#57, T5 REBURN ON R45
49 (WH12-15-G-1203-S): SUSPECT BUBBLER- RR#60
52 (BUBBLER CHECK): TH-RR#53
53 (BUBBLER CHECK): CHANGE SODA LIME
64 (CCV5): TL-RR#65

(A)

QUALITY ASSURANCE
PEER-REVIEWED
INITIALS: 1-23-04

RR=Rerun
RR#= See rerun number
TL= Too low
TH= Too high
T5= Trap #5

The RPD for the MD came out too high. The MD was rerun and the RPD came out in range. The failure is most likely due to the large amount of suspended particulate in this sample.

The final CCV came out too low. The analyst reran it on the same trap/ bubbler combination and it came out in range.

Validator: **susanc**

Printed: 01/23/2004 11:11:1

Frontier Geosciences

Dataset for CV.AFS Analysis

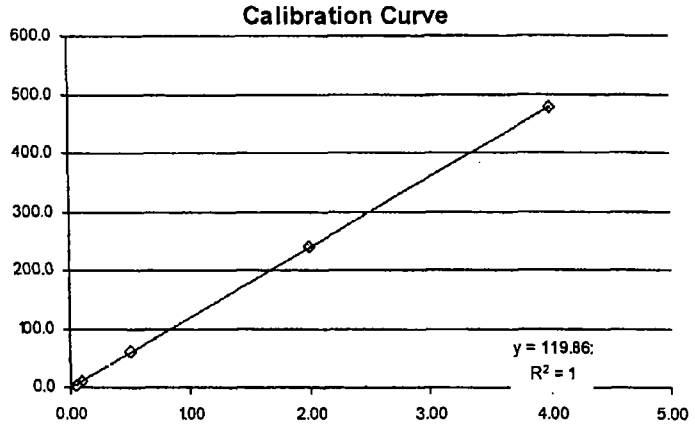
Dataset ID: THg11-031215-1
Analyst: jacobm
Date: 12/15/2003

Calibration Data for THg

ng vs. Measured Intensity

Slope: 119.86120 *R:* 0.99998
SE: 1.03558 *Obs:* 5

True Value-x	IBC Intensity-y	Calc Value	Calc Intensity
0.1000	11.6500	0.0972	11.9861
0.5000	61.5500	0.5135	59.9306
2.0000	240.7500	2.0086	239.7224
4.0000	478.7500	3.9942	479.4448
0.0500	4.9500	0.0413	5.9931



Instrument Blank (IB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	Intensity
1	THg	10	0.104	0.237	0.710	ng/L	1.250000

Preparation Blank (PB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	PB1	PB2	PB3	PB4
3	THg	3	-0.029	0.022	0.066	ng/L	-0.013	-0.054	-0.021	

MSA Sets

QC Sets

Sample	Analyte	Sample	Duplicate	Triplicate	Spike	Spike Dup	Spike TV	Spike Dup TV
RFIMW-22-G-1203-S	THg	33.347	42.808		140.746	130.059	105.300	105.300
	ng/L	Avg=38.077	24.8% RPD			11.0% RPD	97.5%Rec	87.4%Rec

Frontier Geosciences

Dataset for CV.AFS Analysis

Dataset ID: THg11-031215-1
Analyst: jacobm
Date: 12/15/2003

Run	Trap	Pos	Sample Group	Sample ID	Excl.	Type	Aliquot	Intens	Inst Value	Dil	[Liquid Gross]	%Pres	[Liquid Net]	Rec.	TV
1	1	1	{Analysis}	0.10 ng	☐	CAL	100.000 mL	12.9	0.097 ng	1.	0.972 ng/L		0.972 ng/L	97.2%	0.1000
2	2	2	{Analysis}	0.50 ng	☐	CAL	100.000 mL	62.8	0.514 ng	1.	5.135 ng/L		5.135 ng/L	102.7%	0.5000
3	3	3	{Analysis}	2.00 ng	☐	CAL	100.000 mL	242	2.009 ng	1.	20.086 ng/L		20.086 ng/L	100.4%	2.0000
4	4	4	{Analysis}	4.00 ng	☐	CAL	100.000 mL	480	3.994 ng	1.	39.942 ng/L		39.942 ng/L	99.9%	4.0000
5	5	1	{Analysis}	0.05 ng	☐	CAL	100.000 mL	6.2	0.041 ng	1.	0.413 ng/L		0.413 ng/L	82.6%	0.0500
6	6	2	{Analysis}	ICV	☐	CV	100.000 mL	176	1.458 ng	1.	14.579 ng/L		14.579 ng/L	97.2%	15.0000
7	7	3	{Analysis}	ICB/BB	☐	IB	100.000 mL	0.2	0.002 ng	1.	0.017 ng/L		0.017 ng/L		
8	8	4	{BATCH QC}	NIST 1641d	☐	LCS	0.200 mL	180	1.491 ng	200.	1491308.298 ng/L	2.0	1521134.521 ng/L	95.0%	1601000.0000
9	9	1	{BATCH QC}	PBW-1	☐	PB	100.000 mL	1.1	-0.001 ng	1.	-0.013 ng/L		-0.013 ng/L		
10	1	2	{BATCH QC}	PBW-2	☐	PB	100.000 mL	0.6	-0.005 ng	1.	-0.054 ng/L		-0.054 ng/L		
11	2	3	{BATCH QC}	PBW-3	☐	PB	100.000 mL	1	-0.002 ng	1.	-0.021 ng/L		-0.021 ng/L		
12	3	4	ENSR 12/1	BGWW-1-EB	☑	S	100.000 mL	40.9	0.331 ng	1.	3.308 ng/L	1.0	3.370 ng/L		
13	4	1	ENSR 12/4	CMSMW-02-G-1203-FB	☐	S	100.000 mL	3.3	0.017 ng	1.	0.171 ng/L	1.0	0.202 ng/L		
14	5	2	ENSR 12/4	CMSMW-08-G-1203-S	☑	S	50.000 mL	999999	8342.965 ng	1.	166859.297 ng/L	5.0	175202.408 ng/L		
17	6	3	ENSR 12/4	RFIMW-09-G-1203-S	☑	S	50.000 mL	4.9	0.030 ng	1.	0.609 ng/L	2.0	0.680 ng/L		
18	7	4	ENSR 12/4	CMSMW-02-G-1203-S	☑	S	50.000 mL	999999	8342.965 ng	1.	166859.297 ng/L	2.0	170196.541 ng/L		
20	8	1	ENSR 12/4	RFIMW-26-G-1203-S	☐	S	50.000 mL	83.6	0.687 ng	1.	13.741 ng/L	2.0	14.074 ng/L		
21	9	2	{Analysis}	CCV1	☐	CV	100.000 mL	280	2.326 ng	1.	23.256 ng/L		23.256 ng/L	116.3%	20.0000
22	1	3	{Analysis}	CCB1	☐	IB	100.000 mL	0.3	0.003 ng	1.	0.025 ng/L		0.025 ng/L		
23	2	4	ENSR 12/4	WH12-15-G-1203-S	☑	S	100.000 mL	36.8	0.297 ng	1.	2.966 ng/L	2.0	3.084 ng/L		
24	3	1	ENSR 12/5	RFIMW-13-G-1203-FB	☐	S	100.000 mL	2.7	0.012 ng	1.	0.121 ng/L	1.0	0.151 ng/L		
25	4	2	{Analysis}	BUBBLER CHECK	☐	IB	100.000 mL	0.4	0.003 ng	1.	0.033 ng/L		0.033 ng/L		
26	5	3	ENSR 12/5	RFIMW-13-G-1203-EB	☐	S	100.000 mL	3.7	0.020 ng	1.	0.204 ng/L	1.0	0.236 ng/L		
27	6	4	{Analysis}	BUBBLER CHECK	☐	IB	100.000 mL	0.2	0.002 ng	1.	0.017 ng/L		0.017 ng/L		
28	7	1	ENSR 12/5	RFIMW-01-G-1203-D	☐	S	5.000 mL	12.8	0.096 ng	1.	19.272 ng/L	5.0	20.382 ng/L		
29	8	2	ENSR 12/5	RFIMW-01-G-1203-S	☐	S	5.000 mL	21.8	0.171 ng	1.	34.290 ng/L	5.0	36.150 ng/L		
30	9	3	ENSR 12/5	RFIMW-02-G-1203-S	☑	S	5.000 mL	0.8	-0.004 ng	1.	-0.751 ng/L	3.0	-0.686 ng/L		
31	1	4	ENSR 12/5	RFIMW-08-G-1203-S	☑	S	5.000 mL	0.7	-0.005 ng	1.	-0.918 ng/L	5.0	-0.818 ng/L		
32	2	1	ENSR 12/5	RFIMW-13-G-1203-S	☐	S	5.000 mL	32.8	0.263 ng	1.	52.644 ng/L	5.0	55.422 ng/L		
33	3	2	{Analysis}	CCV2	☐	CV	100.000 mL	244	2.025 ng	1.	20.253 ng/L		20.253 ng/L	101.3%	20.0000
34	4	3	{Analysis}	CCB2	☐	IB	100.000 mL	0	0.000 ng	1.	0.000 ng/L		0.000 ng/L		
35	5	4	ENSR 12/5	WH19-25-1203-S	☐	S	5.000 mL	24.4	0.193 ng	1.	38.628 ng/L	6.0	41.121 ng/L		
36	6	1	ENSR 12/5	RFIMW-28-G-1203-D	☑	S	5.000 mL	2.1	0.007 ng	1.	1.418 ng/L	6.0	1.679 ng/L		
37	7	2	ENSR 12/5	RFIMW-28-G-1203-S	☑	S	5.000 mL	3.9	0.022 ng	1.	4.422 ng/L	5.0	4.789 ng/L		
38	8	3	ENSR 12/6	RFIMW-22-G-1203-FB	☐	S	100.000 mL	1.9	0.005 ng	1.	0.054 ng/L	1.0	0.084 ng/L		
39	9	4	ENSR 12/6	RFIMW-22-G-1203-EB	☐	S	100.000 mL	2.1	0.007 ng	1.	0.071 ng/L	1.0	0.101 ng/L		
40	1	1	ENSR 12/6	RFIMW-04-G-1203-S	☐	S	50.000 mL	44.7	0.363 ng	1.	7.250 ng/L	2.0	7.453 ng/L		
41	2	2	ENSR 12/6	RFIMW-22-G-1203-S	☑	S	5.000 mL	15.5	0.119 ng	1.	23.778 ng/L	5.0	25.112 ng/L		
42	3	3	ENSR 12/1	BGWW-1-EB	☐	S	100.000 mL	42.8	0.347 ng	1.	3.467 ng/L	1.0	3.530 ng/L		
43	4	4	ENSR 12/4	RFIMW-09-G-1203-S	☐	S	100.000 mL	16.7	0.129 ng	1.	1.289 ng/L	2.0	1.373 ng/L		
44	5	1	ENSR 12/4	CMSMW-08-G-1203-S	☑	S	5.000 mL	999999	8342.965 ng	1.	1668592.968 ng/L	5.0	1752022.763 ng/L		
46	6	2	{Analysis}	CCV3	☐	CV	100.000 mL	224	1.858 ng	1.	18.584 ng/L		18.584 ng/L	92.9%	20.0000
47	7	3	{Analysis}	CCB3	☐	IB	100.000 mL	0.7	0.006 ng	1.	0.058 ng/L		0.058 ng/L		
48	8	4	ENSR 12/4	CMSMW-02-G-1203-S	☐	S	5.000 mL	256	2.125 ng	1.	425.075 ng/L	2.0	433.635 ng/L		
49	9	1	ENSR 12/4	WH12-15-G-1203-S	☑	S	100.000 mL	45	0.365 ng	1.	3.650 ng/L	2.0	3.781 ng/L		
50	1	2	ENSR 12/5	RFIMW-01-G-1203-D	☐	S	100.000 mL	218	1.808 ng	1.	18.083 ng/L	3.0	18.714 ng/L		

Frontier Geosciences

Dataset for CV.AFS Analysis

Dataset ID: THg11-031215-1
Analyst: jacobm
Date: 12/15/2003

Run	Trap	Pos	Sample Group	Sample ID	Excl	Type	Aliquot	Inten	Inst Value	Dil	[Liquid Gross]	%Pres	[Liquid Net]	Rec	TV
51	2	3	ENSR 12/5	RFIMW-02-G-1203-S	☐	S	100.000 mL	47.1	0.383 ng	1.	3.825 ng/L	5.0	4 163 ng/L		
52	3	4	ENSR 12/5	RFIMW-08-G-1203-S	☐	S	100.000 mL	64.7	0.529 ng	1.	5.294 ng/L		5 323 ng/L		
53	4	1	{Analysis}	BUBBLER CHECK	☐	IB	100.000 mL	9.3	0.078 ng	1.	0.776 ng/L		0 776 ng/L		
53	4	1	{Analysis}	BUBBLER CHECK	☐	IB	100.000 mL	0.4	0.003 ng	1.	0.033 ng/L		0 033 ng/L		
54	5	2	ENSR 12/6	RFIMW-22-G-1203-S MD	☐	MD	5.000 mL	25.6	0.203 ng	1.	40.630 ng/L	5.0	42 808 ng/L		
55	6	3	ENSR 12/6	RFIMW-22-G-1203-S MS	☐	MS	5.000 mL	81.5	0.670 ng	1.	133.905 ng/L	5.0	140 746 ng/L		105.3000
56	7	4	ENSR 12/6	RFIMW-22-G-1203-S MSD	☐	MSD	5.000 mL	75.4	0.619 ng	1.	123.726 ng/L	5.0	130.059 ng/L		105.3000
57	8	1	ENSR 12/4	CMSMW-08-G-1203-S	☐	S	0.500 mL	224	1.858 ng	1.	3716.799 ng/L	5.0	3902.785 ng/L		
58	9	2	{Analysis}	CCV4	☐	CV	100.000 mL	234	1.942 ng	1.	19.418 ng/L		19.418 ng/L	97.1%	20.0000
59	1	3	{Analysis}	CCB4	☐	IB	100.000 mL	0.3	0.003 ng	1.	0.025 ng/L		0.025 ng/L		
60	2	4	ENSR 12/4	WH12-15-G-1203-S	☐	S	100.000 mL	44.2	0.358 ng	1.	3.583 ng/L	2.0	3.713 ng/L		
61	3	1	ENSR 12/6	RFIMW-22-G-1203-S	☐	S	5.000 mL	20.2	0.158 ng	1.	31.620 ng/L	5.0	33.347 ng/L		
62	4	2	ENSR 12/6	RFIMW-28-G-1203-D	☐	S	100.000 mL	34.7	0.279 ng	1.	2.791 ng/L	6.0	3.133 ng/L		
63	5	3	ENSR 12/6	RFIMW-28-G-1203-S	☐	S	100.000 mL	48.8	0.397 ng	1.	3.967 ng/L	5.0	4.311 ng/L		
64	6	4	{Analysis}	CCV5	☑	CV	100.000 mL	140	1.158 ng	1.	11.576 ng/L		11.576 ng/L	57.9%	20.0000
65	6	4	{Analysis}	CCV5	☐	CV	100.000 mL	236	1.959 ng	1.	19.585 ng/L		19.585 ng/L	97.9%	20.0000
66	7	1	{Analysis}	CCB5	☐	IB	100.000 mL	0.7	0.006 ng	1.	0.058 ng/L		0.058 ng/L		

CCB1

CCV1

TRAP #7 Reburn

RFIMW-26-G1203-S

RFIMW-09-G-1203-S

Trap #5 Reburn

~~CMSW~~ CMSMW-02-G-1203-S

TRAP #5 Reburn

CMSMW-02-G-1203-FB

CMSMW-08-G-1203-S

BGWW-1-EB

PBW-3

PBW-2

PBW-1

ICB/BB

NIST 1641d

0.05ng

ICV

4.0ng

2.0ng

0.10ng

0.50ng

x=20 x=1 chart speed = 1mm/min

JACOB MEYER

THg11-031215-1

12/15/03

START 12:08

RFIMW-08-G-1203-S
RFIMW-02-G1203-S
RFIMW-01-G-1203-D
WH12-15-G-1203-S
CCB3
CMSMW-02-G-1203-S
CCB3 ← CCV3 Trap # 5 Return

RFIMW-09-G-1203-S
CMSMW-08-G-1203-S
BGWW-1-EB
RFIMW-22-G-1203-S
RFIMW-04-G-1203S
RFIMW-22-G-1203-EB
RFIMW-22-G-1203-FB
RFIMW-28-G-1203-S
RFIMW-28-G-1203D
WH19-25-1203-S
CCB2
CCV2
RFIMW-13-G-1203-S
RFIMW-08-G-1203-S
RFIMW-02-G-1203-S
RFIMW-01-G-1203-S
RFIMW-01-G-1203-D
BUBBLER CHECK
RFIMW-13-G-1203-EB
BUBBLER CHECK
RFIMW-13-G-1203-FB

RFIMW-07-1203-S SPM 12/20/03
WH12-15-G-1203-S

CHART NO. KZ X

KEIWM-13-P-1203-EB
BOBBER CHECK
KEIWM-13-P-1203-EB
BOBBER CHECK
KEIWM-01-P-1203-D
KEIWM-01-P-1203-2
KEIWM-03-P-1203-2

END 20:59

CCB5

CCV5

CCV5

RFIMW-28-G-1203-S

RFIMW-28-G-1203-D

RFIMW-22-G-1203-S

WH12-15-G-1203-S

CCB4

CCV4

CMSMW-08-G-1203-S

RFIMW-22-G-1203-S MSD

RFIMW-22-G-1203-S MS

RFIMW-22-G-1203-S MD

F#9 Reduction BUBBLER CHECK

BUBBLER CHECK

CHART NO. KZ XR-2

Frontier Geosciences

Dataset for CV.AFS Analysis

Analysis Method: FGS-069

THg

Dataset ID: **THg12-031215-1**
Analyst: **jacobm**
Data Prep: **jacobm**
Analysis Date: **12/15/2003**

Project List:

Key	HiQA	Sample Group		Corrections: Inst. Blank	Prep Blank	MSA	Effic Factor
3	☑	ENSR 12/9		Yes-1	Yes-2	No	No
		*Prep Method:	THg BrCl Oxidation				
4	☑	ENSR 12/10		Yes-1	Yes-2	No	No
		*Prep Method:	THg BrCl Oxidation				

Analytical Remarks:

15 (PM4NA-G-1203-S): TL-RR#37
16 (RFIMW-26-G-1203-D): SAYS "DISS" BUT HAS PARTICULATE
20 (RFIMW-07-1203-S): TH-RR#38
21 (RFIMW-06-G-1203-S): TH-RR#40, T6 REBURN ON R22
25 (RFIMW-11-G-1203-S): TL-RR#41
26 (WH13-15-G-1203-S): SUSPECT BUBBLER-RR#34
28 (RFIMW-12-G-1203-S): TL-RR#44
29 (RFIMW-15-G-1203-S): TL-RR#45

(B)

TL= Too low
TH= Too high
RR#= See rerun number
T7= Trap #7

No problems to report.

QUALITY ASSURANCE
PEER - REVIEWED
INITIALS: a.m.t. 12-24-03

Validator:

Printed: 12/18/2003 3:29:00

Frontier Geosciences

Dataset for CV.AFS Analysis

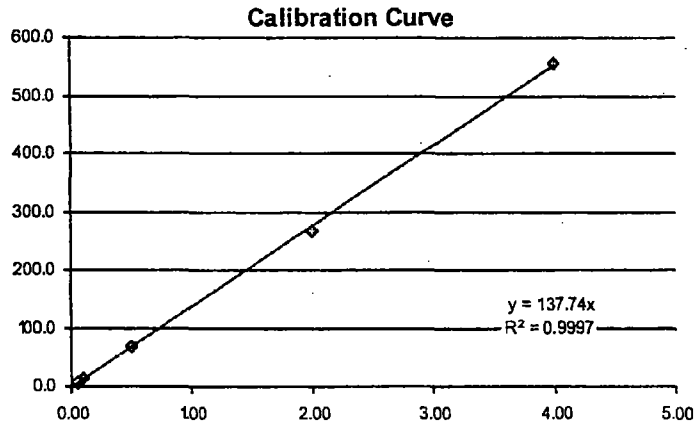
Dataset ID: **THg12-031215-1**
Analyst: **jacobm**
Date: **12/15/2003**

Calibration Data for THg

ng vs. Measured Intensity

Slope: **137.73769** *R:* **0.99985**
SE: **3.62811** *Obs:* **5**

Spike Value	Meas Intensity	Calc Value	Calc Intensity
0.1000	12.0000	0.0871	13.7738
0.5000	67.6000	0.4908	68.8688
2.0000	268.6000	1.9501	275.4754
4.0000	554.6000	4.0265	550.9508
0.0500	6.2000	0.0450	6.8869



Instrument Blank (IB) Sets

Group	Analyte	Count	Avg	Std Dev	EMDL	Units	Intensity
1	THg	5	0.102	0.072	0.216	ng/L	1.400000

Preparation Blank (PB) Sets

Group	Analyte	Count	Avg	Std Dev	EMDL	Units	PB1	PB2	PB3	PB4
2	THg	3	-0.022	0.048	0.143	ng/L	0.029	-0.065	-0.029	

MSA Sets

QC Sets

Sample	Analyte	Sample	Duplicate	Triplicate	Spike	Spike Dup	Spike %R	Spike Dup %R
WH13-15-G-1203-S	THg	10.505	9.532		44.126	48.313	41.240	41.240
	ng/L	Avg=10.019	9.7% RPD			11.6% RPD	82.7%Rec	92.9%Rec

Frontier Geosciences

Dataset for CV.AFS Analysis

Dataset ID: THg12-031215-1
Analyst: jacobm
Date: 12/15/2003

Run	Tube	Pos	Sample ID	Sample Description	Flag	Type	Aliquot	Response	Raw Value	Dilution	Concentration	Error	Recovery	Reference Value
1	1	1	{Analysis}	0.10 ng	☐	CAL	100.000 mL	13.4	0.087 ng	1.	0.871 ng/L		0.871 ng/L	87.1%	0.1000
2	2	2	{Analysis}	0.50 ng	☐	CAL	100.000 mL	69	0.491 ng	1.	4.908 ng/L		4.908 ng/L	98.2%	0.5000
3	4	3	{Analysis}	2.00 ng	☐	CAL	100.000 mL	270	1.950 ng	1.	19.501 ng/L		19.501 ng/L	97.5%	2.0000
4	5	4	{Analysis}	4.00 ng	☐	CAL	100.000 mL	556	4.026 ng	1.	40.265 ng/L		40.265 ng/L	100.7%	4.0000
5	6	1	{Analysis}	0.05 ng	☐	CAL	100.000 mL	7.6	0.045 ng	1.	0.450 ng/L		0.450 ng/L	90.0%	0.0500
6	7	2	{Analysis}	ICV	☐	CV	100.000 mL	202	1.456 ng	1.	14.564 ng/L		14.564 ng/L	97.1%	15.0000
7	9	3	{Analysis}	ICB/BB	☐	IB	100.000 mL	0.3	0.002 ng	1.	0.022 ng/L		0.022 ng/L		
8	10	4	{Analysis}	NIST 1641d	☐	LCS	0.200 mL	218	1.573 ng	200.	1572554.269 ng/L	2.0	1604005.354 ng/L	100.2%	1601000.0000
9	1	1	{BATCH QC}	PBW-1	☐	PB	100.000 mL	1.8	0.003 ng	1.	0.029 ng/L		0.029 ng/L		
10	2	2	{BATCH QC}	PBW-2	☐	PB	100.000 mL	0.5	-0.007 ng	1.	-0.065 ng/L		-0.065 ng/L		
11	4	3	{BATCH QC}	PBW-3	☐	PB	100.000 mL	1	-0.003 ng	1.	-0.029 ng/L		-0.029 ng/L		
12	5	4	ENSR 12/9	RFIMW-06-G-1203-FB	☐	S	100.000 mL	3	0.012 ng	1.	0.116 ng/L	1.0	0.139 ng/L		
13	6	1	ENSR 12/9	RFIMW-06-1203-EB	☐	S	100.000 mL	2.2	0.006 ng	1.	0.058 ng/L	1.0	0.080 ng/L		
14	7	2	ENSR 12/9	WHI3-25-G-1203-S	☐	S	50.000 mL	436	3.155 ng	1.	63.105 ng/L	2.0	64.411 ng/L		
15	9	3	ENSR 12/9	PM4NA-G-1203-S	☑	S	0.500 mL	2.6	0.009 ng	1.	17.424 ng/L	50.0	27.226 ng/L		
16	10	4	ENSR 12/9	RFIMW-26-G-1203-D	☐	S	50.000 mL	172	1.239 ng	1.	24.772 ng/L	2.0	25.311 ng/L		
17	1	1	ENSR 12/9	BGMW-1-G-1203-S	☐	S	100.000 mL	222	1.602 ng	1.	16.016 ng/L	1.0	16.198 ng/L		
18	2	2	{Analysis}	CCV1	☐	CV	100.000 mL	276	1.994 ng	1.	19.936 ng/L		19.936 ng/L	99.7%	20.0000
19	3	3	{Analysis}	CCB1	☐	IB	100.000 mL	1	0.007 ng	1.	0.073 ng/L		0.073 ng/L		
20	5	4	ENSR 12/9	RFIMW-07-1203-S	☑	S	50.000 mL	720	5.217 ng	1.	104.343 ng/L	2.0	106.474 ng/L		
21	6	1	ENSR 12/9	RFIMW-06-G-1203-S	☑	S	100.000 mL	99999	726.000 ng	1.	7260.003 ng/L	1.0	7332.624 ng/L		
23	7	2	ENSR 12/10	WH13-15-G-1203-EB	☐	S	100.000 mL	3.5	0.015 ng	1.	0.152 ng/L	1.0	0.176 ng/L		
24	9	3	ENSR 12/10	WH14-15-G-1203-FB	☐	S	100.000 mL	2.2	0.006 ng	1.	0.058 ng/L	1.0	0.080 ng/L		
25	10	4	ENSR 12/10	RFIMW-11-G-1203-S	☑	S	5.000 mL	1.2	-0.001 ng	1.	-0.290 ng/L	3.0	-0.234 ng/L		
26	1	1	ENSR 12/10	WH13-15-G-1203-S	☑	S	5.000 mL	12.4	0.080 ng	1.	15.972 ng/L	3.0	16.517 ng/L		
27	2	2	ENSR 12/10	WH14-25-G-1203-S	☐	S	1.000 mL	102	0.730 ng	1.	730.374 ng/L	5.0	767.001 ng/L		
28	3	3	ENSR 12/10	RFIMW-12-G-1203-S	☑	S	1.000 mL	13.1	0.085 ng	1.	84.944 ng/L	10.0	93.656 ng/L		
29	5	4	ENSR 12/10	RFIMW-15-G-1203-S	☑	S	5.000 mL	1.4	0.000 ng	1.	0.000 ng/L	3.0	0.065 ng/L		
30	6	1	{Analysis}	CCB2	☐	IB	100.000 mL	1.8	0.013 ng	1.	0.131 ng/L		0.131 ng/L		
31	7	2	{Analysis}	CCV2	☐	CV	100.000 mL	274	1.979 ng	1.	19.791 ng/L		19.791 ng/L		
32	9	3	ENSR 12/10	WH19-2F-G-1203-S	☐	S	5.000 mL	498	3.605 ng	1.	721.081 ng/L	5.0	757.244 ng/L		
33	10	4	ENSR 12/10	WH14-15-G-1203-S	☐	S	50.000 mL	460	3.330 ng	1.	66.590 ng/L	1.0	67.278 ng/L		
34	1	1	ENSR 12/10	WH13-15-G-1203-S	☐	S	50.000 mL	71.2	0.507 ng	1.	10.135 ng/L	3.0	10.505 ng/L		
35	2	2	ENSR 12/10	WH13-15-G-1203-S MD	☐	MD	50.000 mL	64.7	0.460 ng	1.	9.191 ng/L	3.0	9.532 ng/L		
36	3	3	ENSR 12/10	WH13-15-G-1203-S MS	☐	MS	50.000 mL	296	2.139 ng	1.	42.777 ng/L	3.0	44.126 ng/L		41.2400
37	5	4	ENSR 12/10	WH13-15-G-1203-S MSD	☐	MSD	50.000 mL	324	2.342 ng	1.	46.843 ng/L	3.0	48.313 ng/L		41.2400
38	6	1	ENSR 12/9	PM4NA-G-1203-S	☐	S	10.000 mL	48.7	0.343 ng	1.	34.341 ng/L	50.0	52.600 ng/L		
39	7	2	ENSR 12/9	RFIMW-07-1203-S	☐	S	5.000 mL	83.2	0.594 ng	1.	118.776 ng/L	2.0	121.196 ng/L		
40	9	3	ENSR 12/10	RFIMW-06-G-1203-S	☐	S	5.000 mL	222	1.602 ng	1.	320.319 ng/L	1.0	323.544 ng/L		
41	10	4	ENSR 12/10	RFIMW-11-G-1203-S	☐	S	100.000 mL	22.2	0.151 ng	1.	1.510 ng/L	3.0	1.621 ng/L		
42	1	1	{Analysis}	CCB3	☐	IB	100.000 mL	1	0.007 ng	1.	0.073 ng/L		0.073 ng/L		
43	2	2	{Analysis}	CCV3	☐	CV	100.000 mL	274	1.979 ng	1.	19.791 ng/L		19.791 ng/L	99.0%	20.0000
44	3	3	ENSR 12/10	RFIMW-12-G-1203-S	☐	S	100.000 mL	180	1.297 ng	1.	12.967 ng/L	10.0	14.481 ng/L		
45	5	4	ENSR 12/10	RFIMW-15-G-1203-S	☐	S	100.000 mL	41.5	0.291 ng	1.	2.911 ng/L	3.0	3.064 ng/L		
46	6	1	{Analysis}	CCB4	☐	IB	100.000 mL	2.9	0.021 ng	1.	0.211 ng/L		0.211 ng/L		
47	7	2	{Analysis}	CCV4	☐	CV	100.000 mL	280	2.023 ng	1.	20.227 ng/L		20.227 ng/L	101.1%	20.0000

RFIMW-06-G-1203-S

~~WH12-15-G-1203-S~~

RFIMW-07-1203-S SPM 12/15/03

0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0

CCB1

CCV1

BGMW-1-G-1203-S

PM4NA-G-1203-S RF IMW-26-G-1203-D

RMFMW-06-1203-EB WH13-25-G-1203-S

RFIMW-06-G-1203-FB

PBW-3

PBW-2

PBW-1

0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0

NTST 1641d

ICB/BB

0.05ng ICV

4.0ng

2.0ng

0.50ng

0.10ng

x=20 x=1 chart speed= 1mm/min

SACOB MEYER
THg 12-03/215-1
12/15/03

START 12:07

END 19:02

CCW

CCB4

10	20	30	40	50	60	70	80	90	100
90	80	70	60	50	40	30	20	10	0

RFIMW-15-G-1203-S

RFIMW-12-G-1203-S

CCB3

CCW3

RFIMW-11-G-1203-S

RFIMW-06-G-1203-S

RMIMW-07-1203-S

PM4WA-G-1203-S

WH13-15-G-1203-S MSD

WH13-15-G-1203-S MS

WH13-15-G-1203-S MD

WH13-15-G-1203-S

WH14-15-G-1203-S

WH19-25-G-1203-S

CCW2

CCB2

10	20	30	40	50	60	70	80	90	100
90	80	70	60	50	40	30	20	10	0

RFIMW-15-G-1203-S

RFIMW-12-G-1203-S

WH15-15-G-1203-S WH14-25-G-1203-S

RFIMW-11-G-1203-S

WH14-15-G-1203-FB

WH13-15-G-1203-EB

TRAP #6 Reburn

RFIMW-06-G-1203-S

~~WH12-15-G-1203-S~~

RFIMW-07-1203-S 5PM 12/15/03

Frontier Geosciences

Dataset for CV.AFS Analysis

Analysis Method: FGS-069

THg

Dataset ID: THg08-040202-1
Analyst: cindym
Data Prep: cindym
Analysis Date: 2/2/2004

Project List:

No	HiQA	Sample Group		Corrections: Inst. Blank	Prep Blank	MSA	Effic Factor
3	☐	PARAMETRIX 1/13/04 *Prep Method:	THg BrCl Oxidation	Yes-1	Yes-2	No	No
4	☐	PARAMETRIX 1/23/04 *Prep Method:	THg BrCl Oxidation	Yes-1	Yes-2	No	No
5	☐	CDWR 1/22/04 *Prep Method:	THg BrCl Oxidation	Yes-1	Yes-2	No	No
6	☐	ENSR 12/4/03 *Prep Method:		No	No	No	No

Analytical Remarks:

No analytical issues to report.

QUALITY ASSURANCE
PEER-REVIEWED

INITIALS: 2-2-04

Validator:

Printed: 2/2/2004 4:14:48 P

Frontier Geosciences

Dataset for CV.AFS Analysis

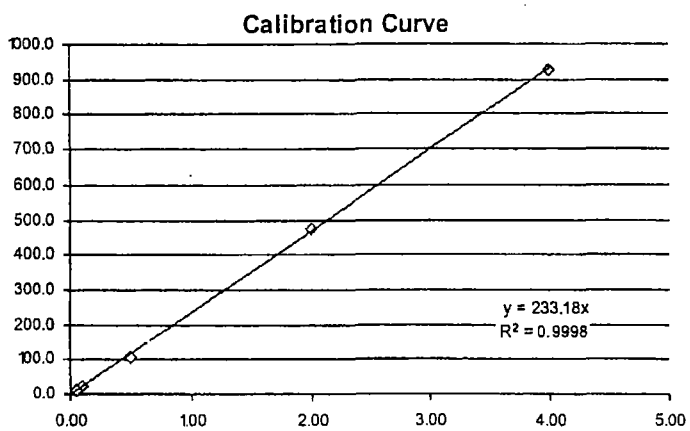
Dataset ID: THg08-040202-1
Analyst: cindym
Date: 2/2/2004

Calibration Data for THg

ng vs. Measured Intensity

Slope: 233.17705 *R:* 0.99988
SE: 5.38976 *Obs:* 5

True Value-x	IBC Intensity-y	Calc Value	Calc Intensity
0.1000	23.6000	0.1012	23.3177
0.5000	109.2000	0.4683	116.5885
2.0000	475.2000	2.0379	466.3541
4.0000	929.2000	3.9850	932.7082
0.0500	11.8000	0.0506	11.6589



Instrument Blank (IB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	Intensity
1	THg	5	0.034	0.021	0.063	ng/L	0.8

Preparation Blank (PB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	PB1	PB2	PB3	PB4
2	THg	3	0.053	0.017	0.052	ng/L	0.034	0.056	0.069	

MSA Sets

QC Sets

Sample	Analyte	Sample	Duplicate	Triplicate	Spike	Spike Dup	Spike TV	Spike Dup TV
KEKAULANA 1/10/04 AMB	THg	1.922	1.944		9.407	9.580	8.081	8.081
	ng/L	Avg=1.933	1.1% RPD			2.3% RPD	92.5%Rec	94.6%Rec
LK O A DAM BTM MD	THg	0.666	0.735					
	ng/L	Avg=0.701	9.9% RPD					
LK O MN BTM	THg	0.675			6.072	6.028	5.051	5.050
	ng/L	Avg=0.675				0.8% RPD	106.9%Rec	106.0%Rec

Frontier Geoscie

Dataset for CV.AFS Analysis

Dataset ID: THg08-040202-1
Analyst: cindym
Date: 2/2/2004

Run	Trap	Pos	Sample Group	Sample ID	Type	Aliquot	Inten	Inst Value	Dil	[Liquid Gross]	%Pres	[Liquid Net]	Rec	TV
1	1	1	{Analysis}	0.10 ng	CAL	100.000 mL	24.4	0.101 ng	1.	1.012 ng/L		1.012 ng/L	101.2%	0.1000
2	2	2	{Analysis}	0.50 ng	CAL	100.000 mL	110	0.468 ng	1.	4.683 ng/L		4.683 ng/L	93.7%	0.5000
3	3	3	{Analysis}	2.00 ng	CAL	100.000 mL	476	2.038 ng	1.	20.379 ng/L		20.379 ng/L	101.9%	2.0000
4	4	4	{Analysis}	4.00 ng	CAL	100.000 mL	930	3.985 ng	1.	39.850 ng/L		39.850 ng/L	99.6%	4.0000
5	5	1	{Analysis}	0.05 ng	CAL	100.000 mL	12.6	0.051 ng	1.	0.506 ng/L		0.506 ng/L	101.2%	0.0500
6	6	2	{Analysis}	ICV	CV	100.000 mL	352	1.506 ng	1.	15.062 ng/L		15.062 ng/L	100.4%	15.0000
7	7	3	{Analysis}	ICB/BB	IB	100.000 mL	1	0.004 ng	1.	0.043 ng/L		0.043 ng/L		
8	8	4	{BATCH QC}	NIST 1641d (200X)	LCS	0.200 mL	358	1.532 ng	200.	1531883.146 ng/L	2.0	1562520.702 ng/L	97.6%	1601000.0000
9	9	1	{BATCH QC}	PBW1	PB	100.000 mL	1.6	0.003 ng	1.	0.034 ng/L		0.034 ng/L		
10	10	2	{BATCH QC}	PBW2	PB	100.000 mL	2.1	0.006 ng	1.	0.056 ng/L		0.056 ng/L		
11	1	3	{BATCH QC}	PBW3	PB	100.000 mL	2.4	0.007 ng	1.	0.069 ng/L		0.069 ng/L		
12	2	4	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 AMB	S	100.000 mL	46.4	0.196 ng	1.	1.956 ng/L	1.0	1.922 ng/L		
13	3	1	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 COMP	S	100.000 mL	45.4	0.191 ng	1.	1.913 ng/L	1.0	1.879 ng/L		
14	4	2	PARAMETRIX 1/13/04	KEKAULANA 1/09/04 AMB	S	100.000 mL	36.4	0.153 ng	1.	1.527 ng/L	1.0	1.489 ng/L		
15	5	3	PARAMETRIX 1/13/04	KEKAULANA 1/09/04 COMP	S	100.000 mL	36.8	0.154 ng	1.	1.544 ng/L	1.0	1.506 ng/L		
16	6	4	PARAMETRIX 1/23/04	KEKAULANA 1/21/04 AMB	S	100.000 mL	24	0.099 ng	1.	0.995 ng/L	1.0	0.952 ng/L		
17	7	1	PARAMETRIX 1/23/04	KEKAULANA 1/21/04 COMP	S	100.000 mL	27	0.112 ng	1.	1.124 ng/L	1.0	1.082 ng/L		
18	8	2	{Analysis}	CCV1	CV	100.000 mL	472	2.021 ng	1.	20.208 ng/L		20.208 ng/L	101.0%	20.0000
19	9	3	{Analysis}	CCB1	IB	100.000 mL	1	0.004 ng	1.	0.043 ng/L		0.043 ng/L		
20	10	4	CDWR 1/22/04	LK O A DM SFC	S	100.000 mL	12.4	0.050 ng	1.	0.497 ng/L	1.0	0.450 ng/L		
21	1	1	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 AMB MD	MD	100.000 mL	46.9	0.198 ng	1.	1.977 ng/L	1.0	1.944 ng/L		
22	2	2	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 AMB MS	MS	50.000 mL	110	0.468 ng	1.	9.366 ng/L	1.0	9.407 ng/L		8.0808
23	3	3	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 AMB MSD	MSD	50.000 mL	112	0.477 ng	1.	9.538 ng/L	1.0	9.580 ng/L		8.0808
24	4	4	CDWR 1/22/04	LK O A DM MID	S	100.000 mL	15	0.061 ng	1.	0.609 ng/L	1.0	0.562 ng/L		
25	5	1	CDWR 1/22/04	LK O A DM BTM	S	100.000 mL	17.4	0.071 ng	1.	0.712 ng/L	1.0	0.666 ng/L		
26	6	2	CDWR 1/22/04	LK O MN SFC	S	100.000 mL	12.2	0.049 ng	1.	0.489 ng/L	1.0	0.441 ng/L		
27	7	3	CDWR 1/22/04	LK O MN BTM	S	100.000 mL	17.6	0.072 ng	1.	0.720 ng/L	1.0	0.675 ng/L		
28	8	4	CDWR 1/22/04	LK O SF SFC	S	100.000 mL	17.8	0.073 ng	1.	0.729 ng/L	1.0	0.683 ng/L		
29	9	1	CDWR 1/22/04	LK O SF BTM	S	100.000 mL	17	0.069 ng	1.	0.695 ng/L	1.0	0.649 ng/L		
30	10	2	{Analysis}	CCV2	CV	100.000 mL	472	2.021 ng	1.	20.208 ng/L		20.208 ng/L	101.0%	20.0000
31	1	3	{Analysis}	CCB2	IB	100.000 mL	1.4	0.006 ng	1.	0.060 ng/L		0.060 ng/L		
32	2	4	CDWR 1/22/04	T AFBY N SFC	S	100.000 mL	16.5	0.067 ng	1.	0.673 ng/L	1.0	0.627 ng/L		
33	3	1	CDWR 1/22/04	LK O A DAM BTM MD	MD	100.000 mL	19	0.078 ng	1.	0.781 ng/L	1.0	0.735 ng/L		
34	4	2	CDWR 1/22/04	LK O MN BTM MS	MS	50.000 mL	71.5	0.303 ng	1.	6.064 ng/L	1.0	6.072 ng/L		5.0505
35	5	3	CDWR 1/22/04	LK O MN BTM MSD	MSD	50.000 mL	71	0.301 ng	1.	6.021 ng/L	1.0	6.028 ng/L		5.0500
36	6	4	CDWR 1/22/04	T AFBY N BTM	S	100.000 mL	20	0.082 ng	1.	0.823 ng/L	1.0	0.779 ng/L		
37	7	1	CDWR 1/22/04	T FOBY S SFC	S	100.000 mL	17	0.069 ng	1.	0.695 ng/L	1.0	0.649 ng/L		
38	8	2	CDWR 1/22/04	T FOBY S BTM	S	100.000 mL	18	0.074 ng	1.	0.738 ng/L	1.0	0.692 ng/L		
39	9	3	CDWR 1/22/04	T AFBY S SFC	S	100.000 mL	17.7	0.072 ng	1.	0.725 ng/L	1.0	0.679 ng/L		
40	10	4	CDWR 1/22/04	T AFBY S BTM	S	100.000 mL	19.1	0.078 ng	1.	0.785 ng/L	1.0	0.740 ng/L		
41	1	1	CDWR 1/22/04	T FOBY N BTM	S	100.000 mL	16.8	0.069 ng	1.	0.686 ng/L	1.0	0.640 ng/L		
42	2	2	{Analysis}	CCV3	CV	100.000 mL	466	1.995 ng	1.	19.951 ng/L		19.951 ng/L	99.8%	20.0000
43	3	3	{Analysis}	CCB3	IB	100.000 mL	0.4	0.002 ng	1.	0.017 ng/L		0.017 ng/L		
44	4	4	CDWR 1/22/04	GLEN POND	S	100.000 mL	64.4	0.273 ng	1.	2.728 ng/L	1.0	2.702 ng/L		
45	5	1	CDWR 1/22/04	GLEN C US GLEN POND	S	100.000 mL	46.6	0.196 ng	1.	1.964 ng/L	1.0	1.931 ng/L		
46	6	2	CDWR 1/22/04	MORRIS RAVINE	S	100.000 mL	63.5	0.269 ng	1.	2.689 ng/L	1.0	2.663 ng/L		

eosciences

Dataset for CV.AFS Analysis

Dataset ID: THg08-040202-1
Analyst: cindym
Date: 2/2/2004

Run	Trap	Pos	Sample Group	Sample ID	Type	Aliquot	Intens	Inst Value	Dil	[Liquid Gross]	%Res	[Liquid Net]	Rec	TV
47	7	3	ENSR 12/4/03	RFIMW-09-6-1203-EB	S	100.000 mL	7	0.030 ng	1.	0.300 ng/L	1.0	0.303 ng/L		
48	8	4	CDWR 1/22/04	T FOBY N SFC	S	100.000 mL	18.5	0.076 ng	1.	0.759 ng/L	1.0	0.714 ng/L		
49	9	1	{Analysis}	CCV4	CV	100.000 mL	470	2.012 ng	1.	20.122 ng/L		20.122 ng/L	100.6%	20.0000
50	10	2	{Analysis}	CCB4	IB	100.000 mL	0.2	0.001 ng	1.	0.009 ng/L		0.009 ng/L		

end 1614

CCB4 CCV4

T FOBY N SFC

RFIMW-09-6-1203 EB

Morris Ravine

Glen CUS Glen Pond

Glen CUS Glen Pond

Glen Pond

CCB3 CCV3

T FOBY N BTM

T AFBY S BTM

T AFBY S SFC

T FOBY S BTM

~~T FOBY SFC S~~ T FOBY S SFC

T AFBY N BTM

LK O MN BTM MSD

LK O MN BTM MS

LK O A DAM BTM MD

T AFBY N SFC

CCB2 CCV2

LK O SF btm

LK O SF SFC

LK O mn Btm

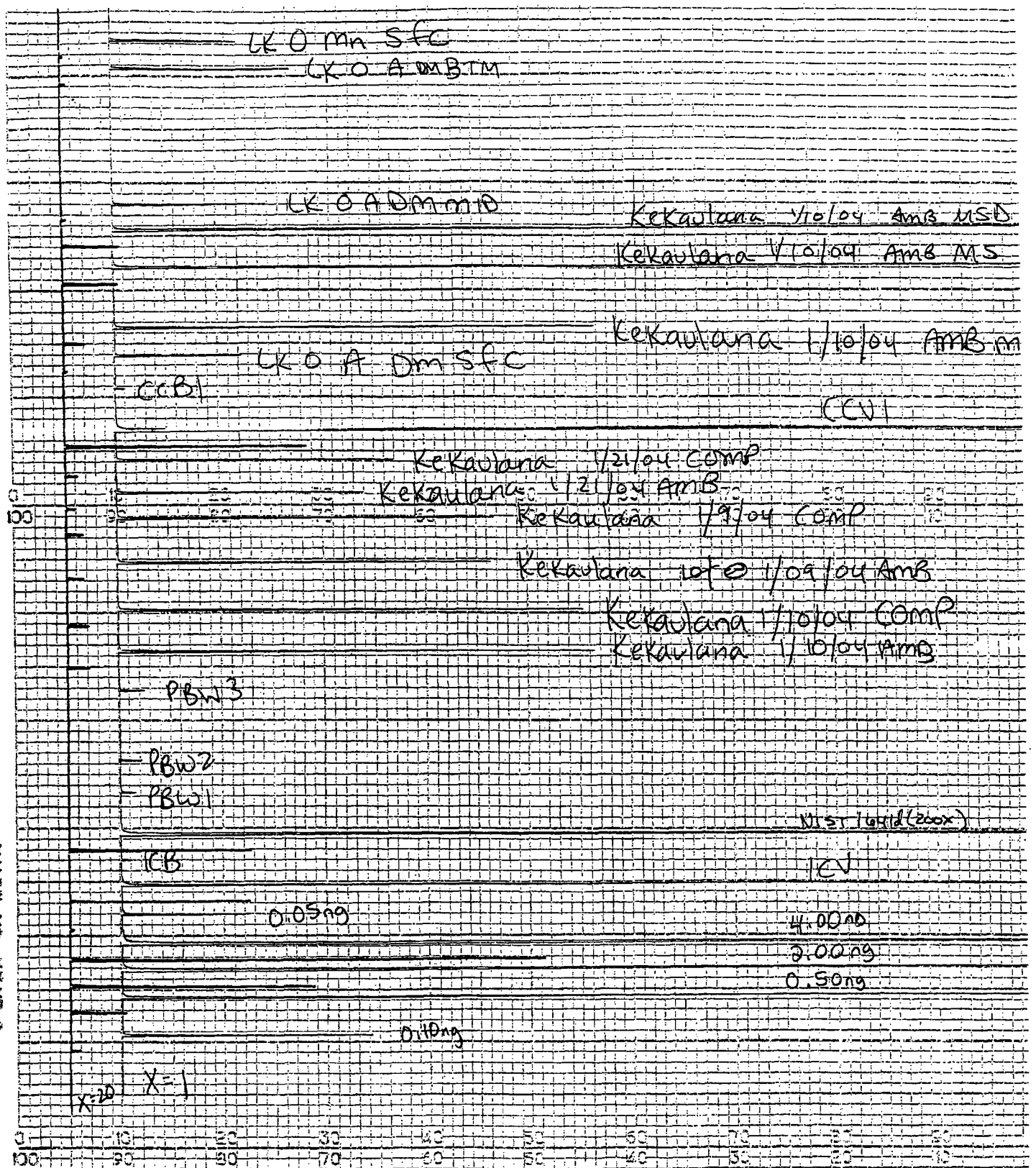
LK O mn SFC

LK O A MBTM

LK O A DM MID

Kekaulana 1/10/04 AMB MSD

Kekaulana 1/10/04 AMB MS



THg8-040202-1

Chart Speed = 1mm/min

Start 1011

Cindy Moulder

Cindy Moulder

APPENDIX C

FLUX CALCULATIONS

ENSR INTERNATIONAL

Memorandum

To:	Bruce Roberts, BASF	**Date:**	25 June 2004
From:	Marcia Greenblatt, ENSR Mark Gerath, ENSR	**File:**	
RE:	Updated Estimate of COC fluxes	**CC:**	Tim Adams, ENSR

In September 2003, ENSR calculated flux estimates of COCs potentially discharging from the Northworks site into the Detroit River. Constituent fluxes were calculated at all locations where there was a measured exceedence of the Michigan Guidelines for Protection of Surface Water, Part 201 Groundwater-Surface water Interface (GSI) criteria. Existing data was used in the calculation, and at locations where multiple rounds of sampling had been performed, an average concentration at each location was calculated and used in the flux estimate. Wells were assigned to flow tubes, and groundwater flow in each tube was estimated in the Waterloo Hydrogeologic groundwater modeling study. Net COC fluxes (including inflow to the site and outflow from the site) were summed across the site and presented in the memo dated 4 September 2003.

Also included in the September 2003 memo was a recommended sampling plan, to resample many of the wells, and to sample other wells that had not been sampled, to improve the distribution of the wells included in the flux estimate. Mercury was sampled at 24 locations, 12 of which were locations where mercury was previously detected. At 12 of these locations, metals and PAHs were also sampled. Sampling methodology (which included low-flow sampling) was designed to include low detection mercury and metals detection limits. The additional sampling was performed in December 2003.

The COC flux estimation was recalculated to include the new metals and PAH data. Data were incorporated into the calculation in the following manner:

- Only new mercury data were included, collected at 24 locations using sensitive sampling and laboratory methods.
- Only mercury data from the newly installed background well, BG-MW-1, was used to estimate flux inflow onto the site.
- Where new metals data were available, collected with low-flow sampling techniques, only these data were included. At other locations, where no additional metals data were collected, historic metals data were included in the flux estimates.

The methodology for inclusion of other data follows that described in the September 2003 memo. Flux estimates were recalculated for two scenarios, a worst-case scenario and average scenario, which differ in the estimated groundwater flow rate across the site.

The estimated total potential loads to the river for each COC and the percentage of the total load contributed by each well are presented in Table 1 (average scenario) and Table 2 (worst-case scenario). A comparison of the results for the two estimates (the initial estimate presented in the September 2003 memo and the estimate including the 2003 data) is presented in Table 3. Some of the increases in net change between the two estimates can be attributed to high detection limits reported for non-detects in the 2003 data. In particular, PAHs at one location were reported with a high detection limit (relative to the GSI criteria). Detection limits were high relative to the GSI criteria for antimony and silver at all locations. Results for the two estimates may also differ because of the increased number of wells included in the present calculation, which now contribute (even very small amount) to the total flux where there was no contribution in the previous estimate. Table 4 presents a comparison of metals data at all locations where historical and new data were available. In many locations, some or all of the metals were not detected in any of the sampling events. In other locations (in particular RFIMW-26), most or all of the metal concentrations were lower or not detected when sampled with the low-flow techniques.

Estimated mercury loads ranged from 0.2 to 0.38 g/day, similar to the previous estimates. Table 5 presents a comparison of recent mercury results compared with average historical results. In general, measured mercury concentrations were one to three orders of magnitude lower in the most recent sampling event compared with earlier results. However, high mercury concentration was detected at CMS-MW-08, which is in the vicinity of the highest previously estimated mercury flux (driven by the relatively high historic concentration in WHI9-2F). Both of these wells are located in a region where predicted groundwater flow to the river is high, which, combined with a high concentration of mercury, dominates the flux estimate. Thus the presence of elevated mercury in this area is confirmed and it may be productive to focus potential groundwater remedies in this location.

Overall, COC fluxes to the river are low for most constituents, and generally not considered an issue as they are not bioaccumulators. If you have any questions, please call Marcia Greenblatt or Mark Gerath at 978-589-3000.

Table 1:
Summary of Estimated Constituent Fluxes by Flow Tube and Well ID
Average Scenario

Flux Direction	Flux In																					Total In
Flow Tube	A						B					C										g/day
Well Name	RFIMW 24	WHI2-1S	WHI2-2S	WHI2-2S	BG-MW-1	WHI2-3S	RFIMW 25	WHI3-1S	WHI3-2S	BG-MW-1	WHI3-3S	RFIMW 26	RFIMW 27	WHI4-1S	WHI4-2S	P-15-N	P-15-N	BG-MW-1	P-36-N	P-36-N		
Aquifer Unit	NS	NS	NS	F	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	F	NS	NS	F		
1,2,4-Trichlorobenzene																						
1,2-Dichloroethane																						
1,2-Dichloropropane																42%	58%					0.1
1,4-Dichlorobenzene																						
1,4-Dioxane																						
2-Chlorophenol																						
3-Methylphenol																						
4-Chloro-3-methylphenol																						
4-Methylphenol																						
Acenaphthene																						
Acetone																						
Antimony					53%			12%		12%		10%		10%				5%				0.02
Arsenic								9%				2%		1%					17%	71%		0.14
Barium												68%		32%								0.05
Benzene																						
bis(2-Chloroethyl) ether																						
bis(2-Ethylhexyl) phthalate		80%				12%		1.8%			1.4%								1%	4%		3.52
Cadmium			67%	33%																		0.02
Chlorobenzene																						
Chromium	63%						33%	0.5%				4%		0.0%								1.51
Copper	10.0%	13.7%	37%	18%			4.6%	1.5%	3.6%			0.9%	2.2%	2%	6.1%							0.6
Dinoseb									100%													0.003
Ethylbenzene																						
Fluoranthene																						
Lead			48%	24%			0.7%	2.0%	2.0%			0.2%		1%	23%							0.87
Mercury					76%					17%								7%				0.0001
Methylene chloride																						
m-Xylene & p-Xylene																						
Naphthalene																						
Nickel	64%						27.0%	1.7%				7%		0.4%								0.43
Pentachlorophenol																						
Phenol																						
Selenium	81%											19%										0.01
Silver					33%			7%		7%		6%	37%	6%				3%				0.01
Total Cyanide																						
Vanadium	9.4%	20%	30%	15%			6.1%	3%	7.2%				1.7%		6%	1%	1%					0.45
Vinyl chloride																						
Zinc			51%	25%			4.3%	2%	6.0%			0%	5.5%	0%	6%							2.29

Flux Direction	Flux Out																																													Total Out	Net[1]
Flow Tube	D		E						F		G					H		I								J																			g/day	g/day
Well Name	RFIMW 28	P-34-N	CMSMW-13S	PM1NA	RFIMW 29	PM4NA	CMSMW-13F	RFIMW 11	RFIMW 12	RFIMW 09	RFIMW 10	WHI9-2S	CMS-MW 08	WHI9-2F	RFIMW 08	RFIMW 07	RFIMW 01	RFIMW 02	RFIMW 03	RFIMW 13	RFIMW 15	RFIMW 04	RFIMW 05	RFIMW 06	RFIMW 01	RFIMW 13	RFIMW 22	RFIMW 23	WHI1-3S	CMSMW 02		
Aquifer Unit	NS	F	NS	NS	NS	NS	F	NS	F	NS	NS	NS	F	F	NS	F	NS	NS	NS	NS	NS	F	F	F	NS	NS	NS	NS	NS	F		
1,2,4-Trichlorobenzene					12%																						88%				0.2	(0.19)
1,2-Dichloroethane														33%						3%						13%	51%				0.3	(0.32)
1,2-Dichloropropane														19%										57%			24%				0.7	(0.63)
1,4-Dichlorobenzene					11%																						89%				0.2	(0.18)
1,4-Dioxane																4.8%	3.4%			4.6%					13%	17%	57%				2.3	(2.25)
2-Chlorophenol					100%																										0.0	(0.02)
3-Methylphenol									88%									12%													0.3	(0.28)
4-Chloro-3-methylphenol					100%																										0.0	(0.03)
4-Methylphenol									88%									12%													0.3	(0.28)
Acenaphthene					100%																										0.0	(0.02)
Acetone																											100%				34.8	(34.8)
Antimony				5%	4%	6%		0.2%	2%	7%				35%		3%	0%			0%	1%				1%	1%	3%			31%	0.4	(0.38)
Arsenic	0.4%	10%		10%		7%		0.1%	1%												0.0%	61%					7%		3.4%		8.3	(8.2)
Barium											23%	16%			9%			1.5%	4.0%				46%								31.8	(31.7)
Benzene			1.1%														0.1%								0.3%		78%		20%		11.1	(11.1)
bis(2-Chloroethyl) ether																		8.4%									92%				0.3	(0.33)
bis(2-Ethylhexyl) phthalate																																3.52
Cadmium	0.7%			8%				0.3%		3%				85%				1.7%	0.8%		0%										0.1	(0.11)
Chlorobenzene																											100%				0.6	(0.59)
Chromium				6.9%	13%			0.4%	2%	36%								3.1%	2.4%		9.6%						9%		18%		2.2	(0.72)
Copper	0.5%	6%		2.7%	1.4%			0.9%	0.2%	0.4%				69%	1.1%	0.1%	0.0%	1.2%	1.2%	0.1%	0.4%	3.3%	3.1%	3.8%	0.1%	0.2%	1.2%	0.8%	2.7%		4.6	(4.05)
Dinoseb																																0.00
Ethylbenzene																24%											76%				0.2	(0.23)
Fluoranthene																												100%			0.1	(0.08)
Lead	0.1%	5%		1.6%	0.3%			0.3%	0.1%					91%				0.2%	0.5%		0.0%						0.2%		0.7%		5.9	(5.00)
Mercury	0%					0.0%		0.0%	0%	0%		0%	74%	14%	0%	0.2%	0%	0%		0%	0.0%	0%		2%	0%	0%	0%			9%	0.20	(0.201)
Methylene chloride																											100%				0.5	(0.5)
m-Xylene & p-Xylene																23%											77%				0.4	(0.42)
Naphthalene							30%							55%		16%															1.3	(1.26)
Nickel	0.6%	12%		5.0%	18%			0.3%	3%	14%								1.9%	2.3%		39.6%						4%				3.2	(2.82)
Pentachlorophenol					100%																										0.04	(0.04)
Phenol									67%							14%											19%				2.7	(2.72)
Selenium									3.9%							8%							50%	21%			6%		10.8%		0.2	(0.20)
Silver						2%			2%	9%				37%		4%	0%			0%	1%				2%	2%	3%			38%	0.1	(0.10)
Total Cyanide				9.3%																							91%				148.7	(148.7)
Vanadium	0.4%	7%		1.9%	0.9%	2%		0.1%	1%					33%				0.7%	0.9%								27%		26%		6.1	(5.64)
Vinyl chloride																											100%				0.8	(0.83)
Zinc	0.9%	20%		6.6%				0.6%	0.4%	1.8%				53%	11.9%			2.3%	2.1%	0.2%	0.2%					0.8%					7.3	(4.99)

Note:
[1]Negative number indicates a net flux off-site

6/26/2004

Table 2:
Summary of Estimated Constituent Fluxes by Flow Tube and Well ID
Worst-Case Scenario

Flux Direction	Flux In																				Total In
Flow Tube	A						B					C									g/day
Well Name	RFIMW 24	WHI2-1S	WHI2-2S	WHI2-2S	BG-MW-1	WHI2-3S	RFIMW 25	WHI3-1S	WHI3-2S	BG-MW-1	WHI3-3S	RFIMW 26	RFIMW 27	WHI4-1S	WHI4-2S	P-15-N	P-15-N	BG-MW-1	P-36-N	P-36-N	
Aquifer Unit	NS	NS	NS	F	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	F	NS	NS	F	
1,2,4-Trichlorobenzene																					
1,2-Dichloroethane																					
1,2-Dichloropropane																34%	66%				0.2
1,4-Dichlorobenzene																					
1,4-Dioxane																					
2-Chlorophenol																					
3-Methylphenol																					
4-Chloro-3-methylphenol																					
4-Methylphenol																					
Acenaphthene																					
Acetone																					
Antimony					59%			10%		10%		8%		8%				4%			0.07
Arsenic								7%				1%		1%					13%	77%	0.58
Barium												68%		32%							0.17
Benzene																					
bis(2-Chloroethyl) ether																					
bis(2-Ethylhexyl) phthalate		81%				12%		1.4%			1.1%								1%	4%	14.25
Cadmium			62%	38%																	0.09
Chlorobenzene																					
Chromium	68%						28%	0.4%				3%		0.0%							5.66
Copper	10.0%	13.7%	37%	23%			3.7%	1.2%	2.8%			0.7%	1.8%	2%	4.8%						2.3
Dinoseb									100%												0.009
Ethylbenzene																					
Fluoranthene																					
Lead			48%	30%			0.6%	1.6%	1.6%			0.1%		0%	18%						3.54
Mercury					80%					14%								6%			0.0003
Methylene chloride																					
m-Xylene & p-Xylene																					
Naphthalene																					
Nickel	69%						23.1%	1.4%				6%		0.3%							1.61
Pentachlorophenol																					
Phenol																					
Selenium	84%											16%									0.06
Silver					39%			7%		7%		6%	34%	6%				3%			0.04
Total Cyanide																					
Vanadium	9.5%	20%	30%	19%			4.9%	2%	5.8%				1.4%		5%	1%	1%				1.81
Vinyl chloride																					
Zinc			50%	31%			3.3%	1%	4.7%			0%	4.3%	0%	5%						9.42

Flux Direction	Flux Out																														Total Out	Net[1]
Flow Tube	D		E					F		G					H		I								J						g/day	g/day
Well Name	RFIMW 28	P-34-N	CMSMW-13S	PM1NA	RFIMW 29	PM4NA	CMSMW-13F	RFIMW 11	RFIMW 12	RFIMW 09	RFIMW 10	WHI9-2S	CMS-MW 08	WHI9-2F	RFIMW 08	RFIMW 07	RFIMW 01	RFIMW 02	RFIMW 03	RFIMW 13	RFIMW 15	RFIMW 04	RFIMW 05	RFIMW 06	RFIMW 01	RFIMW 13	RFIMW 22	RFIMW 23	WHI1-3S	CMSMW 02		
Aquifer Unit	NS	F	NS	NS	NS	NS	F	NS	F	NS	NS	NS	F	F	NS	F	NS	NS	NS	NS	NS	F	F	F	NS	NS	NS	NS	NS	F		
1,2,4-Trichlorobenzene					10%																						90%				0.9	(0.91)
1,2-Dichloroethane														14%						4%						16%	65%				1.2	(1.24)
1,2-Dichloropropane														10%										54%			36%				2.2	(2.04)
1,4-Dichlorobenzene					9%																						91%				0.9	(0.90)
1,4-Dioxane																4.2%	3.1%			4.2%					13%	18%	58%				11.0	(11.05)
2-Chlorophenol					100%																										0.1	(0.10)
3-Methylphenol									88%									12%													1.3	(1.25)
4-Chloro-3-methylphenol					100%																										0.1	(0.13)
4-Methylphenol									88%									12%													1.3	(1.25)
Acenaphthene					100%																										0.1	(0.10)
Acetone																											100%				173.3	(173.3)
Antimony				8%	6%	9%		0.7%	3%	5%				20%		4%	1%			1%	1%				2%	2%	4%			34%	1.1	(1.07)
Arsenic	0.5%	8%		12%		8%		0.4%	1%												0.0%	55%					11%		4.9%		29.2	(28.6)
Barium											17%	12%			11%			2.4%	6.5%				52%								88.7	(88.5)
Benzene			0.9%														0.1%								0.3%		79%		20%		54.9	(54.9)
bis(2-Chloroethyl) ether																		7.6%									92%				1.7	(1.65)
bis(2-Ethylhexyl) phthalate																																14.25
Cadmium	1.7%			17%				1.2%		3%				71%				3.8%	1.7%		1%										0.3	(0.17)
Chlorobenzene																											100%				2.9	(2.94)
Chromium				7.7%	14%			1.1%	2%	20%								3.7%	2.9%		11.6%						12%		24%		8.2	(2.57)
Copper	1.0%	7%		4.8%	2.5%			3.8%	0.3%	0.3%				50%	1.5%	0.3%	0.0%	2.2%	2.3%	0.1%	0.7%	4.4%	4.1%	5.1%	0.1%	0.4%	2.5%	1.6%	5.7%		10.9	(8.59)
Dinoseb																																0.01
Ethylbenzene																22%											78%				1.1	(1.11)
Fluoranthene																												100%			0.4	(0.40)
Lead	0.2%	7%		3.5%	0.7%			1.6%	0.2%					83%				0.5%	1.1%		0.1%						0.4%		1.9%		11.0	(7.41)
Mercury	0%					0.1%		0.0%	0%	0%		0%	68%	13%	0%	0.5%	0%	0%		0%	0.0%	0%		4%	0%	0%	0%			14%	0.37	(0.375)
Methylene chloride																											100%				2.5	(2.5)
m-Xylene & p-Xylene																21%											79%				2.0	(2.05)
Naphthalene							34%							38%		28%															3.0	(3.05)
Nickel	0.7%	8%		5.3%	19%			0.8%	3%	7%								2.2%	2.6%		45.5%						5%				12.6	(11.01)
Pentachlorophenol					100%																										0.16	(0.16)
Phenol									66%							14%											20%				12.4	(12.36)
Selenium									4.8%							10%							44%	18%			8%		14.9%		0.8	(0.71)
Silver						3%			3%	7%				23%		6%	1%			1%	1%				3%	3%	6%			44%	0.3	(0.27)
Total Cyanide				7.8%																							92%				728.3	(728.3)
Vanadium	0.5%	5%		2.1%	1.0%	2%		0.3%	2%					15%				0.8%	1.1%								36%		34%		22.6	(20.77)
Vinyl chloride																											100%				4.1	(4.13)
Zinc	1.7%	22%		11.0%				2.4%	0.7%	1.5%				36%	15.0%			4.1%	3.8%	0.4%	0.3%					1.6%					18.1	(8.65)

Note:
[1]Negative number indicates a net flux off-site

8/12/2004

Table 3
Comparison of Off-site Fluxes Estimated with and without 2003 Data

	Pre-2003 Data			With 2003 Data			
	Total In	Total Out	Net	Total In	Total Out	Net	
Constituent	g/day	g/day	g/day	g/day	g/day	g/day	Net Change
1,2,4-Trichlorobenzene		0.0	(0.02)		0.2	(0.19)	+
1,2-Dichloroethane		0.1	(0.06)		0.3	(0.32)	+
1,2-Dichloropropane	0.1	0.4	(0.33)	0.1	0.7	(0.63)	+
1,4-Dichlorobenzene		0.0	(0.02)		0.2	(0.18)	+
1,4-Dioxane		1.3	(1.25)		2.3	(2.25)	+
2-Chlorophenol		0.0	(0.02)		0.0	(0.02)	
3-Methylphenol		0.3	(0.28)		0.3	(0.28)	
4-Chloro-3-methylphenol		0.0	(0.03)		0.0	(0.03)	
4-Methylphenol		0.3	(0.28)		0.3	(0.3)	
Acenaphthene		0.0	(0.02)		0.0	(0.02)	
Acetone		35.0	(35.0)		34.8	(34.8)	-
Antimony	0.35	0.0	0.32	0.01	0.4	(0.4)	+
Arsenic	0.32	8.9	(8.6)	0.14	7.8	(7.6)	-
Barium	0.90	31.8	(30.9)	0.05	31.8	(31.75)	+
Benzene		11.3	(11.3)		11.1	(11.06)	-
bis(2-Chloroethyl) ether		0.3	(0.30)		0.3	(0.33)	+
bis(2-Ethylhexyl) phthalate	3.52		3.52	3.52		3.52	
Cadmium	0.02	0.0	(0.01)	0.02	0.1	(0.11)	+
Chlorobenzene		0.2	(0.19)		0.6	(0.59)	+
Chromium	3.55	1.8	1.79	1.51	2.2	(0.72)	+
Copper	6.2	33.0	(26.77)	0.6	4.6	(4.05)	-
Dinoseb	0.00		0.00	0.00		0.00	
Ethylbenzene		0.1	(0.06)		0.2	(0.23)	+
Fluoranthene		0.1	(0.08)		0.08	(0.081)	
Lead	4.55	84.9	(80.32)	0.87	5.9	(5.0)	-
Mercury	0.09	0.17	(0.077)	0.00	0.20	(0.20)	+
Methylene chloride		0.5	(0.5)		0.5	(0.50)	+
m-Xylene & p-Xylene		0.1	(0.10)		0.4	(0.42)	+
Naphthalene		1.9	(1.94)		1.3	(1.26)	-
Nickel	1.16	2.5	(1.39)	0.43	3.2	(2.82)	+
Pentachlorophenol		0.0	(0.04)		0.0	(0.04)	
Phenol		2.5	(2.45)		2.7	(2.72)	+
Selenium	0.01	0.3	(0.26)	0.01	0.2	(0.2)	-
Silver	0.00		0.00	0.01	0.1	(0.10)	+
Total Cyanide		148.7	(148.7)		148.7	(148.70)	
Vanadium	0.77	12.7	(11.94)	0.45	6.0	(5.52)	-
Vinyl chloride		0.8	(0.81)		0.8	(0.83)	+
Zinc	3.09	44.3	(41.24)	2.29	7.3	(4.99)	-

Table 4
Metals in Groundwater (mg/L)
Comparison of Historic and 2003 Data

RFIMW 01

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
1997-06-02	0.005 U	0.0059	0.24	0.005 U	0.001 U	0.005 U	0.05 U	0.014 U*	0.003 U	0.04 U	0.005 U	0.01 U	0.01 U	1 UJ	0.02 U	0.021 U*
1996-09-25	0.005 U	0.005 U	0.24	0.005 U	0.001 U	0.055	0.05 U	0.02	0.003 U	0.04 U	0.005 U	0.01 U	0.01 U	1 U	0.02 U	0.043 R
1996-12-17	0.005 U	0.005 U	0.27	0.005 U	0.001 U	0.0091	0.05 U	0.01 U	0.003 UJ	0.04 U	0.005 U	0.01 U	0.01 UJ	1 U	0.02 U	0.02 U
1997-03-24	0.005 U	0.005 U	0.27	0.005 U	0.001 U	0.005 U	0.05 U	0.01 U	0.003 UJ	0.04 U	0.005 U	0.01 U	0.01 UJ	1 UJ	0.02 U	0.032 U*
2003-12-04	0.0031 U	0.0029 U	0.18	0.00047 U	0.00043 J+	0.0015	0.0011 J+	0.0018 UJ	0.0023 U	0.0043 J+	0.0039 UJ	0.0011 U	0.0071	0.0039 U	0.0054 J-	0.018 J+
2003-12-04	0.0031 U	0.0035 J+	0.19	0.00047 U	0.00036 U	0.0021	0.0014 J+	0.0018 UJ	0.0023 U	0.0035 J+	0.0039 UJ	0.0011 U	0.0082	0.0039 U	0.0056 J-	0.016 J+

RFIMW 07

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
1996-09-23	0.005 U	0.0096 J	0.13	0.005 U	0.001 U	0.063	0.05 U	0.032	0.0039	0.041	0.016	0.01 U	0.01 U	1 U	0.02 U	0.047 J
1996-12-18	0.005 U	0.0073	0.13	0.005 U	0.001 U	0.035	0.05 U	0.02 J	0.0038 U*	0.04 U	0.021	0.01 U	0.01 UJ	1 U	0.02 U	0.11 U*
1997-03-20	0.005 U	0.005 UJ	0.091	0.005 U	0.001 U	0.023	0.05 U	0.01 U	0.003 U	0.04 U	0.016 J	0.01 U	0.01 U	1 UJ	0.02 U	0.032 U*
1997-06-03	0.005 U	0.005 U	0.089	0.005 U	0.001 U	0.022	0.05 U	0.02 U*	0.003 U	0.04 U	0.023	0.01 U	0.01 U	1 UJ	0.02 U	0.039 U*
2003-12-08	0.0031 U	0.0029 U	0.086	0.00047 U	0.00036 U	0.0011 J	0.0011 U	0.0018 UJ	0.0023 U	0.0036 J+	0.0048 J-	0.0011 U	0.0056 U	0.0039 U	0.0013 J-	0.013 UJ

RFIMW 09

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
1996-09-23	0.005 U	0.005 U	0.15 J	0.005 U	0.0045	0.082	0.05 U	0.024	0.003 U	0.064	0.005 UJ	0.01 U	0.01 U	1 U	0.02 U	0.3
1996-12-18	0.005 U	0.025	0.22	0.005 U	0.001 U	0.005 U	0.05 U	0.01 U	0.003 UJ	0.04 U	0.005 U	0.01 U	0.01 UJ	1 U	0.02 U	0.028 U*
1997-06-04	0.005 U	0.025	0.2	0.005 U	0.001 U	0.005 U	0.05 U	0.016 U*	0.003 U	0.04 U	0.005 U	0.01 U	0.01 U	1 UJ	0.02 U	0.056 U*
1997-03-24	0.005 U	0.025 J	0.21	0.005 U	0.001 U	0.005 U	0.05 U	0.01 U	0.003 UJ	0.04 U	0.005 U	0.01 U	0.01 U	1 UJ	0.02 U	0.03 U*
2003-12-03	0.0031 U	0.023	0.16	0.00047 U	0.00036 U	0.088 J	0.0015 J+	0.0018 UJ	0.0023 U	0.048 J	0.0039 UJ	0.0011 U	0.0094	0.0039 U	0.00096 UJ	0.014 J+

RFIMW 12

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
1996-09-18	0.005 U	0.45	0.11	0.005 U	0.001 U	0.091	0.05 U	0.048	0.018	0.31	0.0098	0.01 U	0.01 U	1 U	0.4	0.15
1996-12-19	0.005 U	0.24	0.15	0.005 U	0.0013	0.074	0.05 U	0.032	0.015	0.2	0.0088 U*	0.01 U	0.01 U	1 U	0.25	0.12 U*
1997-03-21	0.005 U	0.36 J	0.048	0.005 U	0.001 U	0.059	0.05 U	0.01 U*	0.003 U	0.22	0.0073	0.01 U	0.01 U	1 UJ	0.36	0.034 U*
1997-06-04	0.005 U	0.41 J	0.043	0.005 U	0.001 U	0.069 J	0.05 U	0.02 U*	0.003 U	0.24	0.0069	0.01 U	0.01 U	1 UJ	0.38	0.078 U*
2003-12-09	0.0031 U	0.038	0.078	0.00047 U	0.00064	0.019 J	0.0011 U	0.0033 J-	0.0023 U	0.046 J	0.0039 UJ	0.0011 U	0.0059	0.0039 U	0.042	0.013 UJ

RFIMW 13

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
1996-09-26	0.005 U	0.0088	0.2	0.005 U	0.001 U	0.04	0.05 U	0.015 J	0.003 U	0.04 U	0.005 U	0.01 U	0.01 U	1 U	0.02 U	0.18
2003-12-04	0.0031 U	0.0048 J+	0.13	0.00047 U	0.00036 U	0.054 J	0.0011 U	0.0057 J-	0.0032	0.0084 J+	0.0039 UJ	0.0011 U	0.0078	0.0039 U	0.0072 J-	0.035 J+

RFIMW 15

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
1996-09-26	0.005 U	0.084	0.3	0.005 U	0.0052	0.12	0.05 U	0.13	0.062	0.15	0.005 U	0.01 U	0.01 U	1 U	0.095	0.54
2003-12-09	0.0031 U	0.0029 U	0.14	0.00047 U	0.00036 U	0.25 J	0.018 J+	0.019 J+	0.0023 U	1.5 J	0.0039 UJ	0.0011 U	0.0096	0.0039 U	0.00096 UJ	0.013 UJ

RFIMW 22

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
1996-09-27	0.0056 U*	0.32	0.16	0.005 U	0.001 U	0.12	0.05 U	0.04	0.012	0.13	0.0092	0.01 U	0.01 U	1 U	1	0.075
1996-12-19	0.005 U	0.27	0.12	0.005 U	0.001 U	0.083	0.05 U	0.021	0.0055 U*	0.079	0.011 U*	0.01 U	0.01 U	1 U	0.82	0.033 U*
1997-03-17	0.005 U	0.34 J	0.16	0.005 U	0.001 U	0.096	0.05 U	0.043 U*	0.0088	0.11	0.0096	0.01 U	0.01 U	1 UJ	1.2	0.059 J
1997-06-02	0.005 U	0.31	0.14	0.005 U	0.001 U	0.093	0.05 U	0.036 U*	0.0054	0.1	0.011	0.01 U	0.01 U	1 UJ	1	0.069 U*
2003-12-05	0.0031 U	0.19	0.11	0.0012	0.00036 U	0.061 J	0.0038	0.017	0.0028	0.042 J	0.0039 UJ	0.0011 U	0.0056 U	0.0039 U	0.5	0.022

Table 4
Metals in Groundwater (mg/L)
Comparison of Historic and 2003 Data

RFIMW 26

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
1996-09-16	0.005 U	0.018	0.91	0.005 U	0.001 U	0.16	0.05 U	0.037	0.011 J	0.3	0.005 U	0.01 U	0.01 U	1 U	0.039	0.086 U*
1996-10-28	0.005 U	0.075 J	0.73	0.005 U	0.001 U	2.8	0.052	0.19	0.053 J	1.4	0.005 UJ	0.01 U	0.01 U	1 U	0.14	0.28
1996-11-19	0.005 U	0.033	0.57 J	0.005 U	0.001 U	1.5 J	0.05 U	0.082	0.021	0.81 J	0.005 U	0.01 U	0.01 U	1 U	0.067 J	0.12 J
1996-12-20	0.005 U	0.0082	0.45	0.005 U	0.001 U	3.3	0.05 U	0.035	0.0056 U*	0.86	0.0054 U*	0.01 U	0.01 UJ	1 U	0.028	0.083 U*
1997-03-18	0.005 U	0.0087 J	1.4	0.005 U	0.0014	1.8	0.05 U	0.054	0.006	0.25	0.005 UJ	0.01 U	0.01 U	1 UJ	0.022	0.069 J
1997-06-05	0.0051 U*	0.038 J	0.68	0.005 U	0.0019	6.4 J	0.05 U	0.15	0.024	1	0.005 U	0.01 U	0.01 U	1 UJ	0.072	0.16 U*
2002-08-29	0.008 U	0.007	0.274	NA	0.001 U	5.17	NA	0.14	0.008	2.46	0.004 U	NA	0.01 U	NA	0.02	0.22
2003-12-08	0.0031 U	0.003	0.051	0.00047 U	0.00036 U	0.023 J	0.0011 U	0.0081 J-	0.0023 U	0.027 J	0.0039 UJ	0.0011 U	0.0082	0.0039 U	0.0027	0.013 UJ
2003-12-08	0.0031 U	0.0056	0.062	0.00047 U	0.00036 U	0.16 J	0.0015	0.0082 J-	0.0023 U	0.07 J	0.0051 J-	0.0011 U	0.012	0.0039 U	0.0031	0.013 UJ

WHI3 1S

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
2002-08-29	0.008 U	0.142	0.291	NA	0.001	0.131	NA	0.148	0.216	0.108	0.004 U	NA	0.01 U	NA	0.24	0.465
2003-12-09	0.0031 UJ	0.016	0.11	0.00047 U	0.00041	0.01 J	0.0037 U	0.011 J-	0.023	0.0092 J	0.0039 U	0.0011 U	0.0056 U	0.0039 U	0.017	0.046

WHI4 1S

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
2002-08-30	0.554	0.103	0.708	NA	0.001 U	0.146	NA	8.69	5.58	0.081	0.02 U	NA	0.01 U	NA	0.171	0.811
2003-12-09	0.0031 UJ	0.0029 U	0.026	0.00047 U	0.00036 U	0.001 UJ	0.0011 U	0.019	0.0085	0.0025 UJ	0.0039 U	0.0011 U	0.0056 U	0.0039 U	0.00096 UJ	0.013 UJ

WHI9 2F

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
2002-08-30	0.008 U	0.033	0.075	NA	0.001	0.027	NA	0.409	1.1	0.033	0.004	NA	0.01 U	NA	0.083	0.525
2003-12-09	0.0036	0.041	0.011	0.00047 U	0.0029	0.0062 J	0.0011 U	0.083	0.14	0.011 J	0.0039 UJ	0.0011 U	0.0056 U	0.0039 U	0.052	0.1

NOTES:

NA = Not Analyzed
J+ = Estimated, Biased High
J- = Estimated, Biased Low
R = Rejected
U = Non-detected
UJ = Non-detected, Estimated detection limit

Table 5
Mercury in Groundwater (mg/L)
Comparison of 2003 and Historical Data

Well ID	Flow Tube	2003 average	Pre-2003 Average
WHI2 1S	A	3.71E-06	--
WHI2-2S	A	--	3.34E-02
WHI3 1S	B	1.05E-05	6.00E-04
WHI3 2S	B	6.44E-05	2.00E-04
RFIMW 26	C	1.97E-05	3.90E-04
WHI4 1S	C	6.73E-05	1.02E-02
WHI4 2S	C	7.67E-04	8.00E-04
RFIMW 28	D	3.72E-06	--
PM4NA	E	5.26E-05	--
PM1NA	E	--	6.80E-04
RFIMW 11	F	1.62E-06	4.25E-03
RFIMW 12	F	1.45E-05	4.43E-03
CMS-MW-08	G	3.90E-03	--
RFIMW 09	G	1.37E-06	--
WHI9 2F	G	7.57E-04	2.00E-03
WHI9 2S	G	4.11E-05	--
RFIMW 07	H	1.21E-04	--
RFIMW 08	H	5.32E-06	--
RFIMW 02	I	4.16E-06	--
RFIMW 04	I	7.45E-06	--
RFIMW 06	I	3.24E-04	5.43E-04
RFIMW 15	I	3.06E-06	1.20E-03
CMSMW-02	J	4.34E-04	--
RFIMW 01	J	2.83E-05	--
RFIMW 13	J	5.54E-05	--
RFIMW 22	J	3.33E-05	--

APPENDIX D

DATA VALIDATION REPORTS

ENSR INTERNATIONAL

MEMORANDUM

To:	Tim Adams /Warrenville	**Date:**	March 30, 2004 Revised April 12, 2004
From:	Sheena Blair /Westford	**File:**	BW002wet.sb.doc 00760-127-310
RE:	Data Validation Monitored Natural Attenuation (MNA) Analyses CMS Supplemental Groundwater Sampling BASF North Works Facility, Wyandotte, MI Microseeps Projects P0312040, P0312067, P0312068 and P0312113	**CC:**	D. McGrath/Westford

SUMMARY

Full validation was performed on the data for 6 groundwater samples analyzed for the following parameters:

- total alkalinity by Methods for the Chemical Analysis of Water and Wastes (MCAWW) 310.1
- chloride by SW-846 9056
- sulfate by SW-846 9056
- nitrate as nitrogen by SW-846 9056
- nitrite as nitrogen by SW-846 9056
- total organic carbon (TOC) by SW-846 9060
- biochemical oxygen demand (BOD) MCAWW 405.1
- chemical oxygen demand (COD) HACH 8000
- total sulfide by MCAWW 376.1
- carbon dioxide by RSK-175, and
- methane by RSK-175

The samples were collected on December 2, 3, and 4, 2003 at the BASF site in Wyandotte, MI. The samples were submitted to Microseeps Inc. (Microseeps) in Pittsburgh, Pennsylvania, for analysis. Microseeps processed and reported the results under project numbers P0312040, P0312067, P0312068 and P0312113.

The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (2/94) and the quality control (QC) criteria specified in the Quality Assurance Project Plan (QAPP). Modification of the Functional Guidelines was performed to accommodate the non-CLP methodologies.

In general, the data are valid as reported and may be used for decision making purposes. Selected data points were qualified due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The samples included in this review are listed below:

Sample IDs	Sampling Date
RFIMW-09-G-1203-S	12/02/03
CMSMW-02-G-1203-S	12/03/03
BGMW-1-G-1203-S	12/03/03
RFIMW-01-G-1203-S	12/04/03
RFIMW-01-G-1203-D (field duplicate of RFIMW-01-G-1203-S)	12/04/03
RF1MW-13-G-1203-S	12/04/03

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Calibrations
- Laboratory method blanks/equipment blanks
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted with COC Request

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the COC and any subsequent correspondence. The following discrepancies were noted.

- Sample CMSMW-02-G-1203-S was identified on the form 1 as CMSMW-02-G-1203-5. The suffix "5" was manually changed to "S" during validation.

- The samples were analyzed for COD by HACH method 8000 instead of MCAWW method 410.4. No validation action was taken other than this notation.

Holding Times/Sample Preservation

All samples were digested and/or analyzed within the method specified holding times with the following exceptions. Samples RFIMW-09-G-1203-S, RFIMW-01-G-1203-S, RFIMW-01-G-1203-D and RFIMW-13-G-1203-S submitted for nitrate and nitrite analyses were reported from reanalysis of the samples due matrix interference in the initial analysis. The diluted samples were reanalyzed one day past the 48 hour holding time. The nondetect nitrate and nitrite result for samples RFIMW-09-G-1203-S, RFIMW-01-G-1203-S, RFIMW-01-G-1203-D and RFIMW-13-G-1203-S were therefore qualified as estimated (UJ).

The temperatures of the coolers met the acceptable range of 4°C ± 2°C.

The Cooler Receipt Form states that the correct preservatives were added to the samples (where applicable); however documentation of individual pH values was not provided. No validation action was taken on this basis.

Calibrations

All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards (where applicable).

Laboratory Method Blanks/Equipment Blanks

No equipment blanks were submitted with this sample set. No validation action was taken on this basis.

Various analytes were detected in the laboratory method blanks associated with these samples. The presence of blank contamination indicates that false positive results may exist for these analytes in the associated samples. An Action Level (AL) was established for each analyte at 5x the highest concentration detected in the blanks and was used to qualify sample data. The following table

summarizes these ALs and the associated samples.

Blank Type (Batch)	Analyte	Conc. Detected (mg/L)	Action Level (mg/L)
M031208013-MB	Alkalinity	2.0	10
M031208014-MB	Alkalinity	2.0	10
M031216015-MB	Alkalinity	2.0	10
M031208009-MB	BOD	1.4	7.0
M031210017-MB	BOD	1.8	9.0
M031213015-MB	Chloride	0.90	4.5
M031213020-MB	Chloride	0.88	4.4
M031215015-MB	COD	3.5	17.5

Associated samples:

- M031208013/ M031208014/ M03126015: All sample results for alkalinity were higher than the action level and therefore no validation action was taken on this basis.
- M031208009-MB: The BOD result in sample RFIMW-09-G-1203S was higher than the action level; therefore no validation action was taken on this basis.
- M031210017-MB: Samples CMSMW-02-G-1203-S and BGMW-1-G-1203-S were negated (U) for BOD. Samples RFIMW-01-G-1203-S, RFIMW-01-G-1203-D, and RFIMW-13-G-1203-S were higher than the action level; therefore no validation action was taken on this basis.
- M031213015-MB: The chloride results in samples CMSMW-02-G-1203-S, BGMW-1-G-1203-S were higher than the action level; therefore no validation action was taken on this basis.
- M031213020-MB: The chloride results in samples RFIMW-01-G-1203-S, RFIMW-01-G-1203-D, and RFIMW-13-G-1203-S were higher than the action level; therefore no validation action was taken on this basis.
- M031215015-MB: All sample results for COD were either nondetect or higher than the action level and therefore no validation action was taken on this basis.

MS/MSD Results

The laboratory performed MS or MS/MSD analyses on selected samples for all parameters except BOD, and carbon dioxide. The percent recoveries (%Rs) and relative percent differences (RPDs), where applicable, met the laboratory QC acceptance limits.

MS/MSD recovery criteria were not met for sample BGMW-1-G-1203-S for chloride and sulfate since the original sample concentration exceeded the spike added concentration by a factor of greater than 4. No validation actions were necessary due to the elevated chloride and sulfate in the original sample.

The laboratory performed additional MS/MSD analyses for selected parameters on samples from a different client. Although this practice is acceptable, the results could not be directly applied to the samples analyzed in this data package because of possible differences in the sample matrix and type. No validation action was taken on this basis.

Laboratory Duplicate Results

Laboratory duplicate analyses were performed for TOC, BOD, nitrate, nitrite, sulfate, chloride, alkalinity and carbon dioxide. Precision in the laboratory for the other parameters was demonstrated by the MS/MSD analyses as discussed above. The laboratory performed laboratory duplicate analyses on sample BGMW-1-G-1203-S for TOC, nitrate, nitrite, sulfate, chloride, alkalinity and carbon dioxide and on sample CMSMW-02-G-1203-S for BOD. All RPDs, with the exception of TOC, met the QC acceptance

criteria of ± <20%. The RPD for TOC (41%) for sample BGMW-1-G-1203-S was considered acceptable due to the sample and duplicate results being <5x the PQL.

The laboratory performed LCS/LCSD analyses for methane and carbon dioxide (see discussion below). The laboratory performed additional laboratory duplicate analyses for selected parameters on samples from a different client. Although this practice is acceptable, the results could not be directly applied to the samples analyzed in this data package because of possible differences in the sample matrix and type. No validation action was taken on this basis.

Field Duplicate Results

Samples RFIMW-01-G-1203-S and RFIMW-01-G-1203-D were submitted as the field duplicate pair with this sample set. The following table summarizes the RPDs of the detected analytes in this field duplicate pair.

Analytes	RFIMW-01-G-1203-S (mg/L)	RFIMW-01-G-1203-D (mg/L)	RPD (%)
Total Alkalinity	720	720	0
BOD	17	17	0
COD	680	710	4
Chloride	21000	16000	27
Sulfate	710	740	4
Sulfide	2.2	1.8	20
Total Organic Carbon	100	86	15
Carbon Dioxide	98	120	20
Methane	7300 µg/L	8200 µg/L	12

The RPDs were within the QC acceptance criteria of ± 30%.

LCS/LCSD Results

LCS and/or LCS/LCSD analyses were performed for all analytes. The %Rs and RPDs of all spiked analytes met the QC acceptance criteria in the LCS and LCS/LCSD analyses.

Sample Quantitation/Detection Limit Results

Several samples were analyzed as dilutions due to either matrix interference or to analyte concentrations that exceeded the instrument's calibration range in the undiluted samples. The laboratory elevated the project quantitation limits (PQLs) by a factor equivalent to the dilution factor. The following table summarizes the samples and the dilutions.

Sample ID	Analyte	Dilution Factor
RFIMW-09-G-1203-S	Chloride, Nitrate, Nitrite	50
CMSMW-02-G-1203-S	Chloride	5
BGMW-1-G-1203-S	Sulfate	5
	Chloride	2
RFIMW-01-G-1203-S	COD, Nitrate, Nitrite, Sulfate	10
	Chloride	250
RFIMW-01-G-1203-D	COD,	10
	Nitrate, Nitrite, Sulfate	5
	Chloride	500
RFIMW-13-G-1203-S	COD, Nitrate, Nitrite, Sulfate	10
	Chloride	200

The following laboratory qualifiers were removed during data validation in order to avoid confusion with the validated results.

Laboratory Qualifiers	Laboratory Definition
J	Values were between the MDL and the PQL
M	Accuracy or precision nonconformance

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 12
Lab Project #: P0312040
Report Date: 12/22/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312040-01

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-09-G-1203-S	Water	02 Dec. 03 15:15	03 Dec. 03

Analyte(s)	Result		Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem									
Alkalinity as CaCO3	760			4.0	mg/L	310.1	rh	12/4/03	
Biochemical Oxygen Demand	9.3			3.0	mg/L	405.1	tld	12/3/03	15:26
Chemical Oxygen Demand	120			5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	3800		~~M~~	1.0	mg/L	9056	md	12/5/03	3:57
Nitrate	< 25	UJ	~~UM~~	25	mg/L	9056	md	12/5/03	3:57
Nitrite	< 25	UJ	~~UM~~	25	mg/L	9056	md	12/5/03	3:57
Sulfate	14		~~M~~	1.0	mg/L	9056	md	12/3/03	19:08
Sulfide	< 2.0		U	2.0	mg/L	376.1	tld	12/5/03	
Total Organic Carbon	10		~~M~~	5.0	mg/L	9060	md	12/12/03	
RiskAnalysis									
Carbon dioxide	120			0.60	mg/L	AM20GAX	rw	12/13/03	
Methane	1300			0.015	ug/L	AM20GAX	rw	12/13/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 12
Lab Project #: P0312067
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312067-01

Sample Description	Matrix	Sampled Date/Time	Received
CMSMW-02-G-1203-~~5~~S	Water	03 Dec. 03 17:10	04 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	740		4.0	mg/L	310.1	jb	12/5/03	
Biochemical Oxygen Demand	8.5		3.0	mg/L	405.1	tld	12/5/03	9:52
Chemical Oxygen Demand	26		5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	320	M	5.0	mg/L	9056	md	12/6/03	21:40
Nitrate	< 0.50	U	0.50	mg/L	9056	md	12/4/03	23:28
Nitrite	8.2		0.50	mg/L	9056	md	12/4/03	23:28
Sulfate	96	M	1.0	mg/L	9056	md	12/4/03	23:28
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/8/03	
Total Organic Carbon	12		5.0	mg/L	9060	md	12/12/03	
RiskAnalysis								
Carbon dioxide	< 0.60	U	0.60	mg/L	AM20GAX	rw	12/13/03	
Methane	16000		0.015	ug/L	AM20GAX	rw	12/13/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 12
Lab Project #: P0312068
Report Date: 12/29/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312068-01

Sample Description	Matrix	Sampled Date/Time	Received
BGMW-1-G-1203-S	Water	03 Dec. 03 10:40	04 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	130		4.0	mg/L	310.1	jb	12/5/03	
Biochemical Oxygen Demand	3.3	J	3.0	mg/L	405.1	tld	12/5/03	10:03
Chemical Oxygen Demand	< 5.0	U	5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	180	M	2.0	mg/L	9056	md	12/6/03	16:46
Nitrate	< 0.50	U	0.50	mg/L	9056	md	12/4/03	17:45
Nitrite	< 0.50	U	0.50	mg/L	9056	md	12/4/03	17:45
Sulfate	1800	M	25	mg/L	9056	md	12/6/03	17:35
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/8/03	
Total Organic Carbon	2.0	J	5.0	mg/L	9060	md	12/12/03	
RiskAnalysis								
Carbon dioxide	6.4		0.60	mg/L	AM20GAX	rw	12/14/03	
Methane	13		0.015	ug/L	AM20GAX	rw	12/14/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312113-01

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-01-G-1203-D	Water	04 Dec. 03 15:55	05 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	720		4.0	mg/L	310.1	rh	12/15/03	
Biochemical Oxygen Demand	17		3.0	mg/L	405.1	tld	12/5/03	14:40
Chemical Oxygen Demand	710		50	mg/L	HACH8000	tld	12/15/03	
Chloride	16000	~~M~~	500	mg/L	9056	md	12/19/03	18:57
Nitrate	< 2.5 UJ	~~UM~~	2.5	mg/L	9056	md	12/7/03	2:58
Nitrite	< 2.5 UJ	~~UM~~	2.5	mg/L	9056	md	12/7/03	2:58
Sulfate	740	~~M~~	5.0	mg/L	9056	md	12/7/03	2:58
Sulfide	1.8	J	2.0	mg/L	376.1	tld	12/8/03	
Total Organic Carbon	86		5.0	mg/L	9060	md	12/13/03	
RiskAnalysis								
Carbon dioxide	120		0.60	mg/L	AM20GAX	rw	12/14/03	
Methane	8200		0.015	ug/L	AM20GAX	rw	12/14/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 3 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312113-02

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-13-G-1203-S	Water	04 Dec. 03 18:10	05 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	730		4.0	mg/L	310.1	rh	12/15/03	
Biochemical Oxygen Demand	20		3.0	mg/L	405.1	tld	12/5/03	14:44
Chemical Oxygen Demand	490		50	mg/L	HACH8000	tld	12/15/03	
Chloride	19000	M	200	mg/L	9056	md	12/19/03	20:10
Nitrate	< 5.0	U J	~~UM~~	5.0	mg/L	9056	md	12/7/03	3:47
Nitrite	< 5.0	U J	~~UM~~	5.0	mg/L	9056	md	12/7/03	3:47
Sulfate	680	M	10	mg/L	9056	md	12/7/03	3:47
Sulfide	2.2		2.0	mg/L	376.1	tld	12/8/03	
Total Organic Carbon	85		5.0	mg/L	9060	md	12/13/03	
RiskAnalysis								
Carbon dioxide	120		0.60	mg/L	AM20GAX	rw	12/14/03	
Methane	9800		0.015	ug/L	AM20GAX	rw	12/14/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 4 of 14
Lab Project #: P0312113
Report Date: 12/30/03
Client Proj Name: BASF Wyandotte MI
Client project #: BASF Wyandotte MI

Lab Sample #: P0312113-03

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-01-G-1203-S	Water	04 Dec. 03 15:55	05 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	720		4.0	mg/L	310.1	rh	12/15/03	
Biochemical Oxygen Demand	17		3.0	mg/L	405.1	tld	12/5/03	14:47
Chemical Oxygen Demand	680		50	mg/L	HACH8000	tld	12/15/03	
Chloride	21000	~~M~~	250	mg/L	9056	md	12/19/03	20:35
Nitrate	< 5.0	UJ ~~UM~~	5.0	mg/L	9056	md	12/7/03	4:36
Nitrite	< 5.0	UJ ~~UM~~	5.0	mg/L	9056	md	12/7/03	4:36
Sulfate	710	~~M~~	10	mg/L	9056	md	12/7/03	4:36
Sulfide	2.2		2.0	mg/L	376.1	tld	12/8/03	
Total Organic Carbon	100		5.0	mg/L	9060	md	12/13/03	
RiskAnalysis								
Carbon dioxide	98		0.60	mg/L	AM20GAX	rw	12/14/03	
Methane	7300		0.015	ug/L	AM20GAX	rw	12/14/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

NELAC certified analysis

ENSR INTERNATIONAL

MEMORANDUM

To:	Tim Adams /Warrenville	**Date:**	April 12, 2004 Revised May 11, 2004
From:	Sheena Blair /Westford	**File:**	BW007-009wet.sb.doc 00760-127-310
RE:	Data Validation Monitored Natural Attenuation (MNA) Analyses CMS Supplemental Groundwater Sampling BASF North Works Facility, Wyandotte, MI Microseeps Project P0312193, P0312202 and P0312174	**CC:**	D. McGrath/Westford

SUMMARY

Full validation was performed on the data for 11 groundwater samples analyzed for the following parameters:

- total alkalinity by Methods for the Chemical Analysis of Water and Wastes (MCAWW) 310.1
- chloride by SW-846 9056
- sulfate by SW-846 9056
- nitrate as nitrogen by SW-846 9056
- nitrite as nitrogen by SW-846 9056
- total organic carbon (TOC) by SW-846 9060
- biochemical oxygen demand (BOD) MCAWW 405.1
- chemical oxygen demand (COD) HACH 8000
- total sulfide by MCAWW 376.1
- carbon dioxide by RSK-175, and
- methane by RSK-175

The samples were collected on December 5, 8, and 9, 2003 at the BASF site in Wyandotte, MI. The samples were submitted to Microseeps Inc. (Microseeps) in Pittsburgh, Pennsylvania, for analysis. Microseeps processed and reported the results under project numbers P0312193, P0312202 and P0312174.

The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (2/94) and the quality control (QC) criteria specified in the Quality Assurance Project Plan (QAPP). Modification of the Functional Guidelines was performed to accommodate the non-CLP methodologies.

In general, the data are valid as reported and may be used for decision making purposes. The result for BOD in sample WHI9-2F-G-1203-S was rejected (R) due to holding time nonconformance. Selected other data points were qualified due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The samples included in this review are listed below:

Sample IDs	Sampling Date
RFIMW-22-G-1203-S	12/05/03, 12/09/03*
RFIMW-12-G-1203-S	12/09/03
RFIMW-15-G-1203-S	12/09/03
WHI3-1S-G-1203-S	12/09/03
WHI4-1S-G-1203-S	12/09/03
WHI9-2F-G-1203-S	12/09/03
PM4NA-G-1203-S	12/08/03
RFIMW-07-G-1203-S	12/08/03

Sample IDs	Sampling Date
RFIMW-26-G-1203-S	12/08/03
RFIMW-26-G-1203-D (field duplicate of RFIMW-26-G-1203-S)	12/08/03
*Resampled 12/09/03 for BOD, nitrate and nitrite only.	

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Calibrations
- Laboratory method blanks/equipment blanks
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted with COC Request

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the COC and any subsequent correspondence. The following discrepancies were noted.

- The COC accompanying sample RFIMW-22-G-1203-S (sampling date 12/05/03) requested BOD, nitrate and nitrite. Due to holding time nonconformance these analyses were canceled from the original submission of this sample. Sample RFIMW-22-G-1203-S was resubmitted for BOD, nitrate and nitrite collected on 12/09/03 and these analyses were reviewed under project P0312202.

- The samples were analyzed for COD by HACH method 8000 instead of MCAWW method 410.4. No validation action was taken other than this notation.

Holding Times/Sample Preservation

All samples were digested and/or analyzed within the method specified holding times with the following exceptions:

- Samples RFIMW-12-G-1203-S, RFIMW-15-G-1203-S, WHI9-2F-G-1203-S, RFIMW-22-G-1203-S and RFIMW-07-G-1203-S submitted for nitrate and nitrite analyses were reported from reanalysis of the samples due to matrix interference in the initial analysis. The diluted samples were reanalyzed one day past the 48 hour holding time. The nondetect nitrate and nitrite results for RFIMW-12-G-1203-S, RFIMW-15-G-1203-S, WHI9-2F-G-1203-S, RFIMW-22-G-1203-S and RFIMW-07-G-1203-S were therefore qualified as estimated (UJ).

- Samples RFIMW-15-G-1203-S, WHI3-1S-G-1203-S, WHI4-1S-G-1203-S, RFIMW-07-G-1203-S, RFIMW-26-G-1203-S and RFIMW-26-G-1203-D submitted for BOD analyses were analyzed several hours outside of the 48-hour holding time. Results for samples RFIMW-15-G-1203-S, WHI3-1S-G-1203-S, WHI4-1S-G-1203-S, RFIMW-07-G-1203-S, RFIMW-26-G-1203-S and RFIMW-26-G-1203-D were either nondetect or negated due to blank contamination and therefore were qualified as estimated (UJ.)

- Sample WHI9-2F-G-1203-S was reanalyzed for BOD at greater than 2x the 48-hour holding time due to oxygen depletion in the initial analysis; therefore the BOD result in this sample was rejected (R).

The temperatures of the coolers met the acceptable range of 4 ± 2°C.

The Cooler Receipt Forms state that the correct preservatives were added to the samples (where applicable); however, documentation of individual pH values was not provided with the exception of RFIMW-22-G-1203-S (sampling date 12/05/03) as noted below in the MS/MSD results section. No validation action was taken on this basis.

Calibrations

All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards (where applicable).

Laboratory Method Blanks/Equipment Blanks

No equipment blanks were submitted with this sample set. No validation action was taken on this basis.

Various analytes were detected in the laboratory method blanks associated with these samples. The presence of blank contamination indicates that false positive results or false negative results (for negative blanks) may exist for these analytes in the associated samples. An Action Level (AL) was established for each analyte at 5x the highest concentration detected in the blanks and was used to qualify sample data. The following table summarizes these ALs.

Blank Type (Batch)/Date	Analyte	Conc. Detected (mg/L)	Action Level (mg/L)
M031230011-MB (12/11/03)	Alkalinity	2.0	10.0
M031215010-MB (12/10/03)	BOD	1.1	5.5
M031217003-MB (12/11/03)	BOD	2.2	11.0
M031222017-MB (12/17/03)	BOD	2.0	10.0
M031229026-MB (12/10/03)	Chloride	0.92	4.6
MB/ICB/CCB (12/11/03)	Chloride	1.105	5.52
M031212017-MB (12/12/03)	Sulfide	0.37	1.85
MB/ICB/CCB (12/15/03)	COD	1.83	9.15
M031215015 (12/15/03)	COD	3.5	17.5
MB/ICB/CCB (12/10/03)	Sulfate	1.008	5.04
MB/ICB/CCB (12/23/03)	TOC	-0.6245	-3.12
M031221018-MB	TOC	1.3192	6.6

Associated samples:

- M031230011-MB: All associated sample results for alkalinity were greater than the AL; therefore the data were accepted unqualified.
- M031215010-MB: The BOD results in samples RFIMW-07-G-1203-S and RFIMW-26-G-1203-S were negated (U) due to blank contamination. The BOD result in sample RFIMW-22-G-1203-S was greater than the AL; therefore the data was accepted unqualified.
- M031217003-MB: The BOD result in sample WHI3-1S-G-1203-S was negated (U) due to blank contamination. Sample results for the other associated samples were either nondetect or greater than the AL; these results were accepted unqualified.
- M031222017-MB: The BOD result in sample WH19-2F-G-1203-S was previously rejected (R) due to holding time nonconformance. No further qualification was applied.
- M031212017-MB: All sulfide results in the associated samples were greater than the AL; therefore these results were accepted unqualified.
- All associated chloride results were greater than the ALs for both analytical dates 12/10/03 and

12/11/03; therefore these results were accepted unqualified.

- M031215015-MB: The COD results in samples RFIMW26-G-1203-S and RFIMW26-G-1203-D were negated (U) due to blank contamination. Sample results for the other associated samples were either nondetect or greater than the AL; these results were accepted unqualified.

- MB/ICB/CCB (12/15/03): COD results for the other associated samples were either nondetect or greater than the AL; these results were accepted unqualified.

- MB/ICB/CCB (12/10/03): Sulfate results in samples WHI3-1S-G-2003-S and WHI4-1S-G-2003-S were greater than the AL; these results were accepted unqualified.

- MB/ICB/CCB (12/23/03): The TOC results in samples WHI4-1S-G-1203-S and RFIMW-15-G-1203-S were estimated (J) due to possible low bias from negative blank contamination. Results for all other associated samples were greater than the AL and therefore these results were accepted unqualified.

- M031221018-MB: The TOC results in all associated samples were greater than the AL; therefore these results were accepted unqualified.

MS/MSD Results

The laboratory performed MS or MS/MSD analyses on selected samples for all parameters except BOD. The percent recoveries (%Rs) and relative percent differences (RPDs), where applicable, met the laboratory QC acceptance limits with the following exceptions.

- MS/MSD recovery was <10% for carbon dioxide and methane in sample RFIMW-22-G-1203-S (sampling date 12/05/03). The sample pH was approximately 10 which caused interference with the release of the gases during analysis; therefore the positive results for carbon dioxide and methane in sample RFIMW-22-G-1203-S were qualified as estimated (J).

- MS/MSD recovery criteria were not met for samples RFIMW-22-G-1203-S, RFIMW-12-G-1203-S and RFIMW-07-G-1203-S for chloride since the original sample concentrations exceeded the spike added concentration by a factor of greater than 4. No validation actions were necessary due to the elevated chloride in the original samples.

- MS/MSD recovery criteria were not met for sample RFIMW-12-G-1203-S analyzed for nitrate and nitrite due to the spike being diluted out for matrix interference. No validation action was taken on this basis.

- MS/MSD recovery criteria were not met for sample RFIMW-07-G-1203-S analyzed for nitrite due to the spike being diluted out for matrix interference. No validation action was taken on this basis.

- MS recovery (61%) for sulfide in sample RFIMW-12-G-1203-S did not meet the QC acceptance criteria. All positive and nondetect sample results for sulfide in this data set were qualified as estimated (J and UJ, respectively).

- MS/MSD recoveries (61% and 460%, respectively) did not meet the QC acceptance criteria for sulfate in sample RFIMW-22-G-1203-S; therefore the nondetect sulfate result for this sample was qualified as estimated (UJ).

The laboratory performed additional MS/MSD analyses for selected parameters on samples from a different client. Although this practice is acceptable, the results could not be directly applied to the samples analyzed in this data package because of possible differences in the sample matrix and type.

Laboratory Duplicate Results

Laboratory duplicate analyses were performed on samples RFIMW-15-G-1203-S for TOC, WH14-1S-G-1203-S and RFIMW-12-G-1203-S for BOD, and RFIMW-12-G-1203-S for nitrate, nitrite, sulfate and chloride. All RPDs with the exception of TOC met the QC acceptance criteria of ± <20%. The RPD for TOC (29%) for sample RFIMW-15-G-1203-S was considered acceptable due to the sample and duplicate results being <5x the PQL. Precision in the laboratory for the other parameters was demonstrated by the MS/MSD analyses as discussed above.

The laboratory performed LCS/LCSD analyses for methane and carbon dioxide (see discussion below).

The laboratory performed additional laboratory duplicate analyses for selected parameters on samples from a different client. Although this practice is acceptable, the results could not be directly applied to the samples analyzed in this data package because of possible differences in the sample matrix and type.

Field Duplicate Results

Samples RFIMW-26-G-1203-S and RFIMW-26-G-1203-D were submitted as the field duplicate pair with this sample set. The following table summarizes the RPDs of the detected analytes in this field duplicate pair.

Analytes	RFIMW-26-G-1203-S (mg/L)	RFIMW-26-G-1203-D (mg/L)	RPD (%)
Total Alkalinity	620	660	6.2
Chloride	1200	1200	0
Nitrate	8.0	9.8	20
Sulfate	74	73	1
Total Organic Carbon	7.8	7.7	1
Carbon Dioxide	22	23	4
Methane	5.9 µg/L	2.9 µg/L	68

- The RPD for methane did not meet the QC acceptance criteria of ±30%; therefore the positive and nondetect methane results in all samples were qualified as estimated (J and UJ, respectively).
- The RPDs for all the remaining analytes were within the QC acceptance criteria of ±30%.

LCS/LCSD Results

LCS and/or LCS/LCSD analyses were performed for all analytes. The %Rs and RPDs of all spiked analytes met the QC acceptance criteria in the LCS and LCS/LCSD analyses.

Sample Quantitation/Detection Limit Results

Several samples were analyzed as dilutions due to either matrix interference or to analyte concentrations that exceeded the instrument's calibration range in the undiluted samples. The laboratory elevated the PQLs by a factor equivalent to the dilution factor. The following table summarizes the samples and the dilutions.

Sample ID	Analyte	Dilution Factor
RFIMW-12-G-1203-S	Chloride, Nitrate, Nitrate	50
	COD	5
RFIMW-15-G-1203-S	Nitrite, Nitrate, Sulfate	50
	COD	2
	Chloride	100
WHI9-2F-G-1203-S	COD,	5
	Chloride	2

Sample ID	Analyte	Dilution Factor
RFIMW-22-G-1203-S	Nitrite, Nitrate	50
	Chloride, Sulfate	100
	Sulfide	5
	TOC	24
	COD	10
PM4NA-G-1203-S	COD	10
	Chloride	200
	Nitrite, Nitrate, TOC	24
	Sulfate	25
	Sulfide	5
RFIMW-07-G-1203-S	Chloride	25
	Nitrite, Nitrate, Sulfate	5
RFIMW-26-G-1203-S	Chloride	10
RFIMW-26-G-1203-D	Chloride	10

The following laboratory qualifiers were removed during data validation in order to avoid confusion with the validated results.

Laboratory Qualifiers	Laboratory Definition
J	Values were between the MDL and the PQL
M	Accuracy or precision nonconformance

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312174-03

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-26-G-1203-S	Water	08 Dec. 03 15:00	09 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	620		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Demand	4.5	U J	3.0	mg/L	405.1	tld	12/10/03	14:43
Chemical Oxygen Demand	5.2	UL	5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	1200	~~M~~	10	mg/L	9056	md	12/11/03	2:45
Nitrate	8.0		0.50	mg/L	9056	md	12/9/03	18:49
Nitrite	< 0.50	~~UM~~	0.50	mg/L	9056	md	12/9/03	18:49
Sulfate	74	~~M~~	1.0	mg/L	9056	md	12/9/03	18:49
Sulfide	< 2.0	UJ ~~U~~	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	7.8		5.0	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	22		0.60	mg/L	AM20GAX	jl	12/17/03	
Methane	5.9	J	0.015	ug/L	AM20GAX	jl	12/17/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312174-04

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-26-G-1203-D	Water	08 Dec. 03 15:00	09 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	660		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Demand	<3.0 UJ	~~U~~	3.0	mg/L	405.1	tld	12/10/03	14:47
Chemical Oxygen Demand	15	~~U~~	5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	1200	~~M~~	10	mg/L	9056	md	12/10/03	20:04
Nitrate	9.8		0.50	mg/L	9056	md	12/9/03	19:14
Nitrite	< 0.50 UJ	~~UM~~	0.50	mg/L	9056	md	12/9/03	19:14
Sulfate	73	~~M~~	1.0	mg/L	9056	md	12/9/03	19:14
Sulfide	< 2.0 UJ	~~U~~	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	7.7		5.0	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	23		0.60	mg/L	AM20GAX	jl	12/17/03	
Methane	2.9 J		0.015	ug/L	AM20GAX	jl	12/17/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 4 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-03

Sample Description	Matrix	Sampled Date/Time	Received
WHI3-1S-G-1203-S	Water	09 Dec. 03 8:40	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	430		4	mg/L	310 1	rh	12/11/03	
Biochemical Oxygen Deman	2.0		3.0	mg/L	405.1	tld	12/11/03	14:10
Chemical Oxygen Demand	27		5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	120	M	1.0	mg/L	9056	md	12/10/03	19:00
Nitrate	22	M	0.50	mg/L	9056	md	12/10/03	19:00
Nitrite	2 8	M	0.50	mg/L	9056	md	12/10/03	19:00
Sulfate	140	M	1 0	mg/L	9056	md	12/10/03	19:00
Sulfide	< 2.0	U	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	7.5	M	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	76	M	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	5 6 J	M	0 015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value. U - Non detect. R - Poor surrogate recovery. M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank. S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 5 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-04

Sample Description	Matrix	Sampled Date/Time	Received
WHI4-1S-G-1203-S	Water	09 Dec. 03 19:00	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	180		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Deman	< 3 0 UJ	~~U~~	3.0	mg/L	405.1	tld	12/11/03	14:01
Chemical Oxygen Demand	< 5.0	U	5 0	mg/L	HACH8000	tld	12/15/03	
Chloride	140	~~M~~	1.0	mg/L	9056	md	12/10/03	19:24
Nitrate	< 0.50 ~~UJ~~	~~UM~~	0.50 u	mg/L	9056	md	12/10/03	19:24
Nitrite	< 0.50	UM	0 50	mg/L	9056	md	12/10/03	19:24
Sulfate	67	~~M~~	1 0	mg/L	9056	md	12/10/03	19:24
Sulfide	< 2.0 UJ	~~U~~	2 0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	2 1 J	~~JM~~	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	29	~~M~~	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	19 J	~~M~~	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP, B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

V - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 15
Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312174-01

Sample Description	Matrix	Sampled Date/Time	Received
PM4NA-G-1203-S	Water	08 Dec. 03 19:10	09 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	7100		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Demand	220		3.0	mg/L	405.1	tld	12/10/03	14:37
Chemical Oxygen Demand	1200		50	mg/L	HACH8000	tld	12/15/03	
Chloride	22000	~~UM~~ M	200	mg/L	9056	md	12/10/03	23:05
Nitrate	< 12	~~US~~	12 U	mg/L	9056	md	12/9/03	20:27
Nitrite	< 12	UM	12	mg/L	9056	md	12/9/03	20:27
Sulfate	1200	M	25	mg/L	9056	md	12/9/03	20:27
Sulfide	110	J	10	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	460		120	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	28		0.60	mg/L	AM20GAX	jl	12/17/03	
Methane	6800	J	0.015	ug/L	AM20GAX	jl	12/17/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-01

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-12-G-1203-S	Water	09 Dec. 03 15:50	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	2500		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Deman	44		3.0	mg/L	405.1	tld	12/11/03	14:04
Chemical Oxygen Demand	340		25	mg/L	HACH8000	tld	12/15/03	
Chloride	7400	~~M~~	50	mg/L	9056	md	12/11/03	17:32
Nitrate	< 25 UJ	~~UM~~	25	mg/L	9056	md	12/11/03	17:32
Nitrite	< 25 UJ	~~UM~~	25	mg/L	9056	md	12/11/03	17:32
Sulfate	< 1.0	~~UM~~	1.0	mg/L	9056	md	12/11/03	17:32
Sulfide	46 J		2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	63	~~M~~	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	< 0.60	~~UM~~	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	17000 J	~~M~~	0.015	ug/L	AM20GAX	jl	12/18/03	

ata Qualifiers: J - estimated value. U - Non detect. R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as eet NELAC sample acceptance criteria, L - Subcontracted Lab used

_- NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 3 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-02

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-15-G-1203-S	Water	09 Dec. 03 11:50	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	56		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Deman	< 3.0 UJ	~~U~~	3.0	mg/L	405.1	tld	12/11/03	14:07
Chemical Oxygen Demand	89		10	mg/L	HACH8000	tld	12/15/03	
Chloride	11000	~~M~~	100	mg/L	9056	md	12/11/03	20:23
Nitrate	< 25 UJ	~~UM~~	25	mg/L	9056	md	12/11/03	20:23
Nitrite	< 25 UJ	~~UM~~	25	mg/L	9056	md	12/11/03	20:23
Sulfate	930	~~M~~	50	mg/L	9056	md	12/11/03	20:23
Sulfide	< 2.0 UJ	~~U~~	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	1.7 J	~~JM~~	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	1.2	~~M~~	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	15 J	~~M~~	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP. B - detected in blank. S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

1 - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 6 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-05

Sample Description	Matrix	Sampled Date/Time	Received
WHI9-2F-G-1203-S	Water	09 Dec. 03 13:40	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	1300		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Deman	~~12~~ R		3.0	mg/L	405.1	tld	12/17/03	13:34
Chemical Oxygen Demand	280		25	mg/L	HACH8000	tld	12/15/03	
Chloride	200	~~M~~	2.0	mg/L	9056	md	12/11/03	22:01
Nitrate	< 0.50 UJ	~~UM~~	0.50	mg/L	9056	md	12/11/03	22:01
Nitrite	< 0.50 UJ	~~UM~~	0.50	mg/L	9056	md	12/11/03	22:01
Sulfate	330	~~M~~	5.0	mg/L	9056	md	12/11/03	22:01
Sulfide	13 J		2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	57	~~M~~	5.0	mg/L	9060	md	12/23/03	
RiskAnalysis								
Carbon dioxide	< 0.60	~~UM~~	0.60	mg/L	AM20GAX	jl	12/18/03	
Methane	11000 J	~~M~~	0.015	ug/L	AM20GAX	jl	12/18/03	

Data Qualifiers: J - estimated value. U - Non detect. R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP. B - detected in blank. S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 7 of 19
Lab Project #: P0312202
Report Date: 01/30/04
Client Proi Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312202-06

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-22-G-1203-S	Water	09 Dec. 03 17:10	10 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Biochemical Oxygen Deman	67		3.0	mg/L	405.1	tld	12/10/03	14:55
Nitrate	< 25	UJ UM	25	mg/L	9056	md	12/11/03	22:26
Nitrite	< 25	UJ UM	25	mg/L	9056	md	12/11/03	22:26

Data Qualifiers: J - estimated value, U - Non detect. R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD. SAMP/DUP. B - detected in blank, S - field sample as meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Page: Page 2 of 13
Lab Project #: P0312193
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312193-01

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-22-G-1203-S	Water	05 Dec. 03 10:00	08 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time
WetChem							
Alkalinity as CaCO3	2200		4.0	mg/L	310.1	rh	12/11/03
Chemical Oxygen Demand	1400		50	mg/L	HACH8000	tld	12/15/03
Chloride	8900	~~M~~	100	mg/L	9056	md	12/11/03 23:39
Sulfate	< ~~1.0~~	~~UM~~	1.0 UJ	mg/L	9056	md	12/10/03 21:27
Sulfide	12		10	mg/L	376.1	tld	12/12/03
Total Organic Carbon	380		120	mg/L	9060	md	12/21/03
RiskAnalysis							
Carbon dioxide	0.67 J	~~M~~	0.60	mg/L	AM20GAX	jl	12/18/03
Methane	14000 J	~~M~~	0.015	ug/L	AM20GAX	jl	12/18/03

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as rec meet NELAC sample acceptance criteria, L - Subcontracted Lab used

N - NELAC certified analysis

Client Name: ENSR
Contact: Tim Adams
Address: 27755 Diehl Road

Warrenville, IL 60555

Lab Project #: P0312174
Report Date: 01/08/04
Client Proj Name: BASF Wyandotte MI
Client project #: 00760127300

Lab Sample #: P0312174-02

Sample Description	Matrix	Sampled Date/Time	Received
RFIMW-07-G-1203-S	Water	08 Dec. 03 12:00	09 Dec. 03

Analyte(s)	Result	Flag	PQL	Units	Method #	Analyst	Analysis Date & Time	
WetChem								
Alkalinity as CaCO3	810		4	mg/L	310.1	rh	12/11/03	
Biochemical Oxygen Demand	5.4 UJ		3.0	mg/L	405.1	tld	12/10/03	14:40
Chemical Oxygen Demand	44		5.0	mg/L	HACH8000	tld	12/15/03	
Chloride	5200	M	25	mg/L	9056	md	12/11/03	0:18
Nitrate	< 2.5 UJ	U	2.5	mg/L	9056	md	12/10/03	23:29
Nitrite	< 2.5 UJ	UM	2.5	mg/L	9056	md	12/10/03	23:29
Sulfate	310	M	5.0	mg/L	9056	md	12/10/03	23:29
Sulfide	< 2.0 UJ	U	2.0	mg/L	376.1	tld	12/12/03	
Total Organic Carbon	13		5.0	mg/L	9060	md	12/21/03	
RiskAnalysis								
Carbon dioxide	< 0.60	U	0.60	mg/L	AM20GAX	jl	12/17/03	
Methane	4800 J		0.015	ug/L	AM20GAX	jl	12/17/03	

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as re meet NELAC sample acceptance criteria, L - Subcontracted Lab used.

N - NELAC certified analysis

ENSR

MEMORANDUM

TO:	Tim Adams/Warrenville	**DATE:**	March 24, 2004
FROM:	Linda Sulkowski/Westford	**FILE:**	BW001voc.doc 00760-127-310
RE:	Data Validation Volatile Organic Compound Analyses CMS Supplemental Groundwater Sampling BASF North Works Facility, Wyandotte, MI STL SDG 3L04249	**CC:**	D. McGrath/Westford

SUMMARY

Full validation was performed on the data for 15 groundwater samples and five trip blanks analyzed for volatile organic compounds (VOCs) using SW-846 method 8260B. The samples were collected at the BASF facility in Wyandotte, Michigan on December 3-5, 8, and 9, 2003 and submitted to Severn Trent Laboratories (STL) in North Canton, Ohio. STL logged in the samples under lot numbers A3L040249, A3L050302, A3L060156, A3L090272, and A3L100288 and reported the samples under sample delivery group (SDG) 3L04249.

The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (10/99) and the quality control (QC) criteria specified in the Quality Assurance Project Plan (QAPP). The Functional Guidelines were modified to accommodate the non-CLP methodology.

In general, the data are valid as reported and may be used for decision making purposes. Selected data points were qualified as nondetected (U) due to laboratory and/or trip blank contamination. Other data points were qualified as estimated (J, UJ) due to nonconformances of certain quality control (QC) criteria (see discussion below).

SAMPLES

The samples included in this review are listed below:

Sample IDs	Sample IDs
RFIMW-09-G-1203-S	CMSMW-02-G-1203-S
TRIP BLANK-01-120303-TB (trip blank)	RFIMW-01-G-1203-S
RFIMW-01-G-1203-D (field duplicate of RFIMW-01-G-1203-S)	RFIMW-13-G-1203-S
TRIPBLANK-02-120403-TB (trip blank)	RFIMW-22-G-1203-S
TRIP BLANK-03-120503-TB (trip blank)	RFIMW-26-G-1203-S
RFIMW-26-G-1203-D (field duplicate of RFIMW-26-G-1203-S)	TRIPBLANK04-120803-TB (trip blank)
RFIMW-07-G-1203-S	PM4NA-G-1203-S
WHI9-2F-G-1203-S	RFIMW-12-G-1203-S
RFIMW-15-G-1203-S	WHI3-1S-G-1203-S
WHI4-1S-G-1203-S	TRIP BLANK05-120903-TB (trip blank)

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with the chain of custody (COC) requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blank/trip blank/equipment blank
- Surrogate spike recoveries
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Internal standard performance
- Field duplicate results
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results
- Quantitation limits and sample results

DISCUSSION

Agreement of Analyses Conducted with COC Requests

Sample reports corresponded to the analytical requests designated on the COC.

Holding Times and Sample Preservation

The cooler temperatures upon receipt at the laboratory ranged from 1.6 to 3.9°C. One of the five cooler temperatures fell below the acceptable range of 4 ± 2°C. Qualification of the data due to this minor nonconformance was not required.

With the following exception, all samples were analyzed within the method specified holding time. Trip blank sample TRIP BLANK-03-120503-TB was analyzed three days beyond the holding time limit of 14 days. The laboratory listed sample TRIP BLANK-03-120503-TB on the internal tracking system as being analyzed when the sample had not been analyzed. Believing that the sample had been analyzed, the laboratory then removed sample TRIP BLANK-03-120503-TB from the refrigerator on December 19, 2003 and stored the sample at ambient temperature. After discovering the error, the laboratory analyzed sample TRIP BLANK-03-120503-TB outside of holding time on December 22, 2003. With the exception of acetone, all non-detected data were rejected (R) and all positive results were estimated (J) for sample TRIP BLANK-03-120503-TB due to the hold time and temperature nonconformances. The result for acetone, which was qualified as nondetected (U) due to blank contamination actions, was further qualified as estimated (UJ) due to the holding time and temperature nonconformances.

The pH of sample PM4NA was 7, which exceeded the acceptance criteria of <2. The sample was analyzed within the method specified holding time of 14 days. However, since the pH was >2 and the sample was analyzed after 7 days, all positive and non-detected aromatic results were estimated (J, UJ) in sample PM4NA.

ENSR

GC/MS Tunes

The frequency and abundance of the bromofluorobenzene (BFB) tunes were within the QC acceptance criteria. All samples were analyzed within 12 hours from the BFB tune.

Initial and Continuing Calibrations

The percent relative standard deviations (%RSDs), correlation coefficients (r^2), and response factors (RFs) were all within the QC acceptance criteria in the initial calibrations.

The following tables summarize the percent difference (%D) nonconformances in the continuing calibrations.

Date	Compound	% D
12/11/03	Trichlorofluoromethane	33.6
	Acetone	-28.7
	1,1,2-Trichloro-1,2,2-trifluoromethane	33.4
Samples Affected: RFIMW-01-G-1203-S, RFIMW-01-G-1203-D, and RFIMW-13-G-1203-S.		

Date	Compound	% D
12/17/03	Acetone	-25.6
Sample Affected: RFIMW-22-G-1203-S.		

Date	Compound	% D
12/12/03	Acetone	56.4
	2-Butanone	-49.5
	4-Methyl-2-pentanone	-28.5
	2-Hexanone	39.6
Sample Affected: TRIP BLANK-02-120403-TB.		

Date	Compound	% D
12/13/03	Acetone	42.1
	2-Butanone	-33.5
	2-Hexanone	31.8
Samples Affected: PM4NA-G-1203-S.		

Date	Compound	% D
12/10/03	Dichlorodifluoromethane	28.1
	Acetone	-68.3
	2-Butanone	35.0
	4-Methyl-2-pentanone	31.2
	2-Hexanone	-41.3
Samples Affected: RFIMW-09-G-1203-S, CMSMW-02-G-1203-S, and TRIP BLANK-01-120303-TB		

Date	Compound	% D
12/22/03	Bromomethane	-26.8
	Trichlorofluoromethane	-32.4
	Dichlorodifluoromethane	-35.0
Samples Affected: TRIP BLANK-03-120503-TB		

Samples results in the six tables above were qualified as follows:

- If the %D exceeded the acceptance criteria with a low recovery, detected and non-detected results were qualified as estimated (J, UJ).
- If the %D exceeded the acceptance criteria with a high recovery, detected results were qualified as estimated (J) and non-detected results were accepted without qualification.

Method Blank/Trip Blank/Equipment Blanks

Equipment blanks were not submitted with this sample set. No validation action was taken on this basis.

Several analytes were detected in the laboratory method blanks and trip blanks. The presence of blank contamination indicates that false positives may exist for these compounds in the associated samples. Action Levels (ALs) were established at 10x the concentration detected in the blanks for acetone, methylene chloride, and 2-butanone and at 5x the concentration detected in the blanks for the remaining analytes. The following tables summarize these ALs and the associated samples. It should be noted that contamination in the trip blanks was first negated on the basis of laboratory blank contamination. Any remaining contamination detected in the trip blank after laboratory blank contamination actions was used to qualify sample results.

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Laboratory Method Blank F6JX51AA	Acetone	1.4	14
	Methylene Chloride	0.8	8.0
	1,2,4-Trichlorobenzene	0.46	2.3
Associated samples: RFIMW-01-G-1203-S, RFIMW-01-G-1203-D, and RFIMW-13-G-1203-S.			

ENSR

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Laboratory Method Blank F61FT1AE	Acetone	1.7	17
	Methylene Chloride	0.67	6.7
	1,2,4-Trichlorobenzene	0.72	3.6
Associated sample: RFIMW-22-G-1203-S.			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Laboratory Method Blank F6PV51AA	Methylene Chloride	0.62	6.2
Associated sample: TRIP BLANK-02-120403-TB.			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Laboratory Method Blank F6N9W1AA	Methylene Chloride	0.60	6.0
Associated sample: PM4NA-G-1203-S.			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Laboratory Method Blank F6FE41AA	Acetone	1.1	11
	Methylene Chloride	1.3	13
Associated samples: RFIMW-09-G-1203-S, CMSMW-02-G-1203-S, and TRIP BLANK-01-120303-TB.			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Laboratory Method Blank F61E21AA	Acetone	1.0	10
	Bromomethane	0.26	1.3
Associated samples: RFIMW-26-G-1203-S, RFIMW-26-G-1203-D, TRIP BLANK04-120803-TB, and RFIMW-07-G-1203-S.			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Laboratory Method Blank F61GT1AA	Acetone	1.2	12
Associated samples: WHI9-2F-G-1203-S, RFIMW-12-G-1203-S, RFIMW-15-G-1203-S, WHI3-1S-G-1203-S, WHI4-1S-G-1203-S, and TRIP BLANK05-120903-TB.			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Laboratory Method Blank F67TX1AA	Acetone	0.73	7.3
Associated sample: TRIP BLANK-03-120503-TB			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Trip Blank TRIP BLANK-01-120303-TB	2-Butanone	1.7	17
	1,1-Dichlorethene	0.51	2.6
	Toluene	0.68	3.4
Associated samples: RFIMW-09-G-1203-S and CMSMW-02-G-1203-S			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Trip Blank TRIP BLANK-03-120503-TB	Methylene chloride	2.1	21
	Toluene	0.49	2.5
Associated sample: RFIMW-22-G-1203-S.			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Trip Blank TRIP BLANK04-120803-TB	2-Butanone	0.78	7.8
Associated samples: RFIMW-26-G-1203-S, RFIMW-26-G-1203-D, RFIMW-07-G-1203-S, and PM4NA-G-1203-S.			

Type of Blank	Compound	Concentration Detected (µg/L)	Action Level (µg/L)
Trip Blank TRIP BLANK05-120903-TB	2-Butanone	1.5	15
	Toluene	0.3	1.5
Associated samples: WHI9-2F-G-1203-S, RFIMW-12-G-1203-S, RFIWM-15-G-1203-S, WHI3-1S-G-1203-S, and WH14-1S-G-1203-S.			

Results in the associated samples listed above were qualified as follows:

- If the sample result was ≤ AL and ≤ the sample quantitation limit (SQL), the result was qualified as nondetect (U) at the SQL.
- If the sample result was ≤ AL and > SQL, the result was qualified as nondetect (U) at the reported concentration.
- If the sample result was > AL, the result was not qualified.

Surrogate Spike Recoveries

The surrogate recoveries were within the QC acceptance limits in all sample analyses.

MS/MSD Results

Samples RFIMW-01-G-1203-S and RFIMW-22-G-1203-S were submitted for MS/MSD analyses. All percent recoveries (%Rs) and relative percent differences (RPDs) reported by the laboratory were within the QC acceptance limits in the MS/MSD analyses performed on sample RFIMW-22-G-1203-S.

The RPD of benzene (21%) and the %R of toluene (69%) in the MSD exceeded the QC acceptance criteria in the MS/MSD analyses performed on sample RFIMW-01-G-1203-S. The positive result for toluene was qualified as estimated (J) and the non-detected result for benzene was qualified as estimated (UJ) in the unspiked sample RFIMW-01-G-1203-S.

The laboratory also performed several other MS/MSD on samples from different clients. Although this practice is acceptable, the results could not be directly applied to the samples analyzed in this data package because of possible differences in the sample matrix and type.

Internal Standard Performance

Internal standard performance met the QC acceptance criteria in all sample analyses.

Field Duplicate Results

Samples RFIMW-01-G-1203-S/RFIMW-01-G-1203-D and RFIMW-26-G-1203-S/RFIMW-26-G-1203-D were submitted as the field duplicate pairs with this sample set. The following tables summarize the RPDs of the detected analytes in the field duplicate pairs. The RPDs were within the QC acceptance criteria and precision was deemed acceptable.

Compound	RFIMW-01-G-1203-S (µg/L)	RFIMW-01-G-1203-D (µg/L)	%RPD
Toluene	120	120	0

Compound	RFIMW-26-G-1203-S (µg/L)	RFIMW-26-G-1203-D (µg/L)	%RPD
Toluene	27	27	0

LCS/LCSD Results

The %Rs and/or RPDs of the spiked target analytes in the LCS/LCSD analyses were all within the QC acceptance criteria.

Quantitation Limits and Sample Results

The following samples were analyzed at dilutions due to the concentrations of target analytes that would have exceeded the calibration range if analyzed undiluted. The laboratory elevated the SQLs accordingly.

Sample	Dilution
RFIMW-01-G-1203-S	3.33x
RFIMW-01-G-1203-D	3.33x
RFIWM-13-G-1203-S	2x
RFIMW-22-G-1203-S	100x

The following samples were analyzed at dilutions due to the matrix (foaminess) of the samples. The laboratory elevated the SQLs accordingly.

Sample	Dilution
RFIMW-09-G-1203-S	2x
CMSMW-02-G-1203-S	2x
PM4NA-G-1203-S	5x
WHI9-2F-G-1203-S	10x
RFIMW-12-G-1203-S	5x

Sample RFIMW-07-1203-S was analyzed at a 2.5-fold dilution due to the presence of non-target analytes that were apparent on the chromatogram of the sample. The laboratory elevated the SQLs accordingly.

Calculations were spot-checked. There were no discrepancies noted.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-09-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L040249-002 Work Order #...: F51XR1AV Matrix.....: WG
Date Sampled...: 12/03/03 15:15 Date Received..: 12/04/03
Prep Date.....: 12/10/03 Analysis Date..: 12/10/03
Prep Batch #...: 3345209
Dilution Factor: 2 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~3.5 J,B~~	20 UJ	ug/L
Benzene	ND	2.0 U	ug/L
Bromodichloromethane	ND	2.0	ug/L
Bromoform	ND	2.0	ug/L
Bromomethane	ND	2.0	ug/L
2-Butanone	ND	20 UJ	ug/L
Carbon disulfide	ND	2.0 U	ug/L
Carbon tetrachloride	ND	2.0	ug/L
Chlorobenzene	ND	2.0	ug/L
Chloroethane	ND	2.0	ug/L
Chloroform	ND	2.0	ug/L
Chloromethane	ND	2.0	ug/L
Cyclohexane	ND	2.0	ug/L
Dibromochloromethane	ND	2.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	4.0	ug/L
1,2-Dibromoethane	ND	2.0 U	ug/L
1,2-Dichlorobenzene	ND	2.0	ug/L
1,3-Dichlorobenzene	ND	2.0	ug/L
1,4-Dichlorobenzene	ND	2.0	ug/L
Dichlorodifluoromethane	ND	2.0 UJ	ug/L
1,1-Dichloroethane	ND	2.0 U	ug/L
1,2-Dichloroethane	ND	2.0	ug/L
1,1-Dichloroethene	ND	2.0	ug/L
cis-1,2-Dichloroethene	ND	2.0	ug/L
trans-1,2-Dichloroethene	ND	2.0	ug/L
1,2-Dichloropropane	ND	2.0	ug/L
cis-1,3-Dichloropropene	ND	2.0	ug/L
trans-1,3-Dichloropropene	ND	2.0	ug/L
Ethylbenzene	ND	2.0	ug/L
2-Hexanone	ND	20 UJ	ug/L
Isopropylbenzene	ND	2.0 U	ug/L
Methyl acetate	ND	20 U	ug/L
Methylene chloride	~~1.4 J,B~~	2.0 U	ug/L
Methylcyclohexane	ND	2.0 U	ug/L
4-Methyl-2-pentanone	ND	20 UJ	ug/L
Methyl tert-butyl ether	ND	10 U	ug/L
Styrene	ND	2.0 U	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-09-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L040249-002 Work Order #...: F51XR1AV Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	ND	2.0 u	ug/L
Tetrachloroethene	ND	2.0	ug/L
Toluene	ND	2.0	ug/L
1,2,4-Trichloro-benzene	ND	2.0	ug/L
1,1,1-Trichloroethane	ND	2.0 u	ug/L
1,1,2-Trichloroethane	ND	2.0	ug/L
Trichloroethene	ND	2.0	ug/L
Trichlorofluoromethane	ND	2.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ug/L
Vinyl chloride	ND	2.0 u	ug/L
Xylenes (total)	ND	4.0 u	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	93	(73 - 122)
1,2-Dichloroethane-d4	93	(61 - 128)
Toluene-d8	82	(76 - 110)
4-Bromofluorobenzene	92	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Elevated reporting limits due to matrix interference.

ENSR CONSULTING & ENGINEERING

Client Sample ID: CMSMW-02-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L040249-003 **Work Order #...:** F51X21AV **Matrix.....:** WG
Date Sampled...: 12/03/03 17:10 **Date Received..:** 12/04/03
Prep Date.....: 12/10/03 **Analysis Date..:** 12/10/03
Prep Batch #...: 3345209
Dilution Factor: 2 **Initial Wgt/Vol:** 5 mL **Final Wgt/Vol..:** 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	**48 ~~B~~ J**	**~~20~~**	**ug/L**
Benzene	**5.1**	**~~2.0~~**	**ug/L**
Bromodichloromethane	~~ND~~	2.0 U	ug/L
Bromoform	~~ND~~	2.0 U	ug/L
Bromomethane	~~ND~~	2.0 U	ug/L
2-Butanone	**~~6.3 J~~**	**20 UJ**	**ug/L**
Carbon disulfide	~~ND~~	2.0 U	ug/L
Carbon tetrachloride	~~ND~~	2.0 U	ug/L
Chlorobenzene	**0.94 J**	**~~2.0~~**	**ug/L**
Chloroethane	~~ND~~	2.0 U	ug/L
Chloroform	~~ND~~	2.0 U	ug/L
Chloromethane	**0.59 J**	**~~2.0~~**	**ug/L**
Cyclohexane	ND	2.0 U	ug/L
Dibromochloromethane	ND	2.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	4.0	ug/L
1,2-Dibromoethane	~~ND~~	2.0 U	ug/L
1,2-Dichlorobenzene	**1.1 J**	**~~2.0~~**	**ug/L**
1,3-Dichlorobenzene	ND	2.0 U	ug/L
1,4-Dichlorobenzene	ND	2.0 U	ug/L
Dichlorodifluoromethane	ND	2.0 UJ	ug/L
1,1-Dichloroethane	ND	2.0 U	ug/L
1,2-Dichloroethane	ND	2.0 U	ug/L
1,1-Dichloroethene	**~~1.3 J~~**	**2.0 U**	**ug/L**
cis-1,2-Dichloroethene	ND	2.0 U	ug/L
trans-1,2-Dichloroethene	ND	2.0	ug/L
1,2-Dichloropropane	ND	2.0	ug/L
cis-1,3-Dichloropropene	ND	2.0	ug/L
trans-1,3-Dichloropropene	ND	2.0	ug/L
Ethylbenzene	ND	2.0	ug/L
2-Hexanone	ND	20 U J	ug/L
Isopropylbenzene	ND	2.0 U	ug/L
Methyl acetate	ND	20 U	ug/L
Methylene chloride	**~~1.5 J,B~~**	**2.0 U**	**ug/L**
Methylcyclohexane	ND	2.0 U	ug/L
4-Methyl-2-pentanone	ND	20 UJ	ug/L
Methyl tert-butyl ether	ND	10 U	ug/L
Styrene	ND	2.0 U	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: CMSMW-02-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L040249-003 Work Order #...: F51X21AV Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	2.0 U	ug/L
Tetrachloroethene	~~ND~~	2.0 U	ug/L
Toluene	**29**	~~2.0~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	2.0 U	ug/L
1,1,1-Trichloroethane	~~ND~~	2.0 U	ug/L
1,1,2-Trichloroethane	~~ND~~	2.0	ug/L
Trichloroethene	~~ND~~	2.0	ug/L
Trichlorofluoromethane	~~ND~~	2.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	2.0	ug/L
Vinyl chloride	~~ND~~	2.0 U	ug/L
Xylenes (total)	~~ND~~	4.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	89	(73 - 122)
1,2-Dichloroethane-d4	87	(61 - 128)
Toluene-d8	81	(76 - 110)
4-Bromofluorobenzene	94	(74 - 116)

NOTE(S):

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

J Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIP BLANK-01-120303-TB

GC/MS Volatiles

Lot-Sample #...: A3L040249-004 Work Order #...: F51X91AA Matrix.....: WQ
Date Sampled...: 12/03/03 Date Received..: 12/04/03
Prep Date.....: 12/10/03 Analysis Date..: 12/10/03
Prep Batch #...: 3345209
Dilution Factor: 1 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~5.5 J,B~~	10 UJ	ug/L
Benzene	~~ND~~	1.0 U	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	~~ND~~	1.0	ug/L
2-Butanone	1.7 J	~~10~~	ug/L
Carbon disulfide	~~ND~~	1.0 U	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
Cyclohexane	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	2.0	ug/L
1,2-Dibromoethane	~~ND~~	1.0 U	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
Dichlorodifluoromethane	ND	1.0 UJ	ug/L
1,1-Dichloroethane	ND	1.0 U	ug/L
1,2-Dichloroethane	ND	1.0 U	ug/L
1,1-Dichloroethene	0.51 J	~~1.0~~	ug/L
cis-1,2-Dichloroethene	~~ND~~	1.0 U	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	~~ND~~	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
2-Hexanone	ND	10 UJ	ug/L
Isopropylbenzene	ND	1.0 U	ug/L
Methyl acetate	ND	10 U	ug/L
Methylene chloride	4.4 ~~B~~ U	~~1.0~~	ug/L
Methylcyclohexane	~~ND~~	1.0 U	ug/L
4-Methyl-2-pentanone	ND	10 UJ	ug/L
Methyl tert-butyl ether	ND	5.0 U	ug/L
Styrene	ND	1.0 U	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIP BLANK-01-120303-TB

GC/MS Volatiles

Lot-Sample #...: A3L040249-004 Work Order #...: F51X91AA Matrix.....: WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	1.0 U	ug/L
Tetrachloroethene	~~ND~~	1.0 U	ug/L
Toluene	0.68 J	~~1.0~~	ug/L
1,2,4-Trichloro-benzene	~~ND~~	1.0 U	ug/L
1,1,1-Trichloroethane	ND	1.0 U	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.0	ug/L
Vinyl chloride	~~ND~~	1.0 U	ug/L
Xylenes (total)	~~ND~~	2.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	93	(73 - 122)
1,2-Dichloroethane-d4	90	(61 - 128)
Toluene-d8	84	(76 - 110)
4-Bromofluorobenzene	92	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L050302-001 Work Order #...: F540M1AA Matrix.....: WG
Date Sampled...: 12/04/03 15:55 Date Received..: 12/05/03
Prep Date.....: 12/12/03 Analysis Date..: 12/12/03
Prep Batch #...: 3346355
Dilution Factor: 3.33 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~6.2 J,B~~	33 UJ	ug/L
Benzene	ND	3.3 UJ	ug/L
Bromodichloromethane	ND	3.3 U	ug/L
Bromoform	ND	3.3	ug/L
Bromomethane	ND	3.3	ug/L
2-Butanone	ND	33	ug/L
Carbon disulfide	ND	3.3	ug/L
Carbon tetrachloride	ND	3.3	ug/L
Chlorobenzene	ND	3.3	ug/L
Chloroethane	ND	3.3	ug/L
Chloroform	ND	3.3	ug/L
Chloromethane	ND	3.3	ug/L
Cyclohexane	ND	3.3	ug/L
Dibromochloromethane	ND	3.3	ug/L
1,2-Dibromo-3-chloro-propane	ND	6.7	ug/L
1,2-Dibromoethane	ND	3.3 U	ug/L
1,2-Dichlorobenzene	ND	3.3	ug/L
1,3-Dichlorobenzene	ND	3.3	ug/L
1,4-Dichlorobenzene	ND	3.3	ug/L
Dichlorodifluoromethane	ND	3.3	ug/L
1,1-Dichloroethane	ND	3.3	ug/L
1,2-Dichloroethane	ND	3.3	ug/L
1,1-Dichloroethene	ND	3.3	ug/L
cis-1,2-Dichloroethene	ND	3.3	ug/L
trans-1,2-Dichloroethene	ND	3.3	ug/L
1,2-Dichloropropane	ND	3.3	ug/L
cis-1,3-Dichloropropene	ND	3.3	ug/L
trans-1,3-Dichloropropene	ND	3.3	ug/L
Ethylbenzene	ND	3.3	ug/L
2-Hexanone	ND	33	ug/L
Isopropylbenzene	ND	3.3	ug/L
Methyl acetate	ND	33	ug/L
Methylene chloride	~~2.5 J,B~~	3.3 U	ug/L
Methylcyclohexane	ND	3.3 U	ug/L
4-Methyl-2-pentanone	ND	33	ug/L
Methyl tert-butyl ether	ND	17	ug/L
Styrene	ND	3.3	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L050302-001 Work Order #...: F540M1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	3.3 U	ug/L
Tetrachloroethene	~~ND~~	3.3 U	ug/L
Toluene	**120** J	~~3.3~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	3.3 U	ug/L
1,1,1-Trichloroethane	~~ND~~	3.3 U	ug/L
1,1,2-Trichloroethane	~~ND~~	3.3 U	ug/L
Trichloroethene	~~ND~~	3.3 U	ug/L
Trichlorofluoromethane	~~ND~~	3.3 U	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	3.3 U	ug/L
Vinyl chloride	~~ND~~	3.3 U	ug/L
Xylenes (total)	~~ND~~	6.7 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	114	(73 - 122)
1,2-Dichloroethane-d4	111	(61 - 128)
Toluene-d8	100	(76 - 110)
4-Bromofluorobenzene	81	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-D

GC/MS Volatiles

Lot-Sample #...: A3L050302-002 Work Order #...: F542A1AA Matrix.....: WG
Date Sampled...: 12/04/03 15:55 Date Received..: 12/05/03
Prep Date.....: 12/12/03 Analysis Date..: 12/12/03
Prep Batch #...: 3346355
Dilution Factor: 3.33 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	ND	33 UJ	ug/L
Benzene	ND	3.3 U	ug/L
Bromodichloromethane	ND	3.3	ug/L
Bromoform	ND	3.3	ug/L
Bromomethane	ND	3.3	ug/L
2-Butanone	ND	33	ug/L
Carbon disulfide	ND	3.3	ug/L
Carbon tetrachloride	ND	3.3	ug/L
Chlorobenzene	ND	3.3	ug/L
Chloroethane	ND	3.3	ug/L
Chloroform	ND	3.3	ug/L
Chloromethane	ND	3.3	ug/L
Cyclohexane	ND	3.3	ug/L
Dibromochloromethane	ND	3.3	ug/L
1,2-Dibromo-3-chloro-propane	ND	6.7	ug/L
1,2-Dibromoethane	ND	3.3 U	ug/L
1,2-Dichlorobenzene	ND	3.3	ug/L
1,3-Dichlorobenzene	ND	3.3	ug/L
1,4-Dichlorobenzene	ND	3.3	ug/L
Dichlorodifluoromethane	ND	3.3	ug/L
1,1-Dichloroethane	ND	3.3	ug/L
1,2-Dichloroethane	ND	3.3	ug/L
1,1-Dichloroethene	ND	3.3	ug/L
cis-1,2-Dichloroethene	ND	3.3	ug/L
trans-1,2-Dichloroethene	ND	3.3	ug/L
1,2-Dichloropropane	ND	3.3	ug/L
cis-1,3-Dichloropropene	ND	3.3	ug/L
trans-1,3-Dichloropropene	ND	3.3	ug/L
Ethylbenzene	ND	3.3	ug/L
2-Hexanone	ND	33	ug/L
Isopropylbenzene	ND	3.3	ug/L
Methyl acetate	ND	33	ug/L
Methylene chloride	~~2.3 J,B~~	3.3 U	**ug/L**
Methylcyclohexane	ND	3.3 U	ug/L
4-Methyl-2-pentanone	ND	33	ug/L
Methyl tert-butyl ether	ND	17	ug/L
Styrene	ND	3.3	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-D

GC/MS Volatiles

Lot-Sample #...: A3L050302-002 Work Order #...: F542A1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	3.3 U	ug/L
Tetrachloroethene	~~ND~~	3.3 U	ug/L
Toluene	120	~~3.3~~	ug/L
1,2,4-Trichloro-benzene	~~1.6 J,B~~	3.3 U	ug/L
1,1,1-Trichloroethane	~~ND~~	3.3 U	ug/L
1,1,2-Trichloroethane	~~ND~~	3.3 U	ug/L
Trichloroethene	ND	3.3 U	ug/L
Trichlorofluoromethane	~~ND~~	3.3 UJ	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	3.3 UJ	ug/L
Vinyl chloride	~~ND~~	3.3 U	ug/L
Xylenes (total)	~~ND~~	6.7 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	111	(73 - 122)
1,2-Dichloroethane-d4	107	(61 - 128)
Toluene-d8	96	(76 - 110)
4-Bromofluorobenzene	83	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-13-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L050302-003 **Work Order #...:** F542D1AA **Matrix.....:** WG
Date Sampled...: 12/04/03 18:10 **Date Received..:** 12/05/03
Prep Date.....: 12/12/03 **Analysis Date..:** 12/12/03
Prep Batch #...: 3346355
Dilution Factor: 2 **Initial Wgt/Vol:** 5 mL **Final Wgt/Vol..:** 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~3.5 J,B~~	**20** UJ	**ug/L**
Benzene	~~ND~~	2.0 U	ug/L
Bromodichloromethane	ND	2.0	ug/L
Bromoform	ND	2.0	ug/L
Bromomethane	ND	2.0	ug/L
2-Butanone	ND	20	ug/L
Carbon disulfide	ND	2.0	ug/L
Carbon tetrachloride	ND	2.0	ug/L
Chlorobenzene	ND	2.0	ug/L
Chloroethane	ND	2.0	ug/L
Chloroform	ND	2.0	ug/L
Chloromethane	ND	2.0	ug/L
Cyclohexane	ND	2.0	ug/L
Dibromochloromethane	ND	2.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	4.0	ug/L
1,2-Dibromoethane	~~ND~~	2.0 U	ug/L
1,2-Dichlorobenzene	ND	2.0	ug/L
1,3-Dichlorobenzene	ND	2.0	ug/L
1,4-Dichlorobenzene	ND	2.0	ug/L
Dichlorodifluoromethane	ND	2.0	ug/L
1,1-Dichloroethane	ND	2.0	ug/L
1,2-Dichloroethane	**22**	~~2.0~~	**ug/L**
1,1-Dichloroethene	~~ND~~	2.0 U	ug/L
cis-1,2-Dichloroethene	ND	2.0	ug/L
trans-1,2-Dichloroethene	ND	2.0	ug/L
1,2-Dichloropropane	ND	2.0	ug/L
cis-1,3-Dichloropropene	ND	2.0	ug/L
trans-1,3-Dichloropropene	ND	2.0	ug/L
Ethylbenzene	ND	2.0	ug/L
2-Hexanone	ND	20	ug/L
Isopropylbenzene	ND	2.0	ug/L
Methyl acetate	ND	20	ug/L
Methylene chloride	~~1.4 J,B~~	**2.0** U	**ug/L**
Methylcyclohexane	~~ND~~	2.0 U	ug/L
4-Methyl-2-pentanone	ND	20	ug/L
Methyl tert-butyl ether	ND	10	ug/L
Styrene	ND	2.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-13-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L050302-003 Work Order #...: F542D1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	2.0 U	ug/L
Tetrachloroethene	~~ND~~	2.0 U	ug/L
Toluene	**76**	~~2.0~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	2.0 U	ug/L
1,1,1-Trichloroethane	~~ND~~	2.0 U	ug/L
1,1,2-Trichloroethane	~~ND~~	2.0	ug/L
Trichloroethene	~~ND~~	2.0	ug/L
Trichlorofluoromethane	~~ND~~	2.0 UJ	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	2.0 UJ	ug/L
Vinyl chloride	~~ND~~	2.0 U	ug/L
Xylenes (total)	~~ND~~	4.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	114	(73 - 122)
1,2-Dichloroethane-d4	110	(61 - 128)
Toluene-d8	95	(76 - 110)
4-Bromofluorobenzene	79	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIPBLANK-02-120403-TB

GC/MS Volatiles

Lot-Sample #...: A3L050302-004 Work Order #...: F542G1AA Matrix.....: WQ
Date Sampled...: 12/04/03 Date Received..: 12/05/03
Prep Date.....: 12/12/03 Analysis Date..: 12/12/03
Prep Batch #...: 3349558
Dilution Factor: 1 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	ND	10 UJ	ug/L
Benzene	ND	1.0 U	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10 UJ	ug/L
Carbon disulfide	ND	1.0 U	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
Cyclohexane	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	2.0	ug/L
1,2-Dibromoethane	ND	1.0 U	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
Dichlorodifluoromethane	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
2-Hexanone	ND	10 UJ	ug/L
Isopropylbenzene	ND	1.0 U	ug/L
Methyl acetate	ND	10 U	ug/L
Methylene chloride	~~0.45 J,B~~	**1.0 U**	**ug/L**
Methylcyclohexane	ND	1.0 U	ug/L
4-Methyl-2-pentanone	ND	10 UJ	ug/L
Methyl tert-butyl ether	ND	5.0 U	ug/L
Styrene	ND	1.0 U	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIPBLANK-02-120403-TB

GC/MS Volatiles

Lot-Sample #...: A3L050302-004 Work Order #...: F542G1AA Matrix.....: WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	ND	1.0 U	ug/L
Tetrachloroethene	ND	1.0	ug/L
Toluene	ND	1.0	ug/L
1,2,4-Trichloro-benzene	ND	1.0	ug/L
1,1,1-Trichloroethane	ND	1.0 U	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.0	ug/L
Vinyl chloride	ND	1.0 U	ug/L
Xylenes (total)	ND	2.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	115	(73 - 122)
1,2-Dichloroethane-d4	105	(61 - 128)
Toluene-d8	91	(76 - 110)
4-Bromofluorobenzene	76	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-22-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L060156-001 **Work Order #...:** F56G51AA **Matrix.....:** WG
Date Sampled...: 12/05/03 10:00 **Date Received..:** 12/06/03
Prep Date.....: 12/17/03 **Analysis Date..:** 12/17/03
Prep Batch #...: 3352376
Dilution Factor: 100 **Initial Wgt/Vol:** 5 mL **Final Wgt/Vol..:** 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	**5200 ~~B~~**	**~~1000~~**	**ug/L**
Benzene	**2300**	**~~100~~**	**ug/L**
Bromodichloromethane	~~ND~~	100 U	ug/L
Bromoform	~~ND~~	100	ug/L
Bromomethane	~~ND~~	100	ug/L
2-Butanone	**80 J**	**~~1000~~**	**ug/L**
Carbon disulfide	~~ND~~	100 U	ug/L
Carbon tetrachloride	~~ND~~	100 U	ug/L
Chlorobenzene	**640**	**~~100~~**	**ug/L**
Chloroethane	~~ND~~	100 U	ug/L
Chloroform	~~ND~~	100	ug/L
Chloromethane	~~ND~~	100	ug/L
Cyclohexane	~~ND~~	100	ug/L
Dibromochloromethane	~~ND~~	100	ug/L
1,2-Dibromo-3-chloro-propane	~~ND~~	200	ug/L
1,2-Dibromoethane	~~ND~~	100 U	ug/L
1,2-Dichlorobenzene	~~ND~~	100	ug/L
1,3-Dichlorobenzene	~~ND~~	100	ug/L
1,4-Dichlorobenzene	~~ND~~	100	ug/L
Dichlorodifluoromethane	~~ND~~	100	ug/L
1,1-Dichloroethane	~~ND~~	100	ug/L
1,2-Dichloroethane	~~ND~~	100	ug/L
1,1-Dichloroethene	~~ND~~	100	ug/L
cis-1,2-Dichloroethene	~~ND~~	100	ug/L
trans-1,2-Dichloroethene	~~ND~~	100	ug/L
1,2-Dichloropropane	~~ND~~	100	ug/L
cis-1,3-Dichloropropene	~~ND~~	100	ug/L
trans-1,3-Dichloropropene	~~ND~~	100	ug/L
Ethylbenzene	**53 J**	**~~100~~**	**ug/L**
2-Hexanone	~~ND~~	1000 U	ug/L
Isopropylbenzene	~~ND~~	100 U	ug/L
Methyl acetate	~~ND~~	1000 U	ug/L
Methylene chloride	**~~66 J,B~~**	**100 U**	**ug/L**
Methylcyclohexane	~~ND~~	100 U	ug/L
4-Methyl-2-pentanone	~~ND~~	1000	ug/L
Methyl tert-butyl ether	~~ND~~	500	ug/L
Styrene	~~ND~~	100	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-22-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L060156-001 Work Order #...: F56G51AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	100 U	ug/L
Tetrachloroethene	~~ND~~	100 U	ug/L
Toluene	**180** U	~~100~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	100 U	ug/L
1,1,1-Trichloroethane	~~ND~~	100 U	ug/L
1,1,2-Trichloroethane	~~ND~~	100	ug/L
Trichloroethene	~~ND~~	100	ug/L
Trichlorofluoromethane	~~ND~~	100	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	100	ug/L
Vinyl chloride	**280**	~~100~~	**ug/L**
Xylenes (total)	~~ND~~	200 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	103	(73 - 122)
1,2-Dichloroethane-d4	97	(61 - 128)
Toluene-d8	98	(76 - 110)
4-Bromofluorobenzene	83	(74 - 116)

NOTE(S):

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

J Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIP BLANK-03-120503-TB

GC/MS Volatiles

Lot-Sample #...: A3L060156-002 Work Order #...: F56G61AA Matrix.....: WQ
Date Sampled...: 12/05/03 Date Received..: 12/06/03
Prep Date.....: 12/22/03 Analysis Date..: 12/22/03
Prep Batch #...: 3356251
Dilution Factor: 1 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~4.4 J,B~~ 10 UJ	~~10~~ UL R	ug/L
Benzene	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0 UJ	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
Cyclohexane	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	2.0	ug/L
1,2-Dibromoethane	ND	1.0	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
Dichlorodifluoromethane	ND	1.0 UJ	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Isopropylbenzene	ND	1.0	ug/L
Methyl acetate	ND	10	ug/L
Methylene chloride	2.1 J	~~1.0~~	ug/L
Methylcyclohexane	ND	1.0 R	ug/L
4-Methyl-2-pentanone	ND	10	ug/L
Methyl tert-butyl ether	ND	5.0	ug/L
Styrene	ND	1.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIP BLANK-03-120503-TB

GC/MS Volatiles

Lot-Sample #...: A3L060156-002 Work Order #...: F56G61AA Matrix.....: WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	ND	~~1.0~~ R	ug/L
Tetrachloroethene	ND	1.0 R	ug/L
Toluene	**0.49 J**	**~~1.0~~**	**ug/L**
1,2,4-Trichloro-benzene	ND	~~1.0~~ R	ug/L
1,1,1-Trichloroethane	ND	1.0	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.0	ug/L
Vinyl chloride	ND	1.0	ug/L
Xylenes (total)	ND	2.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	88	(73 - 122)
1,2-Dichloroethane-d4	84	(61 - 128)
Toluene-d8	92	(76 - 110)
4-Bromofluorobenzene	82	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L090272-001 Work Order #...: F6ARF1AA Matrix.....: WG
Date Sampled...: 12/08/03 15:00 Date Received..: 12/09/03
Prep Date.....: 12/17/03 Analysis Date..: 12/17/03
Prep Batch #...: 3352368
Dilution Factor: 1 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~0.94 J,B~~	10 U	ug/L
Benzene	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
Cyclohexane	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	2.0	ug/L
1,2-Dibromoethane	ND	1.0 U	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
Dichlorodifluoromethane	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Isopropylbenzene	ND	1.0	ug/L
Methyl acetate	ND	10	ug/L
Methylene chloride	ND	1.0	ug/L
Methylcyclohexane	ND	1.0	ug/L
4-Methyl-2-pentanone	ND	10	ug/L
Methyl tert-butyl ether	ND	5.0	ug/L
Styrene	ND	1.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L090272-001 Work Order #...: F6ARF1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	1.0 U	ug/L
Tetrachloroethene	~~ND~~	1.0 U	ug/L
Toluene	**27**	~~1.0~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	1.0 U	ug/L
1,1,1-Trichloroethane	~~ND~~	1.0 U	ug/L
1,1,2-Trichloroethane	~~ND~~	1.0	ug/L
Trichloroethene	~~ND~~	1.0	ug/L
Trichlorofluoromethane	~~ND~~	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	1.0	ug/L
Vinyl chloride	~~ND~~	1.0 U	ug/L
Xylenes (total)	~~ND~~	2.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	91	(73 - 122)
1,2-Dichloroethane-d4	86	(61 - 128)
Toluene-d8	95	(76 - 110)
4-Bromofluorobenzene	78	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-D

GC/MS Volatiles

Lot-Sample #...: A3L090272-002 Work Order #...: F6ARJ1AA Matrix.....: WG
Date Sampled...: 12/08/03 15:00 Date Received..: 12/09/03
Prep Date.....: 12/17/03 Analysis Date..: 12/17/03
Prep Batch #...: 3352368
Dilution Factor: 1 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~0.92 J,B~~	10 U	ug/L
Benzene	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
Cyclohexane	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	2.0	ug/L
1,2-Dibromoethane	ND	1.0 U	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
Dichlorodifluoromethane	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Isopropylbenzene	ND	1.0	ug/L
Methyl acetate	ND	10	ug/L
Methylene chloride	ND	1.0	ug/L
Methylcyclohexane	ND	1.0	ug/L
4-Methyl-2-pentanone	ND	10	ug/L
Methyl tert-butyl ether	ND	5.0	ug/L
Styrene	ND	1.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-D

GC/MS Volatiles

Lot-Sample #...: A3L090272-002 Work Order #...: F6ARJ1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	1.0 U	ug/L
Tetrachloroethene	~~ND~~	1.0 U	ug/L
Toluene	27	~~1.0~~	ug/L
1,2,4-Trichloro-benzene	~~ND~~	1.0 U	ug/L
1,1,1-Trichloroethane	ND	1.0 U	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.0	ug/L
Vinyl chloride	~~ND~~	1.0 U	ug/L
Xylenes (total)	ND	2.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	88	(73 - 122)
1,2-Dichloroethane-d4	83	(61 - 128)
Toluene-d8	93	(76 - 110)
4-Bromofluorobenzene	85	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIPBLANK04-120803-TB

GC/MS Volatiles

Lot-Sample #...: A3L090272-003 **Work Order #...:** F6ARM1AA **Matrix.....:** WQ
Date Sampled...: 12/08/03 **Date Received..:** 12/09/03
Prep Date.....: 12/17/03 **Analysis Date..:** 12/17/03
Prep Batch #...: 3352368
Dilution Factor: 1 **Initial Wgt/Vol:** 5 mL **Final Wgt/Vol..:** 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~2.7 J,B~~	10 U	ug/L
Benzene	~~ND~~	1.0 U	ug/L
Bromodichloromethane	~~ND~~	1.0	ug/L
Bromoform	~~ND~~	1.0	ug/L
Bromomethane	~~ND~~	1.0	ug/L
2-Butanone	**0.78 J**	~~10~~	ug/L
Carbon disulfide	~~ND~~	1.0 U	ug/L
Carbon tetrachloride	~~ND~~	1.0	ug/L
Chlorobenzene	~~ND~~	1.0	ug/L
Chloroethane	~~ND~~	1.0	ug/L
Chloroform	~~ND~~	1.0	ug/L
Chloromethane	~~ND~~	1.0	ug/L
Cyclohexane	~~ND~~	1.0	ug/L
Dibromochloromethane	~~ND~~	1.0	ug/L
1,2-Dibromo-3-chloro-propane	~~ND~~	2.0	ug/L
1,2-Dibromoethane	~~ND~~	1.0 U	ug/L
1,2-Dichlorobenzene	~~ND~~	1.0	ug/L
1,3-Dichlorobenzene	~~ND~~	1.0	ug/L
1,4-Dichlorobenzene	~~ND~~	1.0	ug/L
Dichlorodifluoromethane	~~ND~~	1.0	ug/L
1,1-Dichloroethane	~~ND~~	1.0	ug/L
1,2-Dichloroethane	~~ND~~	1.0	ug/L
1,1-Dichloroethene	~~ND~~	1.0	ug/L
cis-1,2-Dichloroethene	~~ND~~	1.0	ug/L
trans-1,2-Dichloroethene	~~ND~~	1.0	ug/L
1,2-Dichloropropane	~~ND~~	1.0	ug/L
cis-1,3-Dichloropropene	~~ND~~	1.0	ug/L
trans-1,3-Dichloropropene	~~ND~~	1.0	ug/L
Ethylbenzene	~~ND~~	1.0	ug/L
2-Hexanone	~~ND~~	10	ug/L
Isopropylbenzene	~~ND~~	1.0	ug/L
Methyl acetate	~~ND~~	10	ug/L
Methylene chloride	~~ND~~	1.0	ug/L
Methylcyclohexane	~~ND~~	1.0	ug/L
4-Methyl-2-pentanone	~~ND~~	10	ug/L
Methyl tert-butyl ether	~~ND~~	5.0	ug/L
Styrene	~~ND~~	1.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIPBLANK04-120803-TB

GC/MS Volatiles

Lot-Sample #...: A3L090272-003 Work Order #...: F6ARM1AA Matrix.....: WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	ND	1.0 u	ug/L
Tetrachloroethene	ND	1.0	ug/L
Toluene	ND	1.0	ug/L
1,2,4-Trichloro-benzene	ND	1.0	ug/L
1,1,1-Trichloroethane	ND	1.0 u	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.0	ug/L
Vinyl chloride	ND	1.0 u	ug/L
Xylenes (total)	ND	2.0 u	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	88	(73 - 122)
1,2-Dichloroethane-d4	84	(61 - 128)
Toluene-d8	93	(76 - 110)
4-Bromofluorobenzene	82	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-07-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L090272-004 Work Order #...: F6ARQ1AA Matrix.....: WG
Date Sampled...: 12/08/03 12:00 Date Received..: 12/09/03
Prep Date.....: 12/17/03 Analysis Date..: 12/17/03
Prep Batch #...: 3352368
Dilution Factor: 2.5 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	**44 J**	**~~25~~**	**ug/L**
Benzene	**0.83 J**	**~~2.5~~**	**ug/L**
Bromodichloromethane	~~ND~~	2.5 U	ug/L
Bromoform	~~ND~~	2.5 U	ug/L
Bromomethane	~~ND~~	2.5 U	ug/L
2-Butanone	**14 J** U	**~~25~~**	**ug/L**
Carbon disulfide	~~ND~~	2.5 U	ug/L
Carbon tetrachloride	~~ND~~	2.5	ug/L
Chlorobenzene	~~ND~~	2.5	ug/L
Chloroethane	~~ND~~	2.5	ug/L
Chloroform	~~ND~~	2.5	ug/L
Chloromethane	~~ND~~	2.5	ug/L
Cyclohexane	**1.4 J**	**~~2.5~~**	**ug/L**
Dibromochloromethane	~~ND~~	2.5 U	ug/L
1,2-Dibromo-3-chloro-propane	~~ND~~	5.0 U	ug/L
1,2-Dibromoethane	~~ND~~	2.5 U	ug/L
1,2-Dichlorobenzene	~~ND~~	2.5	ug/L
1,3-Dichlorobenzene	~~ND~~	2.5	ug/L
1,4-Dichlorobenzene	~~ND~~	2.5	ug/L
Dichlorodifluoromethane	~~ND~~	2.5	ug/L
1,1-Dichloroethane	**12**	**~~2.5~~**	**ug/L**
1,2-Dichloroethane	~~ND~~	2.5 U	ug/L
1,1-Dichloroethene	**1.7 J**	**~~2.5~~**	**ug/L**
cis-1,2-Dichloroethene	~~ND~~	2.5 U	ug/L
trans-1,2-Dichloroethene	~~ND~~	2.5	ug/L
1,2-Dichloropropane	~~ND~~	2.5	ug/L
cis-1,3-Dichloropropene	~~ND~~	2.5	ug/L
trans-1,3-Dichloropropene	~~ND~~	2.5	ug/L
Ethylbenzene	**11**	**~~2.5~~**	**ug/L**
2-Hexanone	**1.3 J**	**~~25~~**	**ug/L**
Isopropylbenzene	**4.8**	**~~2.5~~**	**ug/L**
Methyl acetate	~~ND~~	25 U	ug/L
Methylene chloride	~~ND~~	2.5 U	ug/L
Methylcyclohexane	**2.8**	**~~2.5~~**	**ug/L**
4-Methyl-2-pentanone	**0.91 J**	**~~25~~**	**ug/L**
Methyl tert-butyl ether	~~ND~~	12 U	ug/L
Styrene	~~ND~~	2.5 U	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-07-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L090272-004 Work Order #...: F6ARQ1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	2.5 U	ug/L
Tetrachloroethene	~~ND~~	2.5 U	ug/L
Toluene	17	~~2.5~~	ug/L
1,2,4-Trichloro-benzene	~~ND~~	2.5 U	ug/L
1,1,1-Trichloroethane	13	~~2.5~~	ug/L
1,1,2-Trichloroethane	~~ND~~	2.5 U	ug/L
Trichloroethene	~~ND~~	2.5	ug/L
Trichlorofluoromethane	~~ND~~	2.5	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	2.5	ug/L
Vinyl chloride	~~ND~~	2.5 U	ug/L
Xylenes (total)	22	~~5.0~~	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	87	(73 - 122)
1,2-Dichloroethane-d4	82	(61 - 128)
Toluene-d8	91	(76 - 110)
4-Bromofluorobenzene	90	(74 - 116)

NOTE(S):

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

J Estimated result. Result is less than RL.

Elevated reporting limits due to TICs.

ENSR CONSULTING & ENGINEERING

Client Sample ID: PM4NA-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L090272-005 Work Order #...: F6ARX1AA Matrix.....: WG
Date Sampled...: 12/08/03 19:10 Date Received..: 12/09/03
Prep Date.....: 12/13/03 Analysis Date..: 12/13/03
Prep Batch #...: 3349295
Dilution Factor: 5 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~ND~~	50 U ~~J~~	ug/L
Benzene	**1.1 J**	~~**5.0**~~	**ug/L**
Bromodichloromethane	~~ND~~	5.0 U	ug/L
Bromoform	~~ND~~	5.0	ug/L
Bromomethane	~~ND~~	5.0	ug/L
2-Butanone	~~ND~~	50 UJ	ug/L
Carbon disulfide	**1.4 J**	~~**5.0**~~	**ug/L**
Carbon tetrachloride	~~ND~~	5.0 U	ug/L
Chlorobenzene	~~ND~~	5.0 UJ	ug/L
Chloroethane	~~ND~~	5.0 U	ug/L
Chloroform	~~ND~~	5.0	ug/L
Chloromethane	~~ND~~	5.0	ug/L
Cyclohexane	~~ND~~	5.0	ug/L
Dibromochloromethane	~~ND~~	5.0	ug/L
1,2-Dibromo-3-chloro-propane	~~ND~~	10	ug/L
1,2-Dibromoethane	~~ND~~	5.0 U	ug/L
1,2-Dichlorobenzene	~~ND~~	5.0 UJ	ug/L
1,3-Dichlorobenzene	~~ND~~	5.0 UJ	ug/L
1,4-Dichlorobenzene	~~ND~~	5.0 UJ	ug/L
Dichlorodifluoromethane	~~ND~~	5.0 U	ug/L
1,1-Dichloroethane	~~ND~~	5.0	ug/L
1,2-Dichloroethane	~~ND~~	5.0	ug/L
1,1-Dichloroethene	~~ND~~	5.0	ug/L
cis-1,2-Dichloroethene	~~ND~~	5.0	ug/L
trans-1,2-Dichloroethene	~~ND~~	5.0	ug/L
1,2-Dichloropropane	~~ND~~	5.0	ug/L
cis-1,3-Dichloropropene	~~ND~~	5.0	ug/L
trans-1,3-Dichloropropene	~~ND~~	5.0	ug/L
Ethylbenzene	~~ND~~	5.0 UJ	ug/L
2-Hexanone	~~ND~~	50 U ~~J~~	ug/L
Isopropylbenzene	~~ND~~	5.0 UJ	ug/L
Methyl acetate	~~ND~~	50 U	ug/L
Methylene chloride	~~**3.2 J,B**~~	**5.0 U**	**ug/L**
Methylcyclohexane	~~ND~~	5.0 U	ug/L
4-Methyl-2-pentanone	~~ND~~	50 U	ug/L
Methyl tert-butyl ether	~~ND~~	25 U	ug/L
Styrene	~~ND~~	5.0 UJ	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: PM4NA-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L090272-005 Work Order #...: F6ARX1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	5.0 U	ug/L
Tetrachloroethene	~~ND~~	5.0 U	ug/L
Toluene	13 J	~~5.0~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	5.0 UJ	ug/L
1,1,1-Trichloroethane	~~ND~~	5.0 U	ug/L
1,1,2-Trichloroethane	~~ND~~	5.0	ug/L
Trichloroethene	~~ND~~	5.0	ug/L
Trichlorofluoromethane	~~ND~~	5.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	5.0	ug/L
Vinyl chloride	~~ND~~	5.0 U	ug/L
Xylenes (total)	~~ND~~	10 UJ	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	121	(73 - 122)
1,2-Dichloroethane-d4	100	(61 - 128)
Toluene-d8	91	(76 - 110)
4-Bromofluorobenzene	83	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Elevated reporting limits due to matrix interference.

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI9-2F-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-001 Work Order #...: F6DV51AA Matrix.....: WG
Date Sampled...: 12/09/03 13:40 Date Received..: 12/10/03
Prep Date.....: 12/17/03 Analysis Date..: 12/17/03
Prep Batch #...: 3352388
Dilution Factor: 10 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~12 J,B~~	100 U	ug/L
Benzene	ND	10	ug/L
Bromodichloromethane	ND	10	ug/L
Bromoform	ND	10	ug/L
Bromomethane	ND	10	ug/L
2-Butanone	ND	100	ug/L
Carbon disulfide	ND	10	ug/L
Carbon tetrachloride	ND	10	ug/L
Chlorobenzene	ND	10	ug/L
Chloroethane	ND	10	ug/L
Chloroform	ND	10	ug/L
Chloromethane	ND	10	ug/L
Cyclohexane	ND	10	ug/L
Dibromochloromethane	ND	10	ug/L
1,2-Dibromo-3-chloro-propane	ND	20	ug/L
1,2-Dibromoethane	ND	10 U	ug/L
1,2-Dichlorobenzene	ND	10	ug/L
1,3-Dichlorobenzene	ND	10	ug/L
1,4-Dichlorobenzene	ND	10	ug/L
Dichlorodifluoromethane	ND	10	ug/L
1,1-Dichloroethane	ND	10	ug/L
1,2-Dichloroethane	ND	10	ug/L
1,1-Dichloroethene	ND	10	ug/L
cis-1,2-Dichloroethene	ND	10	ug/L
trans-1,2-Dichloroethene	ND	10	ug/L
1,2-Dichloropropane	ND	10	ug/L
cis-1,3-Dichloropropene	ND	10	ug/L
trans-1,3-Dichloropropene	ND	10	ug/L
Ethylbenzene	ND	10	ug/L
2-Hexanone	ND	100	ug/L
Isopropylbenzene	ND	10	ug/L
Methyl acetate	ND	100	ug/L
Methylene chloride	ND	10	ug/L
Methylcyclohexane	ND	10	ug/L
4-Methyl-2-pentanone	ND	100	ug/L
Methyl tert-butyl ether	ND	50	ug/L
Styrene	ND	10	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI9-2F-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-001 Work Order #...: F6DV51AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	10 U	ug/L
Tetrachloroethene	~~ND~~	10 U	ug/L
Toluene	**30**	~~10~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	10 U	ug/L
1,1,1-Trichloroethane	~~ND~~	10 U	ug/L
1,1,2-Trichloroethane	ND	10	ug/L
Trichloroethene	ND	10	ug/L
Trichlorofluoromethane	ND	10	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	10	ug/L
Vinyl chloride	ND	10 U	ug/L
Xylenes (total)	ND	20 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	89	(73 - 122)
1,2-Dichloroethane-d4	85	(61 - 128)
Toluene-d8	94	(76 - 110)
4-Bromofluorobenzene	81	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Elevated reporting limits due to matrix interference.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-12-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-002 Work Order #...: F6DWH1AA Matrix.....: WG
Date Sampled...: 12/09/03 15:50 Date Received..: 12/10/03
Prep Date.....: 12/17/03 Analysis Date..: 12/17/03
Prep Batch #...: 3352388
Dilution Factor: 5 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~14 J,B~~	50 U	ug/L
Benzene	ND	5.0	ug/L
Bromodichloromethane	ND	5.0	ug/L
Bromoform	ND	5.0	ug/L
Bromomethane	ND	5.0	ug/L
2-Butanone	ND	50	ug/L
Carbon disulfide	1.3 J	~~5.0~~	ug/L
Carbon tetrachloride	ND	5.0 U	ug/L
Chlorobenzene	ND	5.0	ug/L
Chloroethane	ND	5.0	ug/L
Chloroform	ND	5.0	ug/L
Chloromethane	ND	5.0	ug/L
Cyclohexane	ND	5.0	ug/L
Dibromochloromethane	ND	5.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	10	ug/L
1,2-Dibromoethane	ND	5.0 U	ug/L
1,2-Dichlorobenzene	ND	5.0	ug/L
1,3-Dichlorobenzene	ND	5.0	ug/L
1,4-Dichlorobenzene	ND	5.0	ug/L
Dichlorodifluoromethane	ND	5.0	ug/L
1,1-Dichloroethane	ND	5.0	ug/L
1,2-Dichloroethane	ND	5.0	ug/L
1,1-Dichloroethene	ND	5.0	ug/L
cis-1,2-Dichloroethene	ND	5.0	ug/L
trans-1,2-Dichloroethene	ND	5.0	ug/L
1,2-Dichloropropane	ND	5.0	ug/L
cis-1,3-Dichloropropene	ND	5.0	ug/L
trans-1,3-Dichloropropene	ND	5.0	ug/L
Ethylbenzene	ND	5.0	ug/L
2-Hexanone	ND	50	ug/L
Isopropylbenzene	ND	5.0	ug/L
Methyl acetate	ND	50	ug/L
Methylene chloride	ND	5.0	ug/L
Methylcyclohexane	ND	5.0	ug/L
4-Methyl-2-pentanone	ND	50	ug/L
Methyl tert-butyl ether	ND	25	ug/L
Styrene	ND	5.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-12-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-002 Work Order #...: F6DWH1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	5.0 U	ug/L
Tetrachloroethene	~~ND~~	5.0 U	ug/L
Toluene	**16**	~~5.0~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	5.0 U	ug/L
1,1,1-Trichloroethane	~~ND~~	5.0 U	ug/L
1,1,2-Trichloroethane	ND	5.0	ug/L
Trichloroethene	ND	5.0	ug/L
Trichlorofluoromethane	ND	5.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	5.0	ug/L
Vinyl chloride	~~ND~~	5.0 U	ug/L
Xylenes (total)	ND	10 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(73 - 122)
1,2-Dichloroethane-d4	85	(61 - 128)
Toluene-d8	94	(76 - 110)
4-Bromofluorobenzene	79	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Elevated reporting limits due to matrix interference.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-15-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-003 Work Order #...: F6DWL1AA Matrix.....: WG
Date Sampled...: 12/09/03 11:50 Date Received..: 12/10/03
Prep Date.....: 12/17/03 Analysis Date..: 12/17/03
Prep Batch #...: 3352388
Dilution Factor: 1 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~0.95 J,B~~	10 U	ug/L
Benzene	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
Cyclohexane	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	2.0	ug/L
1,2-Dibromoethane	ND	1.0 U	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
Dichlorodifluoromethane	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Isopropylbenzene	ND	1.0	ug/L
Methyl acetate	ND	10	ug/L
Methylene chloride	ND	1.0	ug/L
Methylcyclohexane	ND	1.0	ug/L
4-Methyl-2-pentanone	ND	10	ug/L
Methyl tert-butyl ether	ND	5.0	ug/L
Styrene	ND	1.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RPIMW-15-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-003 Work Order #...: F6DWL1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	1.0 U	ug/L
Tetrachloroethene	~~ND~~	1.0 U	ug/L
Toluene	**18**	~~1.0~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	1.0 U	ug/L
1,1,1-Trichloroethane	~~ND~~	1.0 U	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.0	ug/L
Vinyl chloride	~~ND~~	1.0 U	ug/L
Xylenes (total)	~~ND~~	2.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(73 - 122)
1,2-Dichloroethane-d4	84	(61 - 128)
Toluene-d8	93	(76 - 110)
4-Bromofluorobenzene	78	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI3-1S-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-004 Work Order #...: F6DWP1AA Matrix.....: WG
Date Sampled...: 12/09/03 08:40 Date Received..: 12/10/03
Prep Date.....: 12/17/03 Analysis Date..: 12/17/03
Prep Batch #...: 3352388
Dilution Factor: 1 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~0.99 J,B~~	10 U	ug/L
Benzene	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
Cyclohexane	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	2.0	ug/L
1,2-Dibromoethane	ND	1.0 U	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
Dichlorodifluoromethane	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Isopropylbenzene	ND	1.0	ug/L
Methyl acetate	ND	10	ug/L
Methylene chloride	ND	1.0	ug/L
Methylcyclohexane	ND	1.0	ug/L
4-Methyl-2-pentanone	ND	10	ug/L
Methyl tert-butyl ether	ND	5.0	ug/L
Styrene	ND	1.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI3-1S-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-004 Work Order #...: F6DWP1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	1.0 U	ug/L
Tetrachloroethene	~~ND~~	1.0 U	ug/L
Toluene	35	~~1.0~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	1.0 U	ug/L
1,1,1-Trichloroethane	ND	1.0 U	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.0	ug/L
Vinyl chloride	~~ND~~	1.0 U	ug/L
Xylenes (total)	~~ND~~	2.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	91	(73 - 122)
1,2-Dichloroethane-d4	82	(61 - 128)
Toluene-d8	94	(76 - 110)
4-Bromofluorobenzene	81	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI4-1S-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-005 Work Order #...: F6DWV1AA Matrix.....: WG
Date Sampled...: 12/09/03 19:00 Date Received..: 12/10/03
Prep Date.....: 12/17/03 Analysis Date..: 12/17/03
Prep Batch #...: 3352388
Dilution Factor: 1 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~0.85 J,B~~	10 U	ug/L
Benzene	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
Cyclohexane	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	2.0	ug/L
1,2-Dibromoethane	ND	1.0 U	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
Dichlorodifluoromethane	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Isopropylbenzene	ND	1.0	ug/L
Methyl acetate	ND	10	ug/L
Methylene chloride	ND	1.0	ug/L
Methylcyclohexane	ND	1.0	ug/L
4-Methyl-2-pentanone	ND	10	ug/L
Methyl tert-butyl ether	ND	5.0	ug/L
Styrene	ND	1.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI4-1S-G-1203-S

GC/MS Volatiles

Lot-Sample #...: A3L100288-005 Work Order #...: F6DWV1AA Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	1.0 U	ug/L
Tetrachloroethene	~~ND~~	1.0 U	ug/L
Toluene	**14**	~~1.0~~	**ug/L**
1,2,4-Trichloro-benzene	~~ND~~	1.0 U	ug/L
1,1,1-Trichloroethane	~~ND~~	1.0 U	ug/L
1,1,2-Trichloroethane	~~ND~~	1.0	ug/L
Trichloroethene	~~ND~~	1.0	ug/L
Trichlorofluoromethane	~~ND~~	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	~~ND~~	1.0	ug/L
Vinyl chloride	~~ND~~	1.0 U	ug/L
Xylenes (total)	ND	2.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(73 - 122)
1,2-Dichloroethane-d4	84	(61 - 128)
Toluene-d8	95	(76 - 110)
4-Bromofluorobenzene	79	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIP BLANK05-120903-TB

GC/MS Volatiles

Lot-Sample #...: A3L100288-006 Work Order #...: F6DW21AA Matrix.....: WQ
Date Sampled...: 12/09/03 Date Received..: 12/10/03
Prep Date.....: 12/17/03 Analysis Date..: 12/17/03
Prep Batch #...: 3352388
Dilution Factor: 1 Initial Wgt/Vol: 5 mL Final Wgt/Vol..: 5 mL
Method.....: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acetone	~~2.9 J,B~~	10 U	ug/L
Benzene	~~ND~~	1.0 U	ug/L
Bromodichloromethane	~~ND~~	1.0	ug/L
Bromoform	~~ND~~	1.0	ug/L
Bromomethane	~~ND~~	1.0	ug/L
2-Butanone	1.5 J	~~10~~	ug/L
Carbon disulfide	~~ND~~	1.0 U	ug/L
Carbon tetrachloride	~~ND~~	1.0	ug/L
Chlorobenzene	~~ND~~	1.0	ug/L
Chloroethane	~~ND~~	1.0	ug/L
Chloroform	~~ND~~	1.0	ug/L
Chloromethane	~~ND~~	1.0	ug/L
Cyclohexane	~~ND~~	1.0	ug/L
Dibromochloromethane	~~ND~~	1.0	ug/L
1,2-Dibromo-3-chloro-propane	~~ND~~	2.0	ug/L
1,2-Dibromoethane	~~ND~~	1.0 U	ug/L
1,2-Dichlorobenzene	~~ND~~	1.0	ug/L
1,3-Dichlorobenzene	~~ND~~	1.0	ug/L
1,4-Dichlorobenzene	~~ND~~	1.0	ug/L
Dichlorodifluoromethane	~~ND~~	1.0	ug/L
1,1-Dichloroethane	~~ND~~	1.0	ug/L
1,2-Dichloroethane	~~ND~~	1.0	ug/L
1,1-Dichloroethene	~~ND~~	1.0	ug/L
cis-1,2-Dichloroethene	~~ND~~	1.0	ug/L
trans-1,2-Dichloroethene	~~ND~~	1.0	ug/L
1,2-Dichloropropane	~~ND~~	1.0	ug/L
cis-1,3-Dichloropropene	~~ND~~	1.0	ug/L
trans-1,3-Dichloropropene	~~ND~~	1.0	ug/L
Ethylbenzene	~~ND~~	1.0	ug/L
2-Hexanone	~~ND~~	10	ug/L
Isopropylbenzene	~~ND~~	1.0	ug/L
Methyl acetate	~~ND~~	10	ug/L
Methylene chloride	~~ND~~	1.0	ug/L
Methylcyclohexane	~~ND~~	1.0	ug/L
4-Methyl-2-pentanone	~~ND~~	10	ug/L
Methyl tert-butyl ether	~~ND~~	5.0	ug/L
Styrene	~~ND~~	1.0	ug/L

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: TRIP BLANK05-120903-TB

GC/MS Volatiles

Lot-Sample #...: A3L100288-006 Work Order #...: F6DW21AA Matrix.....: WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,1,2,2-Tetrachloroethane	~~ND~~	1.0 U	ug/L
Tetrachloroethene	~~ND~~	1.0 U	ug/L
Toluene	**0.30 J**	~~1.0~~	**ug/L**
1,2,4-Trichloro-benzene	ND	1.0 U	ug/L
1,1,1-Trichloroethane	ND	1.0 U	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.0	ug/L
Vinyl chloride	ND	1.0 U	ug/L
Xylenes (total)	ND	2.0 U	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(73 - 122)
1,2-Dichloroethane-d4	83	(61 - 128)
Toluene-d8	94	(76 - 110)
4-Bromofluorobenzene	82	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ENSR INTERNATIONAL

MEMORANDUM

To:	Tim Adams/Warrenville	**Date:**	March 25, 2004
From:	Linda Sulkowski/Westford Lori Herberich/Westford	**File:**	BW001metals.doc 00760-127-310
RE:	Data Validation Inorganic Analyses CMS Supplemental Groundwater Sampling BASF North Works Facility, Wyandotte, MI STL SDG 3L04249	**CC:**	D. McGrath/Westford

SUMMARY

Full validation was performed on the data for 16 groundwater samples analyzed for project-specific metals by SW-846 method 6010B and hardness by MCAWW Method 130.2. The samples were collected at the BASF facility in Wyandotte, Michigan on December 3-5, 8, and 9, 2003 and submitted to Severn Trent Laboratories (STL) in North Canton, Ohio, for analysis. STL processed the samples under lot numbers A3L040249, A3L050302, A3L060156, A3L090272, and A3L100288 and reported the results under sample delivery group (SDG) 3L04249.

The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (July 2002 and proposed change dated March 27, 2003) and the quality control (QC) criteria specified in the Quality Assurance Project Plan (QAPP). Modification of the Functional Guidelines was performed to accommodate the non-CLP methodologies.

In general, the data are valid as reported and may be used for decision making purposes. Selected data points were qualified due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The samples included in this review are listed below:

Sample IDs	Sample IDs
BGMW-1-G-1203-S	RFIMW-09-G-1203-S
CMSMW-02-G-1203-S	RFIMW-01-G-1203-S
RFIMW-01-G-1203-D (field duplicate of RFIMW-01-G-1203-S)	RFIMW-13-G-1203-S
RFIMW-22-G-1203-S	RFIMW-26-G-1203-S
RFIMW-26-G-1203-D (field duplicate of RFIMW-26-G-1203-S)	RFIMW-07-G-1203-S
PM4NA-G-1203-S	WHI9-2F-G-1203-S
RFIMW-12-G-1203-S	RFIMW-15-G-1203-S
WHI3-1S-G-1203-S	WHI4-1S-G-1203-S

REVIEW ELEMENTS

Sample data were reviewed for the following parameters, where applicable to the method:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Calibrations
- Laboratory blanks/equipment blanks
- Inductively coupled plasma (ICP) interference check sample (ICS) results
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results

- Laboratory control sample (LCS) results
- Serial dilution results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted with COC Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the COC and any subsequent correspondence. An analytical method for hardness was not specified on the COC. The laboratory was not aware of the requirement in the CMS Supplemental Groundwater Sampling Plan to use method 6010B for this parameter and performed method 130.2 instead. No validation action was taken based on this deviation from the Sampling Plan.

Holding Times/Sample Preservation

All samples were digested and/or analyzed within the method specified holding times.

The cooler temperatures upon receipt at the laboratory ranged from 1.6 to 3.9°C. One of the five cooler temperatures fell below the acceptable range of 4 ± 2°C. Qualification of the data due to this minor nonconformance was not required.

Eight samples required additional acid at the time of sample log-in to meet the preservation requirement of pH <2. No validation action was taken on these eight samples since the laboratory added the acid one day after sample collection. The laboratory also attempted to lower the pH of sample PM4NA-G-1203-S at the time of sample log-in but was unsuccessful. Acid was again added to sample PM4NA-G-1203-S at the time of sample preparation and the pH was lowered to <2. Since the sample was prepared three days after sample collection, all positive results for this sample are qualified as estimated (J-) with a low bias and nondetects are qualified as estimated (UJ).

Calibrations

Metals Analysis

All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards for metals.

Although a Contract Required Detection Limit (CRDL) standard is not applicable to SW-846 methods, STL chose to analyze a similar standard (CRI for ICP analyses. All CRI standards met the acceptance criteria.

Laboratory Blanks/Equipment Blanks

No equipment blanks were submitted with this sample set. No validation action was taken on this basis.

Metals Analysis

The calibration blank summary forms are generated using CLP-format software, which reports the blank results to the instrument detection limits (IDLs) as required, by CLP methodology. The sample result and preparation blank summary forms are generated using the laboratory information management system (LIMS), which reports metals to the method detection limit (MDL). Blank actions were applied based on the highest of the IDL/MDL exceedances.

Target analytes were not detected in the laboratory preparation blank. Various analytes were detected in the initial and continuing calibration blanks (ICBs and CCBs) associated with these samples. The presence of blank contamination indicates that false positive results or false negative results (for negative blanks) may exist for these analytes in the associated samples. An Action Level (AL) was established for each analyte at 5x the highest concentration detected in the blanks bracketing each sample and was used

to qualify associated sample data. The following table summarizes these ALs and the associated samples.

	Antimony	Barium	Beryllium	Chromium	Cobalt	Copper	Lead	Nickel	Selenium	Tin	Vanadium	Zinc
	ACTION LEVEL (µg/L)											
BGMW-1-G-1203-S		1.0	1.0			-7.5					3.5	
RF1MW-09-G-1203-S CMSMW-02-G-1203-S RF1MW-01-G-1203-S RF1MW-01-G-1203-D RF1MW-13-G-1203-S RF1MW-22-G-1203-S RF1MW-26-G-1203-S		1.0	1.0			-9.0			-20.0	12.0		-13.0
RF1MW-26-G-1203-D RF1MW-07-G-1203-S PM4NA-G-1203-S WHI9-2F-G-1203-S RF1MW-12-G-1203-S RF1MW-15-G-1203-S		1.0	1.0			-9.0			-20.0	12.0		-15.0
WHI3-1S-G-1203-S WHI4-1S-G-1203-S	-41.5	1.0	1.0	6.0	6.0	-13.5	-8.0	7.0			-6.5	-16.0

Sample results were qualified as follows:

For positive contamination:

- Sample results ≥ method detection limit (MDL) but ≤ AL were qualified as nondetected (U) at the reported concentration.
- Sample results > AL or nondetected results (< MDL) were not qualified.

For negative contamination:

- Sample results ≥ MDL but ≤ the absolute value of the AL were qualified as estimated (J-) at the reported concentration.
- Nondetected results (< MDL) were qualified as estimated (UJ).
- Sample results ≥ the absolute value of the AL were not qualified.

Hardness Analysis

Hardness was not detected in the laboratory preparation blank.

ICP ICS Results

Metals Analysis

All criteria were met for the analysis of the ICS AB solution. Positive results for arsenic, barium, cadmium, cobalt, copper, nickel, and zinc were observed in the ICS A solution at concentrations greater than the MDL although these analytes are not present in this solution. A negative result for vanadium was observed in the ICS A solution with an absolute value exceeding the MDL. These false positives and false negatives indicate a potential bias due to high levels of interfering elements present in the ICS A solution.

High levels of one or more interfering element were observed in samples BGMW-1-G-1203-S, RFIMW-09-G-1203-S, RFIMW-01-G-1203-S, RFIMW-01-G-1203-D, RFIMW-13-G-1203-S, RFIMW-07-G-1203-S, and RFIMW-15-G-1203-S. Estimated interferences were calculated for each analyte for each of these samples. The following actions were taken.

Sample	Analyte	Action
BGMW-1-G-1203-S	Arsenic	Estimate positive result (J+)
	Cobalt	Estimate positive result (J+)
	Copper	Estimate positive result (J+)*
	Vanadium	Estimate nondetect (UJ)
	Zinc	Estimate positive result (J+)
RFIMW-09-G-1203-S	Cobalt	Estimate positive result (J+)
	Vanadium	Estimate nondetect (UJ)
	Zinc	Estimate positive result (J+)
RFIMW-01-G-1203-S	Arsenic	Estimate positive result (J+)
	Cobalt	Estimate positive result (J+)
	Nickel	Estimate positive result (J+)
	Vanadium	Estimate positive result (J-)
	Zinc	Estimate positive result (J+)
RFIMW-01-G-1203-D	Cadmium	Estimate positive result (J+)
	Cobalt	Estimate positive result (J+)
	Nickel	Estimate positive result (J+)
	Vanadium	Estimate positive result (J-)
	Zinc	Estimate positive result (J+)
RFIMW-13-G-1203-S	Arsenic	Estimate positive result (J+)
	Copper	Estimate positive result (J+)*
	Nickel	Estimate positive result (J+)
	Vanadium	Estimate positive result (J-)
	Zinc	Estimate positive result (J+)
RFIMW-07-G-1203-S	Nickel	Estimate positive result (J+)
	Vanadium	Estimate positive result (J-)
RFIMW-15-G-1203-S	Cobalt	Estimate positive result (J+)
	Copper	Estimate positive result (J+)
	Vanadium	Estimate nondetect (UJ)
*These concentrations were previously qualified as (J-). The resulting qualifier is (J), undetermined bias.		

Positive results for arsenic, barium, cadmium, cobalt, copper, nickel, and/or zinc were estimated as biased high (J+) if the calculated estimated interference was greater than 10% of the sample concentration for the analyte. Positive results for vanadium were estimated as biased low (J-) if the calculated estimated interference was greater than 10% of the sample concentration for that analyte and nondetects for vanadium were estimated (UJ).

MS/MSD Results

Metals Analysis

MS/MSD analyses were performed on sample RFIMW-22-G-1203-S. All percent recoveries (%Rs) and relative percent differences (RPDs) were within acceptance limits.

Hardness Analysis

The laboratory performed an MS/MSD on a sample from a different client. Although this practice is acceptable, the results could not be directly applied to the samples analyzed in this data package because of possible differences in the sample matrix and type.

Laboratory Duplicate Results

Laboratory duplicate analyses were not performed. Precision in the laboratory was demonstrated by the

MS/MSD analyses as discussed above.

Field Duplicates

Metals Analysis

Samples RFIMW-01-G-1203-S/RFIMW-01-G-1203-D and RFIMW-26-G-1203-S/RFIMW-26-G-1203-D were submitted as the field duplicate pairs with this sample set. The following table summarizes the RPDs of the detected analytes in field duplicate pair RFIMW-01-G-1203-S/RFIMW-01-G-1203-D. The RPDs for arsenic and cadmium were not calculable (NC) due to a nondetect result in either the sample or field duplicate sample. Precision was deemed acceptable for arsenic and cadmium since the detected result in either the sample or field duplicate sample was <10x the MDL. The RPD for chromium was deemed acceptable since the detected results in both the sample and field duplicate were <10x the MDL and the absolute difference between the sample result and the field duplicate sample result was <4x the MDL. The RPDs for the remaining analytes were all within the QC acceptance criterion of ±30%.

Analytes	RFIMW-01-G-1203-S (mg/L)	RFIMW-01-G-1203-D (mg/L)	RPD (%)
Arsenic	0.0035	0.010 U	NC
Barium	0.19	0.18	5.4
Cadmium	0.0050 U	0.00043	NC
Chromium	0.0021	0.0015	33
Cobalt	0.0014	0.0011	24
Nickel	0.0035	0.0043	21
Thallium	0.0082	0.0071	14
Vanadium	0.0056	0.0054	3.6
Zinc	0.016	0.018	12

The following table summarizes the RPDs of the detected analytes in field duplicate pair RFIMW-26-G-1203-S/RFIMW-26-G-1203-D. The RPDs for cobalt and selenium were NC due to nondetected results in the field duplicate sample. Precision was deemed acceptable for cobalt and selenium since the detected results in the sample was <10x the MDL. The RPDs for arsenic and thallium were deemed acceptable since the detected results in both the sample and field duplicate were <10x the MDL and the absolute difference between the sample result and the field duplicate sample result was <4x the MDL. The RPDs for barium, copper, and vanadium were within the QC acceptance criterion of ±30%. The RPDs for chromium and nickel exceeded the QC acceptance criterion. Positive results and nondetects for chromium and nickel were estimated (J/UJ) in all samples except RFIMW-01-G-1203-S and RFIMW-01-G-1203-D. Concentrations previously qualified as (J+) or (J-) have a resulting qualifier of (J), undetermined bias.

Analytes	RFIMW-26-G-1203-S (mg/L)	RFIMW-26-G-1203-D (mg/L)	RPD (%)
Arsenic	0.0056	0.0030	60
Barium	0.062	0.051	13
Chromium	0.16	0.023	150
Cobalt	0.0015	0.050 U	NC
Copper	0.0082	0.0081	1.2
Nickel	0.070	0.027	89
Selenium	0.0051	0.0050 U	NC
Thallium	0.012	0.0082	38
Vanadium	0.0031	0.0027	14

Hardness Analysis

Samples RFIMW-01-G-1203-S/RFIMW-01-G-1203-D and RFIMW-26-G-1203-S/RFIMW-26-G-1203-D were submitted as the field duplicate pairs with this sample set. The following tables summarize the RPDs of hardness in the field duplicate pairs, which were within the QC acceptance criterion of ±30%.

Analytes	RFIMW-01-G-1203-S (µg/L)	RFIMW-01-G-1203-D (µg/L)	RPD (%)
Hardness	1900	2000	5.1

Analytes	RFIMW-26-G-1203-S (µg/L)	RFIMW-26-G-1203-D (µg/L)	RPD (%)
Hardness	200	200	0

LCS Results

The %Rs of all spiked analytes met the QC acceptance criteria in the LCS analyses for metals.

Serial Dilution Results

Metals Analysis

The laboratory performed the serial dilution analysis on sample BGMW-1-G-1203-S. The percent differences (%Ds) for all analytes met the QC acceptance criteria of <10% for analyte concentrations >10x the MDL before dilution.

Sample Quantitation/Detection Limit Results

Result calculations were spot checked; no discrepancies were noted.

Metals Analysis

The laboratory reported nondetects for samples at the reporting limit; these nondetects were changed to nondetects (U) at the MDL by the validator.

Laboratory qualifiers indicating associated blank contamination (J) and detected results less than the reporting limit (B) were removed during validation to avoid confusion with validation qualifiers.

Hardness Analysis

The following samples were analyzed at a dilution in order to avoid large volumes of titrant required for the analysis. The laboratory elevated the reporting limits accordingly.

Sample	Dilution
BGMW-1-G-1203-S	5x
RFIMW-09-G-1203-S	5x
CMSMW-02-G-1203-S	5x
RFIMW-01-G-1203-S	5x
RFIMW-01-G-1203-D	5x
RFIWM-13-G-1203-S	10x
RFIMW-22-G-1203-S	5x
RFIMW-07-G-1203-S	10x
PM4NA-G-1203-S	5x

Sample	Dilution
RFIMW-15-G-1203-S	25x
WHI3-1S-G-1203-S	5x

ENSR CONSULTING & ENGINEERING

Client Sample ID: BGMW-1-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L040249-001 **Matrix.....:** WG
Date Sampled...: 12/03/03 10:40 **Date Received..:** 12/04/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.0035 B** J+	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XJ1AC**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F51XJ1AD
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F51XJ1AE
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	**0.010**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XJ1AF**
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F51XJ1AG
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.049 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XJ1AH**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F51XJ1AJ
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F51XJ1AK
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.0021 B** J	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XJ1AL**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	**0.0031 B** J+	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XJ1AM**
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.0041 B** J	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XJ1AN**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.044** J	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XJ1AP**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F51XJ1AQ
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F51XJ1AR
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: BGMW-1-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L040249-001 **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F51XJ1AT
		Dilution Factor: 1		MDL.....: 0.00096	UJ	
Zinc	**0.024** J	**0.020**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XJ1AU**
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-09-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L040249-002 **Matrix.....:** WG
Date Sampled...: 12/03/03 15:15 **Date Received..:** 12/04/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.023**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XR1AC**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F51XR1AD
		Dilution Factor: 1		MDL.....: 0.0023	U	
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F51XR1AE
		Dilution Factor: 1		MDL.....: 0.0039	UJ	
Thallium	**0.0094 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XR1AF**
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F51XR1AG
		Dilution Factor: 1		MDL.....: 0.0031	U	
Barium	**0.16 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XR1AH**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F51XR1AJ
		Dilution Factor: 1		MDL.....: 0.00047	U	
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F51XR1AK
		Dilution Factor: 1		MDL.....: 0.00036	U	
Chromium	**0.088** J	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XR1AL**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	**0.0015 B** J+	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XR1AM**
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	ND	0.025	mg/L	SW846 6010B	12/11-12/12/03	F51XR1AN
		Dilution Factor: 1		MDL.....: 0.0018	UJ	
Nickel	**0.048** J	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XR1AP**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F51XR1AQ
		Dilution Factor: 1		MDL.....: 0.0011	U	
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F51XR1AR
		Dilution Factor: 1		MDL.....: 0.0039	U	

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-09-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L040249-002 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F51XR1AT
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	**0.014 B**	**0.020**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51XR1AU**
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: CMSMW-02-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L040249-003 **Matrix.....:** WG
Date Sampled...: 12/03/03 17:10 **Date Received..:** 12/04/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F51X21AC
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F51X21AD
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F51X21AE
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F51X21AF
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F51X21AG
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.23**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51X21AH**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F51X21AJ
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F51X21AK
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F51X21AL
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F51X21AM
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	ND	0.025	mg/L	SW846 6010B	12/11-12/12/03	F51X21AN
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.0042 B**	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F51X21AP**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F51X21AQ
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F51X21AR
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: CMSMW-02-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L040249-003 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	0.0033 B	0.050	mg/L	SW846 6010B	12/11-12/12/03	F51X21AT
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	0.049	0.020	mg/L	SW846 6010B	12/11-12/12/03	F51X21AU
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L050302-001 **Matrix.....:** WG
Date Sampled...: 12/04/03 15:55 **Date Received..:** 12/05/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.0035 B** J+	**0.010** Dilution Factor: 1	**mg/L**	**SW846 6010B** MDL.....: 0.0029	**12/11-12/12/03**	**F540M1AD**
Lead	ND	0.0030 Dilution Factor: 1	mg/L	SW846 6010B MDL.....: 0.0023	12/11-12/12/03 U	F540M1AE
Selenium	ND	0.0050 Dilution Factor: 1	mg/L	SW846 6010B MDL.....: 0.0039	12/11-12/12/03 UJ	F540M1AF
Thallium	**0.0082 B**	**0.010** Dilution Factor: 1	**mg/L**	**SW846 6010B** MDL.....: 0.0056	**12/11-12/12/03**	**F540M1AG**
Antimony	ND	0.060 Dilution Factor: 1	mg/L	SW846 6010B MDL.....: 0.0031	12/11-12/12/03 U	F540M1AH
Barium	**0.19 B**	**0.20** Dilution Factor: 1	**mg/L**	**SW846 6010B** MDL.....: 0.00082	**12/11-12/12/03**	**F540M1AJ**
Beryllium	ND	0.0050 Dilution Factor: 1	mg/L	SW846 6010B MDL.....: 0.00047	12/11-12/12/03 UJ+	F540M1AK
Cadmium	ND	0.0050 Dilution Factor: 1	mg/L	SW846 6010B MDL.....: 0.00036	12/11-12/12/03 U	F540M1AL
Chromium	**0.0021 B**	**0.010** Dilution Factor: 1	**mg/L**	**SW846 6010B** MDL.....: 0.0010	**12/11-12/12/03**	**F540M1AM**
Cobalt	**0.0014 B** J+	**0.050** Dilution Factor: 1	**mg/L**	**SW846 6010B** MDL.....: 0.0011	**12/11-12/12/03**	**F540M1AN**
Copper	ND	0.025 Dilution Factor: 1	mg/L	SW846 6010B MDL.....: 0.0018	12/11-12/12/03 UJ	F540M1AP
Nickel	**0.0035 B** J+	**0.040** Dilution Factor: 1	**mg/L**	**SW846 6010B** MDL.....: 0.0021	**12/11-12/12/03**	**F540M1AQ**
Silver	ND	0.010 Dilution Factor: 1	mg/L	SW846 6010B MDL.....: 0.0011	12/11-12/12/03 U	F540M1AR
Tin	ND	0.10 Dilution Factor: 1	mg/L	SW846 6010B MDL.....: 0.0039	12/11-12/12/03 U	F540M1AT

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L050302-001 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	0.0056 ~~B~~ J	0.050	mg/L	SW846 6010B	12/11-12/12/03	F540M1AU
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	0.016 ~~B~~ J+	0.020	mg/L	SW846 6010B	12/11-12/12/03	F540M1AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-D

TOTAL Metals

Lot-Sample #...: A3L050302-002 **Matrix.....:** WG
Date Sampled...: 12/04/03 15:55 **Date Received..:** 12/05/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F542A1AD
		Dilution Factor: 1		MDL.....: 0.0029	U	
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F542A1AE
		Dilution Factor: 1		MDL.....: 0.0023	U	
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F542A1AF
		Dilution Factor: 1		MDL.....: 0.0039	UJ	
Thallium	**0.0071 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542A1AG**
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F542A1AH
		Dilution Factor: 1		MDL.....: 0.0031	U	
Barium	**0.18 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542A1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F542A1AK
		Dilution Factor: 1		MDL.....: 0.00047	U	
Cadmium	**0.00043 B** J+	**0.0050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542A1AL**
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.0015 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542A1AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	**0.0011 B** J+	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542A1AN**
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	ND	0.025	mg/L	SW846 6010B	12/11-12/12/03	F542A1AP
		Dilution Factor: 1		MDL.....: 0.0018	UJ	
Nickel	**0.0043 B** J+	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542A1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F542A1AR
		Dilution Factor: 1		MDL.....: 0.0011	U	
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F542A1AT
		Dilution Factor: 1		MDL.....: 0.0039	U	

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-D

TOTAL Metals

Lot-Sample #...: A3L050302-002 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	0.0054 ~~B~~ J-	0.050	mg/L	SW846 6010B	12/11-12/12/03	F542A1AU
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	0.018 ~~B~~ J+	0.020	mg/L	SW846 6010B	12/11-12/12/03	F542A1AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-13-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L050302-003 Matrix.....: WG
Date Sampled...: 12/04/03 18:10 Date Received..: 12/05/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.0048 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542D1AD**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	**0.0032**	**0.0030**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542D1AE**
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F542D1AF
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	**0.0078 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542D1AG**
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F542D1AH
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.13 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542D1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F542D1AK
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F542D1AL
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.054**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542D1AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F542D1AN
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.0057 B**	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542D1AP**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.0084 B**	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F542D1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F542D1AR
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F542D1AT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-13-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L050302-003 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	0.0072 B J-J+	0.050	mg/L	SW846 6010B	12/11-12/12/03	F542D1AU
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	0.035 J+	0.020	mg/L	SW846 6010B	12/11-12/12/03	F542D1AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-22-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L060156-001 **Matrix.....:** WG
Date Sampled...: 12/05/03 10:00 **Date Received..:** 12/06/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.19**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F56G51AH**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	**0.0028 B**	**0.0030**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F56G51AL**
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F56G51AP
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F56G51AT
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F56G51AW
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.11 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F56G51A1**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	**0.0012 B**	**0.0050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F56G51A4**
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F56G51A7
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.061**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F56G51CA**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	**0.0038 B**	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F56G51CE**
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.017 B**	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F56G51CH**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.042**	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F56G51CL**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F56G51CP
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F56G51CT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-22-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L060156-001 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	0.50	0.050	mg/L	SW846 6010B	12/11-12/12/03	F56G51CW
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	0.022	0.020	mg/L	SW846 6010B	12/11-12/12/03	F56G51C1
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L090272-001 Matrix.....: WG
Date Sampled...: 12/08/03 15:00 Date Received..: 12/09/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.0056 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARF1AD**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F6ARF1AE
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	**0.0051 J**	**0.0050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARF1AF**
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	**0.012**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARF1AG**
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F6ARF1AH
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.062 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARF1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARF1AK
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARF1AL
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.16 J**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARF1AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	**0.0015 B**	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARF1AN**
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.0082 B J**	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARF1AP**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.070 J**	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARF1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6ARF1AR
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F6ARF1AT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L090272-001 **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	**0.0031 B**	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARF1AU**
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	ND	0.020	mg/L	SW846 6010B	12/11-12/12/03	F6ARF1AV
		Dilution Factor: 1		MDL.....: 0.013		

UJ

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-D

TOTAL Metals

Lot-Sample #...: A3L090272-002 **Matrix.....:** WG
Date Sampled...: 12/08/03 15:00 **Date Received..:** 12/09/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.0030 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARJ1AD**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F6ARJ1AE
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARJ1AF
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	**0.0082 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARJ1AG**
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F6ARJ1AH
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.051 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARJ1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARJ1AK
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARJ1AL
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.023**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARJ1AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6ARJ1AN
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.0081 B**	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARJ1AP**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.027 B**	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARJ1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6ARJ1AR
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F6ARJ1AT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-D

TOTAL Metals

Lot-Sample #...: A3L090272-002 **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	**0.0027 B**	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARJ1AU**
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	ND	0.020	mg/L	SW846 6010B	12/11-12/12/03	F6ARJ1AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-07-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L090272-004 **Matrix.....:** WG
Date Sampled...: 12/08/03 12:00 **Date Received..:** 12/09/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AD
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AE
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	**0.0048 B** J	**0.0050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARQ1AF**
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AG
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AH
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.086 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARQ1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AK
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AL
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.0011 B** J	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARQ1AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AN
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	ND	0.025	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AP
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.0036 B** J	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARQ1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AR
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-07-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L090272-004 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	**0.0013 B** J-	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARQ1AU**
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	ND	0.020	mg/L	SW846 6010B	12/11-12/12/03	F6ARQ1AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: PM4NA-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L090272-005 **Matrix.....:** WG
Date Sampled...: 12/08/03 19:10 **Date Received..:** 12/09/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.30** J	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARX1AD**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F6ARX1AE
		Dilution Factor: 1		MDL.....: 0.0023	UJ	
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARX1AF
		Dilution Factor: 1		MDL.....: 0.0039	UJ	
Thallium	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6ARX1AG
		Dilution Factor: 1		MDL.....: 0.0056	UJ	
Antimony	**0.013** ~~B~~ J	**0.060**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARX1AH**
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.10** ~~B~~ J	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARX1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARX1AK
		Dilution Factor: 1		MDL.....: 0.00047	UJ	
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6ARX1AL
		Dilution Factor: 1		MDL.....: 0.00036	UJ	
Chromium	**0.041** JEL	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARX1AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	**0.0033** ~~B~~ J	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARX1AN**
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.0047** ~~B~~ J	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARX1AP**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.053** JEL	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARX1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6ARX1AR
		Dilution Factor: 1		MDL.....: 0.0011	UJ	
Tin	**0.0050** ~~B~~ UJ	**0.10**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6ARX1AT**
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: PM4NA-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L090272-005 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	0.066 J-	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6ARX1AU
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	0.033 J-	0.020	mg/L	SW846 6010B	12/11-12/12/03	F6ARX1AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI9-2F-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-001 Matrix.....: WG
Date Sampled...: 12/09/03 13:40 Date Received..: 12/10/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.041**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DV51AD**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	**0.14**	**0.0030**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DV51AE**
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DV51AF
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DV51AG
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	**0.0036 B**	**0.060**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DV51AH**
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.011 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DV51AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DV51AK
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	**0.0029 B**	**0.0050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DV51AL**
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.0062 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DV51AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6DV51AN
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.083**	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DV51AP**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.011 B**	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DV51AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DV51AR
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F6DV51AT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI9-2F-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-001 **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	0.052	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6DV51AU
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	0.10	0.020	mg/L	SW846 6010B	12/11-12/12/03	F6DV51AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-12-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-002 **Matrix.....:** WG
Date Sampled...: 12/09/03 15:50 **Date Received..:** 12/10/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.038**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWH1AD**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F6DWH1AE
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWH1AF
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	**0.0059 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWH1AG**
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F6DWH1AH
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.078 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWH1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWH1AK
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	**0.00064 B**	**0.0050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWH1AL**
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.019**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWH1AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6DWH1AN
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.0033 B**	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWH1AP**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.046**	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWH1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DWH1AR
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F6DWH1AT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-12-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-002 **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	**0.042 B**	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWH1AU**
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	ND	0.020	mg/L	SW846 6010B	12/11-12/12/03	F6DWH1AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-15-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-003 **Matrix.....:** WG
Date Sampled...: 12/09/03 11:50 **Date Received..:** 12/10/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AD
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	ND	0.0030	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AE
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AF
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	**0.0096 B**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWL1AG**
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AH
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.14 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWL1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AK
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AL
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.25**	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWL1AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	**0.018 B**	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWL1AN**
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.019 B**	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWL1AP**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**1.5**	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWL1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AR
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-15-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-003 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AU
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	ND	0.020	mg/L	SW846 6010B	12/11-12/12/03	F6DWL1AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI3-1S-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-004 Matrix.....: WG
Date Sampled...: 12/09/03 08:40 Date Received..: 12/10/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	**0.016** J	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWP1AD**
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	**0.023**	**0.0030**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWP1AE**
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWP1AF
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DWP1AG
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F6DWP1AH
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.11 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWP1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWP1AK
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	**0.00041 B**	**0.0050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWP1AL**
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	**0.010** J	**0.010**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWP1AM**
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	**0.0037 B**	**0.050**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWP1AN**
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.011 B** J	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWP1AP**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.0092 B** J	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWP1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DWP1AR
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F6DWP1AT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI3-1S-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-004 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	0.017 B	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6DWP1AU
		Dilution Factor: 1		MDL.....: 0.00096		
Zinc	0.046	0.020	mg/L	SW846 6010B	12/11-12/12/03	F6DWP1AV
		Dilution Factor: 1		MDL.....: 0.013		

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI4-1S-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-005 **Matrix.....:** WG
Date Sampled...: 12/09/03 19:00 **Date Received..:** 12/10/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3345107						
Arsenic	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AD
		Dilution Factor: 1		MDL.....: 0.0029		
Lead	**0.0085**	**0.0030**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWV1AE**
		Dilution Factor: 1		MDL.....: 0.0023		
Selenium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AF
		Dilution Factor: 1		MDL.....: 0.0039		
Thallium	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AG
		Dilution Factor: 1		MDL.....: 0.0056		
Antimony	ND	0.060	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AH
		Dilution Factor: 1		MDL.....: 0.0031		
Barium	**0.026 B**	**0.20**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWV1AJ**
		Dilution Factor: 1		MDL.....: 0.00082		
Beryllium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AK
		Dilution Factor: 1		MDL.....: 0.00047		
Cadmium	ND	0.0050	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AL
		Dilution Factor: 1		MDL.....: 0.00036		
Chromium	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AM
		Dilution Factor: 1		MDL.....: 0.0010		
Cobalt	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AN
		Dilution Factor: 1		MDL.....: 0.0011		
Copper	**0.019 B**	**0.025**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWV1AP**
		Dilution Factor: 1		MDL.....: 0.0018		
Nickel	**0.0025 B**	**0.040**	**mg/L**	**SW846 6010B**	**12/11-12/12/03**	**F6DWV1AQ**
		Dilution Factor: 1		MDL.....: 0.0021		
Silver	ND	0.010	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AR
		Dilution Factor: 1		MDL.....: 0.0011		
Tin	ND	0.10	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AT
		Dilution Factor: 1		MDL.....: 0.0039		

(Continued on next page)

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI4-1S-G-1203-S

TOTAL Metals

Lot-Sample #...: A3L100288-005 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Vanadium	ND	0.050	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AU
		Dilution Factor: 1		MDL.....: 0.00096	UJ	
Zinc	ND	0.020	mg/L	SW846 6010B	12/11-12/12/03	F6DWV1AV
		Dilution Factor: 1		MDL.....: 0.013	UJ	

NOTE(S):

B Estimated result. Result is less than RL.

ENSR CONSULTING & ENGINEERING

Client Sample ID: BGMW-1-G-1203-S

General Chemistry

Lot-Sample #...: A3L040249-001 Work Order #...: F51XJ Matrix.....: WG
Date Sampled...: 12/03/03 10:40 Date Received..: 12/04/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	1900	25	mg/L	MCAWW 130.2	12/11/03	3345488

Dilution Factor: 5 MDL.....: 10

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-09-G-1203-S

General Chemistry

Lot-Sample #...: A3L040249-002 Work Order #...: F51XR Matrix.....: WG
Date Sampled...: 12/03/03 15:15 Date Received..: 12/04/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	1600	25	mg/L	MCAWW 130.2	12/11/03	3345488

Dilution Factor: 5 MDL.....: 10

ENSR CONSULTING & ENGINEERING

Client Sample ID: CMSMW-02-G-1203-S

General Chemistry

Lot-Sample #...: A3L040249-003 Work Order #...: F51X2 Matrix.....: WG
Date Sampled...: 12/03/03 17:10 Date Received..: 12/04/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	590	25	mg/L	MCAWW 130.2	12/11/03	3345488

Dilution Factor: 5 MDL.....: 10

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-S

General Chemistry

Lot-Sample #...: A3L050302-001 Work Order #...: F540M Matrix.....: WG
Date Sampled...: 12/04/03 15:55 Date Received..: 12/05/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	1900	25	mg/L	MCAWW 130.2	12/11/03	3345488

Dilution Factor: 5 MDL.....: 10

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-01-G-1203-D

General Chemistry

Lot-Sample #...: A3L050302-002 Work Order #...: F542A Matrix.....: WG
Date Sampled...: 12/04/03 15:55 Date Received..: 12/05/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	2000	25	mg/L	MCAWW 130.2	12/11/03	3345488

Dilution Factor: 5 MDL.....: 10

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-13-G-1203-S

General Chemistry

Lot-Sample #...: A3L050302-003 **Work Order #...:** F542D **Matrix.....:** WG
Date Sampled...: 12/04/03 18:10 **Date Received..:** 12/05/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	2000	50	mg/L	MCAWW 130.2	12/11/03	3345488

Dilution Factor: 10 MDL.....: 21

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-22-G-1203-S

General Chemistry

Lot-Sample #...: A3L060156-001 Work Order #...: F56G5 Matrix.....: WG
Date Sampled...: 12/05/03 10:00 Date Received..: 12/06/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	40	25	mg/L	MCAWW 130.2	12/11/03	3345488

Dilution Factor: 5 MDL.....: 10

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-S

General Chemistry

Lot-Sample #...: A3L090272-001 **Work Order #...:** F6ARF **Matrix.....:** WG
Date Sampled...: 12/08/03 15:00 **Date Received..:** 12/09/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	**200**	5	**mg/L**	**MCAWW 130.2**	**12/17/03**	**3351416**

Dilution Factor: 1 MDL.....: 2

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-26-G-1203-D

General Chemistry

Lot-Sample #...: A3L090272-002 Work Order #...: F6ARJ Matrix.....: WG
Date Sampled...: 12/08/03 15:00 Date Received..: 12/09/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	200	5	mg/L	MCAWW 130.2	12/17/03	3351416

Dilution Factor: 1 MDL.....: 2

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-07-G-1203-S

General Chemistry

Lot-Sample #...: A3L090272-004 Work Order #...: F6ARQ Matrix.....: WG
Date Sampled...: 12/08/03 12:00 Date Received..: 12/09/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	2100	50	mg/L	MCAWW 130.2	12/17/03	3351416

Dilution Factor: 10 MDL.....: 21

ENSR CONSULTING & ENGINEERING

Client Sample ID: PM4NA-G-1203-S

General Chemistry

Lot-Sample #...: A3L090272-005 **Work Order #...:** F6ARX **Matrix.....:** WG
Date Sampled...: 12/08/03 19:10 **Date Received..:** 12/09/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	**430**	25	**mg/L**	**MCAWW 130.2**	**12/17/03**	**3351416**

Dilution Factor: 5 MDL.....: 10

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI9-2F-G-1203-S

General Chemistry

Lot-Sample #...: A3L100288-001 Work Order #...: F6DV5 Matrix.....: WG
Date Sampled...: 12/09/03 13:40 Date Received..: 12/10/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	27	5	mg/L	MCAWW 130.2	12/17/03	3351416

Dilution Factor: 1 MDL.....: 2

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-12-G-1203-S

General Chemistry

Lot-Sample #...: A3L100288-002 Work Order #...: F6DWH Matrix.....: WG
Date Sampled...: 12/09/03 15:50 Date Received..: 12/10/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	23	5	mg/L	MCAWW 130.2	12/17/03	3351416

Dilution Factor: 1 MDL.....: 2

ENSR CONSULTING & ENGINEERING

Client Sample ID: RFIMW-15-G-1203-S

General Chemistry

Lot-Sample #...: A3L100288-003 Work Order #...: F6DWL Matrix.....: WG
Date Sampled...: 12/09/03 11:50 Date Received..: 12/10/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	9600	120	mg/L	MCAWW 130.2	12/17/03	3351416

Dilution Factor: 25 MDL.....: 52

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI3-1S-G-1203-S

General Chemistry

Lot-Sample #...: A3L100288-004 Work Order #...: F6DWP Matrix.....: WG
Date Sampled...: 12/09/03 08:40 Date Received..: 12/10/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	650	25	mg/L	MCAWW 130.2	12/17/03	3351416

Dilution Factor: 5 MDL.....: 10

ENSR CONSULTING & ENGINEERING

Client Sample ID: WHI4-1S-G-1203-S

General Chemistry

Lot-Sample #...: A3L100288-005 **Work Order #...:** F6DWV **Matrix.....:** WG
Date Sampled...: 12/09/03 19:00 **Date Received..:** 12/10/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Hardness, as CaCO3	**120**	**5**	**mg/L**	**MCAWW 130.2**	**12/17/03**	**3351416**

Dilution Factor: 1 MDL.....: 2

Frontier Geosciences Inc.
Environmental Research & Specialty Analytical Laboratory
414 Pontius Ave N · Seattle WA 98109

Paytha Elliott
ENSR
27755 Diehl Road
Warrenville, IL 60555

February 2, 2004

SUBJECT: Total mercury analysis of water samples for BASF-Wyandotte, MI Project.

Dear Ms. Elliott,

Enclosed please find our report concerning total mercury in the water samples collected on December 2, 2003 through December 9, 2003, for the BASF-Wyandotte, MI project. Samples were received in good condition December 1, 2003 through December 10, 2003.

We had no significant analytical difficulties and all quality control data were within control limits. Please feel free to call (206) 622-6960 or e mail if you have any questions or concerns regarding this report.

Sincerely,

M. Kennard

Misty Kennard
Senior Project Manager
MistyK@frontiergeosciences.com

206 622 6960
fax 206 622 6870
www.FrontierGeosciences.com
email: info@FrontierGeosciences.com

Report to Paytha Elliot
ENSR

Total Mercury in Water Samples
BASF-Wyandotte, MI

Prepared by
Misty Kennard
Frontier Geosciences Inc.
414 Pontius Avenue North
Seattle, WA 98109
(206) 622-6960

February 2, 2004

Table of Contents

Item	Page Number
Table of Contents	1
Case Narrative	2-5
Sample Results	6-7
Quality Control Summary Tables	8-12
Chain-of-Custody Forms	13-38
Total Mercury Raw Data: THG11-031215-1	39-45
Total Mercury Raw Data: THG12-031215-1	46-50
Total Mercury Raw Data: THG08-040202-1	51-56

Total Number of Pages: 56

Total Mercury in Water Samples
ENSR

February 2, 2004

Frontier Geosciences Inc.
414 Pontius Ave. N
Seattle, WA 98109

1. Scope of Work

Sixty-three (63) samples in glass bottles were submitted for total mercury analysis using cold vapor atomic fluorescence spectrometry (CVAFS) on December 1, 2003 through December 9, 2003.

2. Sample Receipt

All samples identified above were logged in according to Frontier's protocols on the day of receipt and were received secure and in good condition in sealed coolers with temperatures of –0.4 °C, 0.0 °C and ambient. Please note the following samples were received and placed on hold by the client. According to the EPA method 1631 revision E, the holding time following preservation is 6 months. Please notify us ASAP if we should proceed with analysis of these samples.

Sample ID	Receipt Date	Analysis
WHI2-1S-G-1203-EB	December 4, 2003	ON HOLD
CMSMW-08-G-1203-EB	December 4, 2003	ON HOLD
CMSMW-02-G-1203-EB	December 4, 2003	ON HOLD
RFIMW-28-G-1203-EB	December 5, 2003	ON HOLD
WHI9-2S-G-1203-EB	December 5, 2003	ON HOLD
RFIMW-08-G-1203-EB	December 5, 2003	ON HOLD
RFIMW-02-G-1203-EB	December 5, 2003	ON HOLD
RFIMW-01-G-1203-EB	December 5, 2003	ON HOLD
RFIMW-04-G-1203-EB	December 6, 2003	ON HOLD
RFIMW-07-1203-EB	December 9, 2003	ON HOLD
WHI3-2S-G-1203-EB	December 9, 2003	ON HOLD
RFIMW-26-G-1203-EB	December 9, 2003	ON HOLD

Sample ID	Receipt Date	Analysis
PM4NA-G-1203-EB	December 9, 2003	ON HOLD
WHI4-2S-G-1203-EB	December 10, 2003	ON HOLD
RFIMW-15-G-1203-EB	December 10, 2003	ON HOLD
WHI9-2F-G-1203-EB	December 10, 2003	ON HOLD
RFIMW-11-G-1203-EB	December 10, 2003	ON HOLD
RFIMW-12-G-1203-EB	December 10, 2003	ON HOLD
WHI4-1S-G-1203-EB	December 10, 2003	ON HOLD
WHI4-2S-G-1203-EB	December 10, 2003	ON HOLD

3. Analysis

General. All samples were received and logged in according to FGS protocols on the day of receipt. Samples were processed using ultra-clean sample handling techniques in a laboratory known to be low in atmospheric Hg and presumably all other trace metals as well. Reagents, gases, and DI water are all reagent or ultra-pure grade, and previously analyzed for Hg to ensure negligible blanks. All Hg analyses were performed using cold vapor atomic fluorescence spectrometry (CVAFS) as a detector (Bloom and Fitzgerald, 1988), with dual pen chart recorders or integrators as output devices. Total Hg (THg) standards are prepared by direct dilution of NIST certified NBS-3133 10.00 mg/mL Hg standard solution, and results independently verified by the analysis of NIST-1641d (water CRM; 1,590 ± 18 μg/g THg).

Total Hg analysis. For preservation/oxidation, 0.2 N BrCl in 11.6 N HCl was added to the sample in the original bottle at a level of 1 mL per 100 mL of sample. The samples were then allowed to digest overnight at room temperature.

Oxidized water samples were analyzed for total Hg in accordance with the Frontier SOP FGS-069 on December 15, 2003 and February 2, 2004. Aliquots of each digest were reduced in pre-purged DDW, first with HN_2OH to destroy free halogens, and then to Hg^0 with $SnCl_2$. The Hg^0 is then purged onto gold traps as a preconcentration step. The Hg contained on the gold traps was then analyzed by thermal desorption into a cold vapor atomic fluorescence detector (CVAFS), using the dual amalgamation technique. Peak areas are accessed by integrator, and recorded on bench sheets in "chart units" to the nearest 0.1 unit. Net THg concentrations were calculated according to the following formula, where **PH** is the chart recorder peak height, **bb** is the mean bubbler blank, **V** is the digest, **B** is the mean BrCl method blank (ng/L) (corresponding to the

appropriate level of oxidation), S is the calibration curve slope in units/ng, for the set of samples, and F_D is the dilution correction factor, calculated similarly:

$$[THg]\ (ng/L) = \frac{([(PH-bb/S)/(V)] - B)}{F_D}$$

4. Analytical Issues

There were no significant analytical issues associated with these samples and all QC were within control limits with the exceptions of those listed below.

- Analysis of the sample RFIMW-22-G-1203-S and its matrix duplicate yielded an elevated RPD at 52.1%. Investigation of the sample was performed showing large amounts of suspended particulate in the sample, which contributed to the failure of the RPD. Reanalysis of the native sample was performed yielding an RPD within control limits of 25% at 24.8%. As all other QC points (CRM, CCV, MS/MSD) were well within control limits, no further corrective action was done and Frontier maintains confidence in the results achieved.
- CCV5 yielded a low result of 57.9%. Reanalysis was performed on the corresponding trap/bubbler yielded a result within control limits of 75%-125% at 97.9%. As there were no additional issues that arose, no further corrective action was taken.

Please feel free to contact me with any questions or concerns regarding this report.

ENSR
Results
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Sample ID	Analytical Batch	THg (ng/L) Total
BGMW-1	A	3.53
BGMW-1-G-1203-S	B	16.2
WHI2-1S-G-1203-S	A	3.71
WHI2-1S-G-1203-EB	ON HOLD	ON HOLD
CMSMW-08-G-1203-S	A	3900
CMSMW-08-G-1203-EB	ON HOLD	ON HOLD
RFIMW-09-G-1203-S	A	1.37
RFIMW-09-G-1203-EB	C	0.30
CMSMW-02-G-1203-S	A	434
CMSMW-02-G-1203-EB	ON HOLD	ON HOLD
CMSMW-02-G-1203-FB	A	0.20
RFIMW-28-G-1203-S	A	4.31
RFIMW-28-G-1203-EB*	ON HOLD	ON HOLD
RFIMW-28-G-1203-D	A	3.13
WHI9-2S-G-1203-S	A	41.1
WHI9-2S-G-1203-EB	ON HOLD	ON HOLD
RFIMW-08-G-1203-S	A	5.32
RFIMW-08-G-1203-EB	ON HOLD	ON HOLD
RFIMW-02-G-1203-S	A	4.16
RFIMW-02-G-1203-EB	ON HOLD	ON HOLD
RFIMW-01-G-1203-S	A	36.2
RFIMW-01-G-1203-EB	ON HOLD	ON HOLD
RFIMW-01-G-1203-D	A	20.4
RFIMW-13-G-1203-S	A	55.4
RFIMW-13-G-1203-EB	A	0.24
RFIMW-13-G-1203-FB	A	0.15
RFIMW-04-G-1203-S	A	7.45
RFIMW-04-G-1203-EB	ON HOLD	ON HOLD
RFIMW-22-G-1203-S	A	33.3
RFIMW-22-G-1203-EB	A	< 0.15
RFIMW-22-G-1203-FB	A	< 0.15
RFIMW-07-1203-S	B	121
RFIMW-07-1203-EB	ON HOLD	ON HOLD
WHI3-2S-G-1203-S	B	64.4
WHI3-2S-G-1203-EB	ON HOLD	ON HOLD
RFIMW-26-G-1203-S	A	14.1
RFIMW-26-G-1203-EB	ON HOLD	ON HOLD
RFIMW-26-G-1203-D	B	25.3

ENSR

Results

BASF-Wyandotte, MI

Frontier Geosciences

February 2, 2004

Sample ID	Analytical Batch	THg (ng/L) Total
RFIMW-06-G-1203-S	B	324
RFIMW-06-G-1203-EB	B	< 0.15
RFIMW-06-G-1203-FB	B	< 0.15
PM4NA-G-1203-S	B	52.6
PM4NA-G-1203-EB	ON HOLD	ON HOLD
WHI3-1S-G-1203-S	B	10.5
WHI3-1S-G-1203-EB	B	0.18
WHI4-2S-G-1203-S	B	767
WHI4-2S-G-1203-EB	ON HOLD	ON HOLD
RFIMW-15-G-1203-S	B	3.06
RFIMW-15-G-1203-EB	ON HOLD	ON HOLD
WHI9-2F-G-1203-S	B	757
WHI9-2F-G-1203-EB	ON HOLD	ON HOLD
RFIMW-11-G-1203-S	B	1.62
RFIMW-11-G-1203-EB	ON HOLD	ON HOLD
RFIMW-12-G-1203-S	B	14.5
RFIMW-12-G-1203-EB	ON HOLD	ON HOLD
WHI4-1S-G-1203-S	B	67.3
WHI4-1S-G-1203-EB	ON HOLD	ON HOLD
WHI4-1S-G-1203-FB	B	< 0.15

ENSR
Method/Prep Blanks
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	THg (ng/L)	THg (ng/L)	THg (ng/L)
Analytical Batch	A	B	C
PB1	-0.01	0.03	0.03
PB2	-0.05	-0.07	0.06
PB3	-0.02	-0.03	0.07
Mean	-0.03	-0.02	0.05
St Dev	0.02	0.05	0.02
EMDL	0.07	0.14	0.05
Reporting Limit	0.15	0.15	0.15

ENSR

Certified Reference Material Report

BASF-Wyandotte, MI

Frontier Geosciences

February 2, 2004

Analyte	THg (ng/L)	THg (ng/L)	THg (ng/L)
Analytical Batch	A	B	C
CRM Identity	NIST 1641d	NIST 1641d	NIST 1641d
Cert Value	1601000	1601000	1601000
Obs Value	1521000	1604000	1563000
% Rec	95.0	100.2	97.6

ENSR
Replicates
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	Analytical Batch	Sample ID	Sample	Duplicate	Mean	RPD
THg (ng/L)	A	RFIMW-22-G-1203-S	33.35	42.81	38.08	24.8
THg (ng/L)	B	WH13-15-G-1203-S	10.50	9.53	10.02	9.7
THg (ng/L)	C	Batch QC	0.67	0.74	0.70	9.9

ENSR
Spikes
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	Analytical Batch	Sample ID	Mean	Spike TV	Obs Spike Value	Spike %Rec	Spike Dup TV	Obs Spike Dup Value	Spike Dup %Rec	RPD
THg (ng/L)	A	RFIMW-22-G-1203-S	38.08	105.3	140.7	97.5	105.3	130.1	87.4	11.0
THg (ng/L)	B	WH13-15-G-1203-S	10.02	41.24	44.13	82.7	41.24	48.31	92.9	11.6
THg (ng/L)	C	Batch QC	0.68	5.05	6.07	106.9	5.05	6.03	106.0	0.8

ENSR
Calibration Blanks
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	Analytical Batch	ICB	CCB1	CCB2	CCB3	CCB4	CCB5
THg (ng/L)	A	0.02	0.03	0.00	0.06	0.03	0.06
THg (ng/L)	B	0.02	0.07	0.13	0.07	0.21	-
THg (ng/L)	C	0.04	0.04	0.06	0.02	0.01	-

ENSR
Calibration Verification
BASF-Wyandotte, MI
Frontier Geosciences
February 2, 2004

Analyte	Analytical Batch	ICV-TV	ICV-Obs	ICV-Rec	CCV1-TV	CCV1-Obs	CCV1-Rec	CCV2-TV	CCV2-Obs	CCV2-Rec
THg (ng/L)	A	15.00	14.58	97.2	20.00	23.26	116.3	20.00	20.25	101.3
THg (ng/L)	B	15.00	14.56	97.1	20.00	19.94	99.7	20.00	19.79	99.0
THg (ng/L)	C	15.00	15.06	100.4	20.00	20.21	101.0	20.00	20.21	101.0

Analyte	Analytical Batch	CCV3-TV	CCV3-Obs	CCV3-Rec	CCV4-TV	CCV4-Obs	CCV4-Rec	CCV5-TV	CCV5-Obs	CCV5-Rec
THg (ng/L)	A	20.00	18.58	92.9	20.00	19.42	97.1	20.00	19.59	97.9
THg (ng/L)	B	20.00	19.79	99.0	20.00	20.23	101.1	-	-	-
THg (ng/L)	C	20.00	19.95	99.8	20.00	20.12	100.6	-	-	-

Frontier Geosciences Inc.
Environmental Research & Specialty Analytical Laboratory
414 Pontius Avenue North • Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@FrontierGeosciences.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12.1.03 Page: 01 of 01

Client Company: ENSR
Address: 27755 Diehl Road Ste. 100
Warrenville IL 60555
CONTACT:
Phone: Fax:
Email:
Project Name:
Contract/PO #:

Frontier Project Manager: Misty
Guaranteed Turnaround Time:
Confirmation of Sample Arrival at Frontier: ☐ YES ☐ NO
Quality Assurance Level: ☐ Standard ☐ High
Disposal*: ☐ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☐ ☒ UPS ☐ Other ☐
Tracking # 7904 8237 5358

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
glass 250	BGMW-1	H_2O	21				

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: Ambient °C
Comments: ice melted

VTSR: 1015

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by:	Relinquished by:
Print name:	Print name:
Company: internal C.o.c	Company:
Date: Time:	Date: Time:
Received by:	Received by:
Print name: Christabel Fowler	Print name:
Company: FGS	Company:
Date: 12.1.3 Time: 1115	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7293

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	WHI2-1S-G-1203-S	FW	1	12/3/03 1240	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	WHI2-1S-G-1203-EB	FW	1	12/3/03 1150	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 2.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/3/03 Time: 1800	Date: Time:
Received by: Barry Hodges	Received by:
Print name: BARRY HODGES	Print name:
Company: Frontier Geosciences	Company:
Date: 12-4-03 Time: 1200	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 ~~1~~ ACS of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8415 1567 7283

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	BGMW-1-G-1203-S	FW	1	12/02/03 1040	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	~~BGMW-1-G-1203-EB~~	~~FW~~	~~1~~	~~12/02/03~~	~~P. Elliott~~	~~NONE~~	~~HOLD~~ ACS

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 2.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other_____

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/3/03 Time: 1800	Date: Time:
Received by: Barry Hodges	Received by:
Print name: BARRY HODGES	Print name:
Company: Frontier Geosciences	Company:
Date: 12-4-03 Time: 1200	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmat on of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7283

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	CMSMW-08-G-1203-S	FW	1	12/3/03 ~~1250~~ 1425 1450	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	CMSMW-08-G-1203-EB	FW	1	12/3/03 1405	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☒ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/3/03 Time: 1800	Date: Time:
Received by: Barry Hodges	Received by:
Print name: BARRY HODGES	Print name:
Company: Frontier Geosciences	Company:
Date: 12-4-03 Time: 1200	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7283

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	~~GMS~~ ASS RFIMW-09-G-1203-S	FW	1	12/3/03 1540	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	RFIMW-09-G-1203-EB	FW	1	12/3/03 1515	P. ELLIOTT	NONE	TOTAL Hg: 1631 REV E

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/3/03 Time: 1800	Date: Time:
Received by: Barry Hodges	Received by:
Print name: BARRY HODGES	Print name:
Company: Frontier Geosciences	Company:
Date: 12-4-03 Time: 1200	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/3/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7283

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	CMSMW-02-G-1203-S	FW	1	12/3/03 1710	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	CMSMW-02-G-1203-FB	FW	1	12/3/03 1615	P. Elliott	NONE	HOLD
	CMSMW-02-G-1203-FB	FW	1	12/3/03 1620	P. ELLIOTT	NONE	TOTAL Hg: 1631 REV E

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/3/03 Time: 1800	Date: Time:
Received by: Barry Hodges	Received by:
Print name: BARRY HODGES	Print name:
Company: Frontier Geosciences	Company:
Date: 12-4-03 Time: 1200	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmat on of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-28-G-1203-S	FW	1	12/04/03 0845	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	* RFIMW-28-G-1203-EB	FW	1	12/04/03 0845	P. Elliott	NONE	HOLD
	RFIMW-28-G-1203-D	FW	1	12/04/03 0845	P. Elliott	NONE	TOTAL Hg: 1631 REV E

Sample Receipt
C.O.C. Seal Intact? ☑ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments: * THERE WAS NO bottle with this ID incl. in shipment. THERE WAS ONE EXTRA bottle in shipment. This one is labeled
VTSR: RFIMW-8-G-1203-EB 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by: A. Malaika Chafarty	Received by:
Print name: A. Malaika Chafarty	Print name:
Company: Frontier	Company:
Date: 12.5.03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR	Frontier Project Manager: MISTY KENNARD
Address: 27755 DIEHL ROAD WARRENVILLE, IL 60555	Guaranteed Turnaround Time: 30 days
CONTACT: PAYTHA ELLIOTT	Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Phone: 630-836-1700 Fax: 630-836-1711	Quality Assurance Level: ☐ Standard ☒ High
Email: pelliott@ensr.com	Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
Project Name: BASF - WYANDOTTE, MI	*All samples are held for at least 2 months after date of receipt. Please note that after this time they are disposed of or returned to the client. Clients may request a longer holding time by writing to the Frontier Project Manager. **Please discuss this with the Frontier Project Manager.
Contract/PO #:	Carrier Information: FED EX ☒ UPS ☐ Other ☐
	Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
*	WHI9-25-G-1203-2	FW	1	12/4/2003 1030	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	WHI9-25-G-1203-3	FW	1	12/4/2003 QAO	P. ELLIOTT	NONE	HOLD

Sample Receipt	[1]Matrix Codes:	Relinquished by: Paytha Elliott	Relinquished by:
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A	FW = fresh water (salinity < 0.5 ppth)	Print name: PAYTHA ELLIOTT	Print name:
Cooler Temperature: -0.4 °C	BW = brackish water	Company: ENSR	Company:
Comments: * Bottle was packaged in a single bubble bag.	SW = seawater	Date: 12/04/03 Time: 2000	Date: Time:
	WW = wastewater	Received by: A. Malika Lafferty	Received by:
	SE = sediment	Print name: A. Malika Lafferty	Print name:
	SO = soil	Company: FRONTIER	Company:
	AT = animal tissue	Date: 12.5.03 Time: 1225	Date: Time:
	PT = plant tissue		
	TR = trap		
	PP = petroleum product		
	OT = other		
VTSR: 10:30			

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-08-G-1203-S	FW	1	12/04/03 1155	P. Elliott	NONE	TOTAL Hg: 1631 REVE
*	RFIMW-08-G-1203-EB	FW	1	12/04/03 1130	P. ELLIOTT	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☑ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments: * PLEASE SEE NOTE REGARDING SAMPLE RFIMW-28-G-1203-EB. THERE IS ONE EXTRA SAMPLE INCL. IN SHIPMENT, IT IS LABELED RFIMW-8-G-1203-EB.
VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by:	Paytha Elliott	Relinquished by:	
Print name:	PAYTHA ELLIOTT	Print name:	
Company:	ENSR	Company:	
Date: 12/04/03	Time: 2000	Date:	Time:
Received by:	A. Malaika Lafferty	Received by:	
Print name:	A. Malaika Lafferty	Print name:	
Company:	FRONTIER	Company:	
Date: 12.5.03	Time: 1225	Date:	Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-02-G-1203S	FW	1	12/4/03 1255	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	RFIMW-02-G-1203EB	FW	1	12/4/03 1225	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☑ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments:
VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by: A. Malaika Lafferty	Received by:
Print name: A. Malaika Lafferty	Print name:
Company: Frontier	Company:
Date: 12.5.03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/4/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-01-G-1203-S	FW	1	12/4/03 1555	P. Elliott	NONE	TOTAL Hg: 1631 RevE
	RFI MW-01-G-1203-EB	FW	1	12/4/03 1515	P. Elliott	NONE	HOLD
	~~RFI~~MW-01-G-1203-D	FW	1	12/4/03 1555	P. Elliott	NONE	TOTAL Hg: 1631 RevE

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments:
VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by:	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by:	Received by:
Print name: A. Malaika Lafferty	Print name:
Company: Frontier	Company:
Date: 12-5-03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/04/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7272

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-13-G-1203-S	FW	1	12/04/03 1810	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFIMW-13-G-1203-EB	FW	1	12/04/03 1745	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFIMW-13-G-1203-FB	FW	1	12/04/03 1740	P. Elliott	NONE	TOTAL Hg: 1631 REVE

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: -0.4 °C
Comments:
VTSR: 1030

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/04/03 Time: 2000	Date: Time:
Received by: A. Malak	Received by:
Print name: A. Malaka Lafferty	Print name:
Company: Frontier	Company:
Date: 12-5-03 Time: 1225	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/05/03 Page: 1 of 2

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: ~~MISTY KENNARD~~ FRUSS
Guaranteed Turnaround Time: 30 days
Confirmat on of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7261

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-04-G-1203-S	FW	1	12/05/03 840	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	RFIMW-04-G-1203-EB	FW	1	12/05/03 810	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 2.0 °C
Comments:
VTSR: 10:00

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/05/03 Time: 1300	Date: Time:
Received by: Brian Setzer	Received by:
Print name: B. Setzer	Print name:
Company: FGS	Company:
Date: 12/6/03 Time: 11:00	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/05/03 Page: 2 of 2

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: ~~MISTY KENNARD~~ FRUSS
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-22-G-1203-S	FW	1	12/05/03 1000	P. Elliott	NONE	TOTAL Hg: 1631 RevE
	RFIMW-22-G-1203-EB	FW	1	12/05/03 915	P. Elliott	NONE	TOTAL Hg: 1631 RevE
	RFIMW-22-G-1203-FB	FW	1	12/05/03 910	P. Elliott	NONE	TOTAL Hg: 1631 RevE
							Perform MS/MSD on this sample

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 pɔth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: Time:	Date: Time:
Received by:	Received by:
Print name:	Print name:
Company:	Company:
Date: Time:	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/8/03 Page: 4 of 5

Client Company:	ENSR
Address:	27755 DIEHL ROAD WARRENVILLE, IL 60555
CONTACT:	PAYTHA ELLIOTT
Phone:	630-836-1700 Fax: 630-836-1711
Email:	pelliott@ensr.com
Project Name:	BASF - WYANDOTTE, MI
Contract/PO #:	

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-07-G-1203-S	FW	1	12/8/03 1200	P. Elliott	NONE	TOTAL Hg: 1631 Rev E
	RFIMW-07-G-1203-EB	FW	1	12/8/03 1118	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:

VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by:	Paytha Elliott	Relinquished by:	
Print name:	PAYTHA ELLIOTT	Print name:	
Company:	ENSR	Company:	
Date: 12/08/03	Time: 2000	Date:	Time:
Received by:	A. Malaika [signature]	Received by:	
Print name:	A. Malaika [signature]	Print name:	
Company:	Frontier	Company:	
Date: 12.9.03	Time: 1100	Date:	Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/8/03 Page: 1 of 5

Client Company: ENSR	Frontier Project Manager: MISTY KENNARD
Address: 27755 DIEHL ROAD WARRENVILLE, IL 60555	Guaranteed Turnaround Time: 30 days
CONTACT: PAYTHA ELLIOTT	Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Phone: 630-836-1700 Fax: 630-836-1711	Quality Assurance Level: ☐ Standard ☒ High
Email: pelliott@ensr.com	Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
Project Name: BASF - WYANDOTTE, MI	*All samples are held for at least 2 months after date of receipt. Please note that after this time they are disposed of or returned to the client. Clients may request a longer holding time by writing to the Frontier Project Manager. **Please discuss this with the Frontier Project Manager.
Contract/PO #:	Carrier Information: FED EX ☒ UPS ☐ Other ☐
	Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	WHI3-2S-G-1203-S	FW	1	12/8/03 1340	P. Elliott	NONE	TOTAL Hg: 1631 Rev E
	WHI3-2S-G-1203-EB	FW	1	12/8/03 1305	P. Elliott	NONE	HOLD

Sample Receipt	[1]Matrix Codes:	Relinquished by: Paytha Elliott	Relinquished by:
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A	FW = fresh water (salinity < 0.5 ppth)	Print name: PAYTHA ELLIOTT	Print name:
Cooler Temperature: 0.0 °C	BW = brackish water	Company: ENSR	Company:
Comments:	SW = seawater	Date: 12/08/03 Time: 2000	Date: Time:
	WW = wastewater	Received by: A. Malaika [signature]	Received by:
	SE = sediment	Print name: A. Malaika [signature]	Print name:
	SO = soil	Company: Frontier	Company:
VTSR: 1000	AT = animal tissue	Date: 12.9.03 Time: 1100	Date: Time:
	PT = plant tissue		
	TR = trap		
	PP = petroleum product		
	OT = other		

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/08/03 Page: 3 of 5

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled		Collected by	Preservation	Analysis Required/Comments
	RFIMW-26-G-1203-S	FW	1	12/08/03	1500	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	RFIMW-26-G-1203-B	FW	1	12/08/03	1410	P. Elliott	NONE	HOLD
	RFIMW-26-G-1203-D	FW	1	12/08/03	1500	P. Elliott	NONE	TOTAL Hg: 1631 REVE

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/08/03 Time: 2000	Date: Time:
Received by: A. Malaika Lafferty	Received by:
Print name: A. Malaika Lafferty	Print name:
Company: FRONTIER	Company:
Date: 12.9.03 Time: 1100	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/8/03 Page: 5 of 5

Client Company: ENSR	Frontier Project Manager: MISTY KENNARD
Address: 27755 DIEHL ROAD WARRENVILLE, IL 60555	Guaranteed Turnaround Time: 30 days
CONTACT: PAYTHA ELLIOTT	Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Phone: 630-836-1700 Fax: 630-836-1711	Quality Assurance Level: ☐ Standard ☒ High
Email: pelliott@ensr.com	Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
Project Name: BASF - WYANDOTTE, MI	*All samples are held for at least 2 months after date of receipt. Please note that after this time they are disposed of or returned to the client. Clients may request a longer holding time by writing to the Frontier Project Manager. **Please discuss this with the Frontier Project Manager.
Contract/PO #:	Carrier Information: FED EX ☒ UPS ☐ Other ☐
	Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-06-G-1203-S	FW	1	12/8/03 1725	P. Elliott	NONE	TOTAL Hg: 1631 Rev E
	RFIMW-06-G-1203-EB	FW	1	12/8/03 1650	P. Elliott	NONE	TOTAL Hg: 1631 Rev E
	RFIMW-06-G-1203-FB	FW	1	12/8/03 1645	P. ELLIOTT	NONE	TOTAL Hg: 1631 REV E

Sample Receipt	[1]Matrix Codes:		
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A	FW = fresh water (salinity < 0.5 ppth)	Relinquished by: Paytha Elliott	Relinquished by:
Cooler Temperature: 0.0 °C	BW = brackish water	Print name: PAYTHA ELLIOTT	Print name:
Comments:	SW = seawater	Company: ENSR	Company:
	WW = wastewater	Date: 12/08/03 Time: 2000	Date: Time:
	SE = sediment	Received by: [signature]	Received by:
	SO = soil	Print name: A. Malaika Lafferty	Print name:
	AT = animal tissue	Company: FRONTIER	Company:
VTSR: 1000	PT = plant tissue	Date: 12-9-03 Time: 1100	Date: Time:
	TR = trap		
	PP = petroleum product		
	OT = other		

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/08/03 Page: 2 of 15

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 8413 1567 7250

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	PM4NA-G-1203-S	FW	1	12/08/03 1910	P. Elliott	NONE	TOTAL Hg: 1631 REVE
	PM4NA-G-1203-EB	FW	1	12/08/03 1840	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: 0.0 °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/08/03 Time: 2000	Date: Time:
Received by: [signature]	Received by:
Print name: A. Melissa Lafferty	Print name:
Company: Frontier	Company:
Date: 12-9-03 Time: 1100	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	WHI3-1S-G-1203-S	FW	1	12/09/03 0840	P. Elliott	NONE *	TOTAL Hg: 1631 RevE*
	WHI3-1S-G-1203-EB	PW	1	12/09/03 0745	P. Elliott	NONE	TOTAL Hg: 1631 RevE
						*	Please perform MS/MSD analyses for this sample.

Sample Receipt	[1]Matrix Codes:	Relinquished by: Paytha Elliott	Relinquished by:
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A	FW = fresh water (salinity < 0.5 ppth)	Print name: PAYTHA ELLIOTT	Print name:
Cooler Temperature: °C	BW = brackish water	Company: ENSR	Company:
Comments:	SW = seawater	Date: 12/09/03 Time: 2000	Date: Time:
	WW = wastewater	Received by: [illegible]	Received by:
	SE = sediment	Print name: M. Wisdom	Print name:
	SO = soil	Company: PGS	Company:
VTSR:	AT = animal tissue	Date: 12·10·03 Time: 1050	Date: Time:
	PT = plant tissue		
	TR = trap		
	PP = petroleum product		
	OT = other		

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/9/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	WHI4-2S-G-1203-S	FW	1	12/9/03 1040	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	WHI4-2S-G-1203-EB	FW	1	12/9/03 1010	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by:	Paytha Elliott	Relinquished by:	
Print name:	PAYTHA ELLIOTT	Print name:	
Company:	ENSR	Company:	
Date: 12/09/03	Time: 2000	Date:	Time:
Received by:	Melissa C. Wisdom	Received by:	
Print name:	M WISDOM	Print name:	
Company:	FGS	Company:	
Date: 12.10.03	Time: 1050	Date:	Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
•	RFIMW-15-G-1203-S	FW	1	12/09/03 1150	P. Elliott	NONE	TOTAL Hg: 1631 REVE
•	RFIMW-15-G-1203-EB	FW	1	12/09/03 1115	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: [signature]	Received by:
Print name: M WISDOM	Print name:
Company: FGS	Company:
Date: 12.10.03 Time: 1050	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
•	WHI9-2F-G-1203-S	FW	1	12/09/03 1340	P. Elliott	NONE	TOTAL Hg: 1631 Rev E
•	WHI9-2F-G-1203-EB	FW	1	12/09/03 1305	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: Melanie C. Wisdom	Received by:
Print name: M WISDOM	Print name:
Company: FGS	Company:
Date: 12-10-03 Time: 1050	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/9/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking # 3413 1567 7240

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
	RFIMW-11-G-1203-S	FW	1	12/9/03 1500	P. Elliott	NONE	TOTAL Hg: 1631 REV E
	RFIMW-11-G-1203-EB	FW	1	12/9/03 1435	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☒ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR: 1000

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: Stephanie C. Wisdom	Received by:
Print name: M. WISDOM	Print name:
Company: FGS	Company:
Date: 12.10.03 Time: 1050	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
•	RFI MW-12-G-1203-S	FW	1	12/09/03 1550	P. Elliott	NONE	TOTAL Hg: 1631 REV E
•	RFIMW-12-G-1203-EB	FW	1	12/09/03 1520	P. Elliott	NONE	HOLD

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: Mytrie Wisdom	Received by:
Print name: M. WISDOM	Print name:
Company: FGS	Company:
Date: 12·10·03 Time: 1050	Date: Time:

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 12/09/03 Page: 1 of 1

Client Company: ENSR
Address: 27755 DIEHL ROAD
WARRENVILLE, IL 60555
CONTACT: PAYTHA ELLIOTT
Phone: 630-836-1700 Fax: 630-836-1711
Email: pelliott@ensr.com
Project Name: BASF - WYANDOTTE, MI
Contract/PO #:

Frontier Project Manager: MISTY KENNARD
Guaranteed Turnaround Time: 30 days
Confirmation of Sample Arrival at Frontier: ☒ YES ☐ NO
Quality Assurance Level: ☐ Standard ☒ High
Disposal*: ☒ Frontier Dispose ☐ Return to Client ☐ Ship to 3rd Party**
*All samples are held for at least 2 months after date of receipt.
Please note that after this time they are disposed of or returned to the client.
Clients may request a longer holding time by writing to the Frontier Project Manager.
**Please discuss this with the Frontier Project Manager.
Carrier Information: FED EX ☒ UPS ☐ Other ☐
Tracking #

Engraved Bottle ID	Sample ID	Matrix[1]	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
•	WHI4-1S-G-1203-S	FW	1	12/09/03 1900	P. Elliott	NONE	TOTAL Hg: 1631 REVE
•	WHI4-1S-G-1203-EB	FW	1	12/09/03 1805	P. Elliott	NONE	HOLD
•	WHI4-1S-G-1203-FB	FW	1	12/09/03 1800	P. Elliott	NONE	TOTAL Hg: 1631 REVE

Sample Receipt
C.O.C. Seal Intact? ☐ YES ☐ NO ☐ N/A
Cooler Temperature: °C
Comments:
VTSR:

[1]Matrix Codes:
FW = fresh water (salinity < 0.5 ppth)
BW = brackish water
SW = seawater
WW = wastewater
SE = sediment
SO = soil
AT = animal tissue
PT = plant tissue
TR = trap
PP = petroleum product
OT = other

Relinquished by: Paytha Elliott	Relinquished by:
Print name: PAYTHA ELLIOTT	Print name:
Company: ENSR	Company:
Date: 12/09/03 Time: 2000	Date: Time:
Received by: Stephanie C. Wisdom	Received by:
Print name: M WISDOM	Print name:
Company: FGS	Company:
Date: 12.10.03 Time: 1050	Date: Time:

Frontier Geosciences

Dataset for CV.AFS Analysis

Analysis Method: FGS-069

THg

Dataset ID:	**THg11-031215-1**
Analyst:	**jacobm**
Data Prep:	**jacobm**
Analysis Date:	**12/15/2003**

Project List:

No.	HiQA	Sample Group		Corrections: Inst. Blank	Prep. Blank	MSA	Effic. Factor
2	☑	ENSR 12/1		Yes-1	Yes-3	No	No
		*Prep Method:	THg BrCl Oxidation				
4	☑	ENSR 12/4		Yes-1	Yes-3	No	No
		*Prep Method:	THg BrCl Oxidation				
5	☑	ENSR 12/5		Yes-1	Yes-3	No	No
		*Prep Method:	THg BrCl Oxidation				
6	☑	ENSR 12/6		Yes-1	Yes-3	No	No
		*Prep Method:	THg BrCl Oxidation				

Analytical Remarks:

12 (BGWW-1-EB): RR TO CONFIRM-RR#42
14 (CMSMW-08-G-1203-S): TH-RR#57, T5 REBURN ON R15-16
17 (RFIMW-09-G-1203-S): TL-RR#43
18 (CMSMW-02-G-1203-S): TH-RR#48, T7 REBURN ON R19
23 (WH12-15-G-1203-S): SUSPECT BUBBLER-RR#60
30 (RFIMW-02-G-1203-S): TL-RR#51
31 (RFIMW-08-G-1203-S): TL-RR#50
36 (RFIMW-28-G-1203-D): TL-RR#62
37 (RFIMW-28-G-1203-S): TL-RR#63
41 (RFIMW-22-G-1203-S): POOR RPD- RR#61
44 (CMSMW-08-G-1203-S): TH-RR#57, T5 REBURN ON R45
49 (WH12-15-G-1203-S): SUSPECT BUBBLER- RR#60
52 (BUBBLER CHECK): TH-RR#53
53 (BUBBLER CHECK): CHANGE SODA LIME
64 (CCV5): TL-RR#65

A

QUALITY ASSURANCE
PEER-REVIEWED

INITIALS: 1-23-04

RR=Rerun
RR#= See rerun number
TL= Too low
TH= Too high
T5= Trap #5

The RPD for the MD came out too high. The MD was rerun and the RPD came out in range. The failure is most likely due to the large amount of suspended particulate in this sample.

The final CCV came out too low. The analyst reran it on the same trap/ bubbler combination and it came out in range.

Validator: **susanc**

Printed: 01/23/2004 11:11:1

Frontier Geosciences

Dataset for CV.AFS Analysis

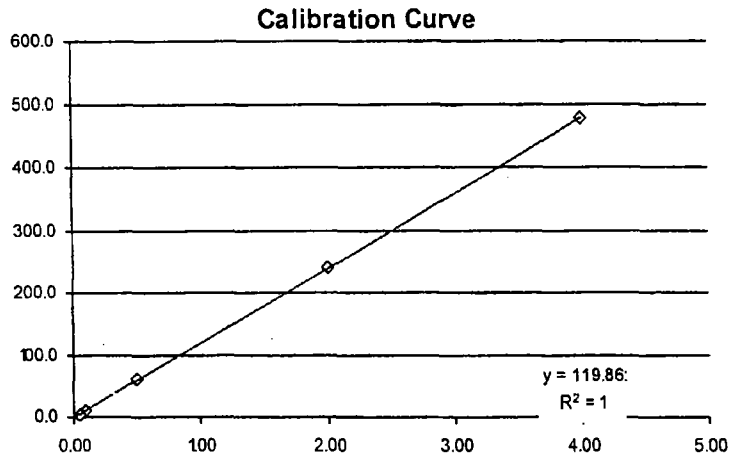
Dataset ID: THg11-031215-1
Analyst: jacobm
Date: 12/15/2003

Calibration Data for THg

ng vs. Measured Intensity

Slope: 119.86120 *R:* 0.99998
SE: 1.03558 *Obs:* 5

True Value-x	IBC Intensity-y	Calc Value	Calc Intensity
0.1000	11.6500	0.0972	11.9861
0.5000	61.5500	0.5135	59.9306
2.0000	240.7500	2.0086	239.7224
4.0000	478.7500	3.9942	479.4448
0.0500	4.9500	0.0413	5.9931



Instrument Blank (IB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	Intensity
1	THg	10	0.104	0.237	0.710	ng/L	1.250000

Preparation Blank (PB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	PB1	PB2	PB3	PB4
3	THg	3	-0.029	0.022	0.066	ng/L	-0.013	-0.054	-0.021	

MSA Sets

QC Sets

Sample	Analyte	Sample	Duplicate	Triplicate	Spike	Spike Dup.	Spike TV	Spike Dup. TV
RFIMW-22-G-1203-S	THg	33.347	42.808		140.746	130.059	105.300	105.300
	ng/L	Avg=38.077	24.8% RPD			11.0% RPD	97.5%Rec	87.4%Rec

Frontier Geosciences

Dataset for CV.AFS Analysis

Dataset ID: THg11-031215-1
Analyst: jacobm
Date: 12/15/2003

Run	Trap	Pos	Sample Group	Sample ID	Excl.	Type	Aliquot	Intens.	Inst Value	Dil.	[Liquid Gross]	%Pres	[Liquid Net]	Rec.	TV
1	1	1	{Analysis}	0.10 ng	☐	CAL	100.000 mL	12.9	0.097 ng	1.	0.972 ng/L		0.972 ng/L	97.2%	0.1000
2	2	2	{Analysis}	0.50 ng	☐	CAL	100.000 mL	62.8	0.514 ng	1.	5.135 ng/L		5.135 ng/L	102.7%	0.5000
3	3	3	{Analysis}	2.00 ng	☐	CAL	100.000 mL	242	2.009 ng	1.	20.086 ng/L		20.086 ng/L	100.4%	2.0000
4	4	4	{Analysis}	4.00 ng	☐	CAL	100.000 mL	480	3.994 ng	1.	39.942 ng/L		39.942 ng/L	99.9%	4.0000
5	5	1	{Analysis}	0.05 ng	☐	CAL	100.000 mL	6.2	0.041 ng	1.	0.413 ng/L		0.413 ng/L	82.6%	0.0500
6	6	2	{Analysis}	ICV	☐	CV	100.000 mL	176	1.458 ng	1.	14.579 ng/L		14.579 ng/L	97.2%	15.0000
7	7	3	{Analysis}	ICB/BB	☐	IB	100.000 mL	0.2	0.002 ng	1.	0.017 ng/L		0.017 ng/L		
8	8	4	{BATCH QC}	NIST 1641d	☐	LCS	0.200 mL	180	1.491 ng	200.	1491308.298 ng/L	2.0	1521134.521 ng/L	95.0%	1601000.0000
9	9	1	{BATCH QC}	PBW-1	☐	PB	100.000 mL	1.1	-0.001 ng	1.	-0.013 ng/L		-0.013 ng/L		
10	1	2	{BATCH QC}	PBW-2	☐	PB	100.000 mL	0.6	-0.005 ng	1.	-0.054 ng/L		-0.054 ng/L		
11	2	3	{BATCH QC}	PBW-3	☐	PB	100.000 mL	1	-0.002 ng	1.	-0.021 ng/L		-0.021 ng/L		
12	3	4	ENSR 12/1	BGWW-1-EB	☑	S	100.000 mL	40.9	0.331 ng	1.	3.308 ng/L	1.0	3.370 ng/L		
13	4	1	ENSR 12/4	CMSMW-02-G-1203-FB	☐	S	100.000 mL	3.3	0.017 ng	1.	0.171 ng/L	1.0	0.202 ng/L		
14	5	2	ENSR 12/4	CMSMW-08-G-1203-S	☑	S	50.000 mL	999999	8342.965 ng	1.	166859.297 ng/L	5.0	175202.408 ng/L		
17	6	3	ENSR 12/4	RFIMW-09-G-1203-S	☑	S	50.000 mL	4.9	0.030 ng	1.	0.609 ng/L	2.0	0.680 ng/L		
18	7	4	ENSR 12/4	CMSMW-02-G-1203-S	☑	S	50.000 mL	999999	8342.965 ng	1.	166859.297 ng/L	2.0	170196.541 ng/L		
20	8	1	ENSR 12/4	RFIMW-26-G-1203-S	☐	S	50.000 mL	83.6	0.687 ng	1.	13.741 ng/L	2.0	14.074 ng/L		
21	9	2	{Analysis}	CCV1	☐	CV	100.000 mL	280	2.326 ng	1.	23.256 ng/L		23.256 ng/L	116.3%	20.0000
22	1	3	{Analysis}	CCB1	☐	IB	100.000 mL	0.3	0.003 ng	1.	0.025 ng/L		0.025 ng/L		
23	2	4	ENSR 12/4	WH12-15-G-1203-S	☑	S	100.000 mL	36.8	0.297 ng	1.	2.966 ng/L	2.0	3.084 ng/L		
24	3	1	ENSR 12/5	RFIMW-13-G-1203-FB	☐	S	100.000 mL	2.7	0.012 ng	1.	0.121 ng/L	1.0	0.151 ng/L		
25	4	2	{Analysis}	BUBBLER CHECK	☐	IB	100.000 mL	0.4	0.003 ng	1.	0.033 ng/L		0.033 ng/L		
26	5	3	ENSR 12/5	RFIMW-13-G-1203-EB	☐	S	100.000 mL	3.7	0.020 ng	1.	0.204 ng/L	1.0	0.236 ng/L		
27	6	4	{Analysis}	BUBBLER CHECK	☐	IB	100.000 mL	0.2	0.002 ng	1.	0.017 ng/L		0.017 ng/L		
28	7	1	ENSR 12/5	RFIMW-01-G-1203-D	☐	S	5.000 mL	12.8	0.096 ng	1.	19.272 ng/L	5.0	20.382 ng/L		
29	8	2	ENSR 12/5	RFIMW-01-G-1203-S	☐	S	5.000 mL	21.8	0.171 ng	1.	34.290 ng/L	5.0	36.150 ng/L		
30	9	3	ENSR 12/5	RFIMW-02-G-1203-S	☑	S	5.000 mL	0.8	-0.004 ng	1.	-0.751 ng/L	3.0	-0.686 ng/L		
31	1	4	ENSR 12/5	RFIMW-08-G-1203-S	☑	S	5.000 mL	0.7	-0.005 ng	1.	-0.918 ng/L	5.0	-0.818 ng/L		
32	2	1	ENSR 12/5	RFIMW-13-G-1203-S	☐	S	5.000 mL	32.8	0.263 ng	1.	52.644 ng/L	5.0	55.422 ng/L		
33	3	2	{Analysis}	CCV2	☐	CV	100.000 mL	244	2.025 ng	1.	20.253 ng/L		20.253 ng/L	101.3%	20.0000
34	4	3	{Analysis}	CCB2	☐	IB	100.000 mL	0	0.000 ng	1.	0.000 ng/L		0.000 ng/L		
35	5	4	ENSR 12/5	WH19-25-1203-S	☐	S	5.000 mL	24.4	0.193 ng	1.	38.628 ng/L	6.0	41.121 ng/L		
36	6	1	ENSR 12/5	RFIMW-28-G-1203-D	☑	S	5.000 mL	2.1	0.007 ng	1.	1.418 ng/L	6.0	1.679 ng/L		
37	7	2	ENSR 12/5	RFIMW-28-G-1203-S	☑	S	5.000 mL	3.9	0.022 ng	1.	4.422 ng/L	5.0	4.789 ng/L		
38	8	3	ENSR 12/6	RFIMW-22-G-1203-FB	☐	S	100.000 mL	1.9	0.005 ng	1.	0.054 ng/L	1.0	0.084 ng/L		
39	9	4	ENSR 12/6	RFIMW-22-G-1203-EB	☐	S	100.000 mL	2.1	0.007 ng	1.	0.071 ng/L	1.0	0.101 ng/L		
40	1	1	ENSR 12/6	RFIMW-04-G-1203-S	☐	S	50.000 mL	44.7	0.363 ng	1.	7.250 ng/L	2.0	7.453 ng/L		
41	2	2	ENSR 12/6	RFIMW-22-G-1203-S	☑	S	5.000 mL	15.5	0.119 ng	1.	23.778 ng/L	5.0	25.112 ng/L		
42	3	3	ENSR 12/1	BGWW-1-EB	☐	S	100.000 mL	42.8	0.347 ng	1.	3.467 ng/L	1.0	3.530 ng/L		
43	4	4	ENSR 12/4	RFIMW-09-G-1203-S	☐	S	100.000 mL	16.7	0.129 ng	1.	1.289 ng/L	2.0	1.373 ng/L		
44	5	1	ENSR 12/4	CMSMW-08-G-1203-S	☑	S	5.000 mL	999999	8342.965 ng	1.	1668592.968 ng/L	5.0	1752022.763 ng/L		
46	6	2	{Analysis}	CCV3	☐	CV	100.000 mL	224	1.858 ng	1.	18.584 ng/L		18.584 ng/L	92.9%	20.0000
47	7	3	{Analysis}	CCB3	☐	IB	100.000 mL	0.7	0.006 ng	1.	0.058 ng/L		0.058 ng/L		
48	8	4	ENSR 12/4	CMSMW-02-G-1203-S	☐	S	5.000 mL	256	2.125 ng	1.	425.075 ng/L	2.0	433.635 ng/L		
49	9	[illegible]	ENSR 12/4	WH12-15-G-1203-S	☑	S	100.000 mL	45	0.365 ng	1.	3.650 ng/L	2.0	3.781 ng/L		
50	1	[illegible]	ENSR 12/5	RFIMW-01-G-1203-D	☐	S	100.000 mL	218	1.80[illegible]	1.	18.083 ng/L	3.0	18.714 ng/L		

Front[illegible] Geosciences

Dataset for CV.AFS Analysis

Dataset ID: THg11-031215-1
Analyst: jacobm
Date: 12/15/2003

Run	Trap	Pos	Sample Group	Sample ID	Excl.	Type	Aliquot	Inten.	Inst Value	Dil.	[Liquid Gross]	%Pres.	[Liquid Net]	Rec.	TV
51	2	3	ENSR 12/5	RFIMW-02-G-1203-S	☐	S	100.000 mL	47.1	0.383 ng	1.	3.825 ng/L	5.0	4 163 ng/L		
52	3	4	ENSR 12/5	RFIMW-08-G-1203-S	☐	S	100.000 mL	64.7	0.529 ng	1.	5.294 ng/L		5 323 ng/L		
53	4	1	{Analysis}	BUBBLER CHECK	☐	IB	100.000 mL	9.3	0.078 ng	1.	0.776 ng/L		0 776 ng/L		
53	4	1	{Analysis}	BUBBLER CHECK	☐	IB	100.000 mL	0.4	0.003 ng	1.	0.033 ng/L		0 033 ng/L		
54	5	2	ENSR 12/6	RFIMW-22-G-1203-S MD	☐	MD	5.000 mL	25.6	0.203 ng	1.	40.630 ng/L	5.0	42 808 ng/L		
55	6	3	ENSR 12/6	RFIMW-22-G-1203-S MS	☐	MS	5.000 mL	81.5	0.670 ng	1.	133.905 ng/L	5.0	140 746 ng/L		105.3000
56	7	4	ENSR 12/6	RFIMW-22-G-1203-S MSD	☐	MSD	5.000 mL	75.4	0.619 ng	1.	123.726 ng/L	5.0	130.059 ng/L		105.3000
57	8	1	ENSR 12/4	CMSMW-08-G-1203-S	☐	S	0.500 mL	224	1.858 ng	1.	3716.799 ng/L	5.0	3902.785 ng/L		
58	9	2	{Analysis}	CCV4	☐	CV	100.000 mL	234	1.942 ng	1.	19.418 ng/L		19.418 ng/L	97.1%	20.0000
59	1	3	{Analysis}	CCB4	☐	IB	100.000 mL	0.3	0.003 ng	1.	0.025 ng/L		0.025 ng/L		
60	2	4	ENSR 12/4	WH12-15-G-1203-S	☐	S	100.000 mL	44.2	0.358 ng	1.	3.583 ng/L	2.0	3.713 ng/L		
61	3	1	ENSR 12/6	RFIMW-22-G-1203-S	☐	S	5.000 mL	20.2	0.158 ng	1.	31.620 ng/L	5.0	33.347 ng/L		
62	4	2	ENSR 12/6	RFIMW-28-G-1203-D	☐	S	100.000 mL	34.7	0.279 ng	1.	2.791 ng/L	6.0	3.133 ng/L		
63	5	3	ENSR 12/6	RFIMW-28-G-1203-S	☐	S	100.000 mL	48.8	0.397 ng	1.	3.967 ng/L	5.0	4.311 ng/L		
64	6	4	{Analysis}	CCV5	☑	CV	100.000 mL	140	1.158 ng	1.	11.576 ng/L		11.576 ng/L	57.9%	20.0000
65	6	4	{Analysis}	CCV5	☐	CV	100.000 mL	236	1.959 ng	1.	19.585 ng/L		19.585 ng/L	97.9%	20.0000
66	7	1	{Analysis}	CCB5	☐	IB	100.000 mL	0.7	0.006 ng	1.	0.058 ng/L		0.058 ng/L		

CCB1

CCV1

TRAP#7 Reburn

RFIMW-26-G1203-S

RFIMW-09-G-1203-S

TRAP#5 Reburn

CMSW- CMSMW-02-G-1203-S

TRAP#5 Reburn

CMSMW-02-G-1203-FB

CMSMW-08-G-1203-S

BGWW-1-EB

PBW-3

PBW-2

PBW-1

ICB/BB

NIST 1641d

0.05ng

ICV

4.0ng

20ng

0.10ng

0.50ng

K=20 X=1 chart speed= 1mm/min

JACOB MEYER

THg 11-031215-1

12/15/03

START 12:08

RFIMW-08-G-1203-S
RFIMW-02-G1203-S

RFIMW-01-G-1203-D
WH12-15-G-1203-S

CCB3
CMSMW-02-G-1203-S

CCB3 ← CCV3 Trap #5 Reburn

RFIMW-09-G-1203-S
CMSMW-08-G-1203-S
BEWW-1-EB

RFIMW-22-G-1203-S
RFIMW-04-G-1203S

RFIMW-22-G-1203-EB
RFIMW-22-G-1203-FB
RFIMW-28-G-1203-S
RFIMW-28-G-1203D

WH19-25-1203-S

CCB2

CCV2
RFIMW-13-G-1203-S

RFIMW-08-G-1203-S
RFIMW-02-G-1203-S
RFIMW-01-G-1203-S
RFIMW-01-G-1203-D

BUBBLER CHECK
RFIMW-13-G-1203-EB
BUBBLER CHECK
RFIMW-13-G-1203-FB

~~RFIMW-07-1203-S~~ SPM 12/10/13
WH12-15-G-1203-S

KEIWM-13-P-1203-EB
BOBBER CHECK
KEIWM-13-P-1203-EB
BOBBER CHECK

KEIWM-01-P-1203-D
KEIWM-01-P-1203-2
KEIWM-02-P-1203-2

END 20:59

CCB5

CCV5

CCU5

RFIMW-28-G-1203-S

RFIMW-28-G-1203-D

RFIMW-22-G-1203-S

WH12-15-G-1203-S

CCB4

CCV4

CMSMW-08-G-1203-S

RFIMW-22-G-1203-S MSD

RFIMW-22-G-1203-S MS

RFIMW-22-G-1203-S MD

F#4 Reboiler BUBBLER CHECK

BUBBLER CHECK

CHART NO. KZ XII-2

Frontier Geosciences

Dataset for CV.AFS Analysis

Analysis Method: FGS-069

THg

Dataset ID: **THg12-031215-1**
Analyst: **jacobm**
Data Prep: **jacobm**
Analysis Date: **12/15/2003**

Project List:

No.	HiQA	Sample Group		Corrections: Inst. Blank	Prep Blank	MSA	Dilu. Factor
3	☑	ENSR 12/9		Yes-1	Yes-2	No	No
		*Prep Method:	THg BrCl Oxidation				
4	☑	ENSR 12/10		Yes-1	Yes-2	No	No
		*Prep Method:	THg BrCl Oxidation				

Analytical Remarks:

15 (PM4NA-G-1203-S): TL-RR#37
16 (RFIMW-26-G-1203-D): SAYS "DISS" BUT HAS PARTICULATE
20 (RFIMW-07-1203-S): TH-RR#38
21 (RFIMW-06-G-1203-S): TH-RR#40, T6 REBURN ON R22
25 (RFIMW-11-G-1203-S): TL-RR#41
26 (WH13-15-G-1203-S): SUSPECT BUBBLER-RR#34
28 (RFIMW-12-G-1203-S): TL-RR#44
29 (RFIMW-15-G-1203-S): TL-RR#45

(B)

TL= Too low
TH= Too high
RR#= See rerun number
T7= Trap #7

No problems to report.

QUALITY ASSURANCE
PEER - REVIEWED
INITIALS: A.M.L. 12-24-03

Validator:

Printed: 12/18/2003 3:29:00

Frontier Geosciences

Dataset for CV.AFS Analysis

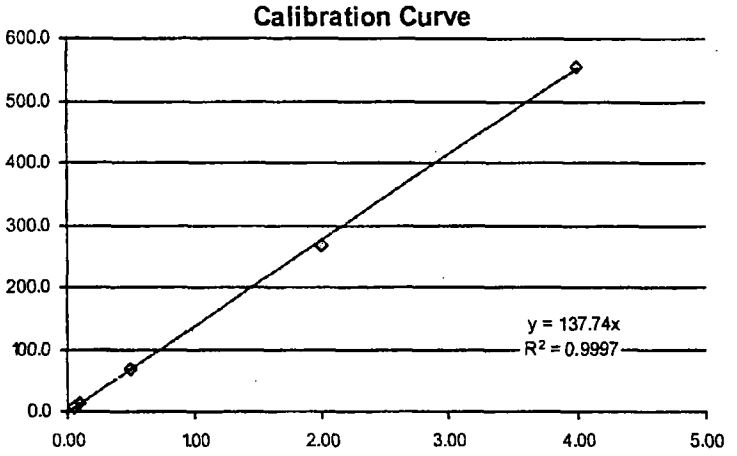
Dataset ID: **THg12-031215-1**
Analyst: **jacobm**
Date: **12/15/2003**

Calibration Data for THg

ng vs. Measured Intensity

Slope: **137.73769** *R:* **0.99985**
SE: **3.62811** *Obs:* **5**

True Value x	IBC Intensity y	Calc Value	Calc Intensity
0.1000	12.0000	0.0871	13.7738
0.5000	67.6000	0.4908	68.8688
2.0000	268.6000	1.9501	275.4754
4.0000	554.6000	4.0265	550.9508
0.0500	6.2000	0.0450	6.8869



Instrument Blank (IB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	Intensity
1	THg	5	0.102	0.072	0.216	ng/L	1.400000

Preparation Blank (PB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	PB1	PB2	PB3	PB4
2	THg	3	-0.022	0.048	0.143	ng/L	0.029	-0.065	-0.029	

MSA Sets

QC Sets

Sample	Analyte	Sample	Duplicate	Triplicate	Spike	Spike Dup	Spike TV	Spike Dup. TV
WH13-15-G-1203-S	THg	10.505	9.532		44.126	48.313	41.240	41.240
	ng/L	Avg=10.019	9.7% RPD			11.6% RPD	82.7%Rec	92.9%Rec

Fronti[illegible] Geosciences

Dataset for CV.AFS Analysis

Dataset ID: THg12-031215-1
Analyst: jacobm
Date: 12/15/2003

Run	Tray	Pos	Sample Group	Sample ID	Etch	Type	Aliquot	Intens	Inst Value	Dilu	Liquid Grab	%Rec	Liquid Net	Rec	Qty
1	1	1	{Analysis}	0.10 ng	☐	CAL	100.000 mL	13.4	0.087 ng	1.	0.871 ng/L		0.871 ng/L	87.1%	0.1000
2	2	2	{Analysis}	0.50 ng	☐	CAL	100.000 mL	69	0.491 ng	1.	4.908 ng/L		4.908 ng/L	98.2%	0.5000
3	4	3	{Analysis}	2.00 ng	☐	CAL	100.000 mL	270	1.950 ng	1.	19.501 ng/L		19.501 ng/L	97.5%	2.0000
4	5	4	{Analysis}	4.00 ng	☐	CAL	100.000 mL	556	4.026 ng	1.	40.265 ng/L		40.265 ng/L	100.7%	4.0000
5	6	1	{Analysis}	0.05 ng	☐	CAL	100.000 mL	7.6	0.045 ng	1.	0.450 ng/L		0.450 ng/L	90.0%	0.0500
6	7	2	{Analysis}	ICV	☐	CV	100.000 mL	202	1.456 ng	1.	14.564 ng/L		14.564 ng/L	97.1%	15.0000
7	9	3	{Analysis}	ICB/BB	☐	IB	100.000 mL	0.3	0.002 ng	1.	0.022 ng/L		0.022 ng/L		
8	10	4	{Analysis}	NIST 1641d	☐	LCS	0.200 mL	218	1.573 ng	200.	1572554.269 ng/L	2.0	1604005.354 ng/L	100.2%	1601000.0000
9	1	1	{BATCH QC}	PBW-1	☐	PB	100.000 mL	1.8	0.003 ng	1.	0.029 ng/L		0.029 ng/L		
10	2	2	{BATCH QC}	PBW-2	☐	PB	100.000 mL	0.5	-0.007 ng	1.	-0.065 ng/L		-0.065 ng/L		
11	4	3	{BATCH QC}	PBW-3	☐	PB	100.000 mL	1	-0.003 ng	1.	-0.029 ng/L		-0.029 ng/L		
12	5	4	ENSR 12/9	RFIMW-06-G-1203-FB	☐	S	100.000 mL	3	0.012 ng	1.	0.116 ng/L	1.0	0.139 ng/L		
13	6	1	ENSR 12/9	RFIMW-06-1203-EB	☐	S	100.000 mL	2.2	0.006 ng	1.	0.058 ng/L	1.0	0.080 ng/L		
14	7	2	ENSR 12/9	WHI3-25-G-1203-S	☐	S	50.000 mL	436	3.155 ng	1.	63.105 ng/L	2.0	64.411 ng/L		
15	9	3	ENSR 12/9	PM4NA-G-1203-S	☑	S	0.500 mL	2.6	0.009 ng	1.	17.424 ng/L	50.0	27.226 ng/L		
16	10	4	ENSR 12/9	RFIMW-26-G-1203-D	☐	S	50.000 mL	172	1.239 ng	1.	24.772 ng/L	2.0	25.311 ng/L		
17	1	1	ENSR 12/9	BGMW-1-G-1203-S	☐	S	100.000 mL	222	1.602 ng	1.	16.016 ng/L	1.0	16.198 ng/L		
18	2	2	{Analysis}	CCV1	☐	CV	100.000 mL	276	1.994 ng	1.	19.936 ng/L		19.936 ng/L	99.7%	20.0000
19	3	3	{Analysis}	CCB1	☐	IB	100.000 mL	1	0.007 ng	1.	0.073 ng/L		0.073 ng/L		
20	5	4	ENSR 12/9	RFIMW-07-1203-S	☑	S	50.000 mL	720	5.217 ng	1.	104.343 ng/L	2.0	106.474 ng/L		
21	6	1	ENSR 12/9	RFIMW-06-G-1203-S	☑	S	100.000 mL	99999	726.000 ng	1.	7260.003 ng/L	1.0	7332.624 ng/L		
23	7	2	ENSR 12/10	WH13-15-G-1203-EB	☐	S	100.000 mL	3.5	0.015 ng	1.	0.152 ng/L	1.0	0.176 ng/L		
24	9	3	ENSR 12/10	WH14-15-G-1203-FB	☐	S	100.000 mL	2.2	0.006 ng	1.	0.058 ng/L	1.0	0.080 ng/L		
25	10	4	ENSR 12/10	RFIMW-11-G-1203-S	☑	S	5.000 mL	1.2	-0.001 ng	1.	-0.290 ng/L	3.0	-0.234 ng/L		
26	1	1	ENSR 12/10	WH13-15-G-1203-S	☑	S	5.000 mL	12.4	0.080 ng	1.	15.972 ng/L	3.0	16.517 ng/L		
27	2	2	ENSR 12/10	WH14-25-G-1203-S	☐	S	1.000 mL	102	0.730 ng	1.	730.374 ng/L	5.0	767.001 ng/L		
28	3	3	ENSR 12/10	RFIMW-12-G-1203-S	☑	S	1.000 mL	13.1	0.085 ng	1.	84.944 ng/L	10.0	93.656 ng/L		
29	5	4	ENSR 12/10	RFIMW-15-G-1203-S	☑	S	5.000 mL	1.4	0.000 ng	1.	0.000 ng/L	3.0	0.065 ng/L		
30	6	1	{Analysis}	CCB2	☐	IB	100.000 mL	1.8	0.013 ng	1.	0.131 ng/L		0.131 ng/L		
31	7	2	{Analysis}	CCV2	☐	CV	100.000 mL	274	1.979 ng	1.	19.791 ng/L		19.791 ng/L		
32	9	3	ENSR 12/10	WH19-2F-G-1203-S	☐	S	5.000 mL	498	3.605 ng	1.	721.081 ng/L	5.0	757.244 ng/L		
33	10	4	ENSR 12/10	WH14-15-G-1203-S	☐	S	50.000 mL	460	3.330 ng	1.	66.590 ng/L	1.0	67.278 ng/L		
34	1	1	ENSR 12/10	WH13-15-G-1203-S	☐	S	50.000 mL	71.2	0.507 ng	1.	10.135 ng/L	3.0	10.505 ng/L		
35	2	2	ENSR 12/10	WH13-15-G-1203-S MD	☐	MD	50.000 mL	64.7	0.460 ng	1.	9.191 ng/L	3.0	9.532 ng/L		
36	3	3	ENSR 12/10	WH13-15-G-1203-S MS	☐	MS	50.000 mL	296	2.139 ng	1.	42.777 ng/L	3.0	44.126 ng/L		41.2400
37	5	4	ENSR 12/10	WH13-15-G-1203-S MSD	☐	MSD	50.000 mL	324	2.342 ng	1.	46.843 ng/L	3.0	48.313 ng/L		41.2400
38	6	1	ENSR 12/9	PM4NA-G-1203-S	☐	S	10.000 mL	48.7	0.343 ng	1.	34.341 ng/L	50.0	52.600 ng/L		
39	7	2	ENSR 12/9	RFIMW-07-1203-S	☐	S	5.000 mL	83.2	0.594 ng	1.	118.776 ng/L	2.0	121.196 ng/L		
40	9	3	ENSR 12/10	RFIMW-06-G-1203-S	☐	S	5.000 mL	222	1.602 ng	1.	320.319 ng/L	1.0	323.544 ng/L		
41	10	4	ENSR 12/10	RFIMW-11-G-1203-S	☐	S	100.000 mL	22.2	0.151 ng	1.	1.510 ng/L	3.0	1.621 ng/L		
42	1	1	{Analysis}	CCB3	☐	IB	100.000 mL	1	0.007 ng	1.	0.073 ng/L		0.073 ng/L		
43	2	2	{Analysis}	CCV3	☐	CV	100.000 mL	274	1.979 ng	1.	19.791 ng/L		19.791 ng/L	99.0%	20.0000
44	3	3	ENSR 12/10	RFIMW-12-G-1203-S	☐	S	100.000 mL	180	1.297 ng	1.	12.967 ng/L	10.0	14.481 ng/L		
45	5	4	ENSR 12/10	RFIMW-15-G-1203-S	☐	S	100.000 mL	41.5	0.291 ng	1.	2.911 ng/L	3.0	3.064 ng/L		
46	6	1	{Analysis}	CCB4	☐	IB	100.000 mL	2.9	0.021 ng	1.	0.211 ng/L		0.211 ng/L		
47	7	2	{Analysis}	CCV4	☐	CV	100.000 mL	280	2.023 ng	1.	20.227 ng/L		20.227 ng/L	101.1%	20.0000

RFIMW-06-G-1203-5

~~WH12-15-G-1203-5~~

RFIMW-07-1203-5 SPM 12/15/03

0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0

CCB1

CCV1

BGMW-1-G-1203-5

PM4NA-G-1203-5 RFIMW-26-G-1203-D

RMFMW-06-1203-EB WH13-25-G-1203-5

RFIMW-06-G-1203-FB

PBW-3

PBW-2

PBW-1

0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0

NIST 1641d

ICB/BB

0.05ng ICV

4.0ng

2.0ng

0.50ng

0.10ng

x=20 x=1 chart speed= 1mm/min

SACOB MEYER

THg 12-03 1215-1

12/15/03

START 12:07

END 19:02

CCW4

CCB4

10	20	30	40	50	60	70	80	90	100
90	80	70	60	50	40	30	20	10	0

RFIMW-15-G-1203-S

RFIMW-12-G-1203-S

CCW3

CCB3

RFIMW-11-G-1203-S

RFIMW-06-G-1203-S

RMIMW-07-1203-S

PM4WA-G-1203-S

WH13-15-G-1203-S MSD

WH13-15-G-1203-S MS

WH13-15-G-1203-S MD

WH13-15-G-1203-S

WH14-15-G-1203-S

WH19-2F-G-1203-S

CCW2

CCB2

10	20	30	40	50	60	70	80	90	100
90	80	70	60	50	40	30	20	10	0

RFIMW-15-G-1203-S

RFIMW-12-G-1203-S

WH15-15-G-1203-S

WH14-25-G-1203-S

RFIMW-11-G-1203-S

WH14-15-G-1203-FB

WH13-15-G-1203-EB

TRAP #6 Reburn

RFIMW-06-G-1203-S

~~WH12-15-G-1203-S~~

DM 12/15/03

Frontier Geosciences

Dataset for CV.AFS Analysis

Analysis Method: FGS-069

THg

Dataset ID: **THg08-040202-1**
Analyst: **cindym**
Data Prep: **cindym**
Analysis Date: **2/2/2004**

Project List:

No	HiQA	Sample Group		Corrections: Inst. Blank	Prep. Blank	MSA	Effic. Factor
3	☐	PARAMETRIX 1/13/04 *Prep Method:	THg BrCl Oxidation	Yes-1	Yes-2	No	No
4	☐	PARAMETRIX 1/23/04 *Prep Method:	THg BrCl Oxidation	Yes-1	Yes-2	No	No
5	☐	CDWR 1/22/04 *Prep Method:	THg BrCl Oxidation	Yes-1	Yes-2	No	No
6	☐	ENSR 12/4/03 *Prep Method:		No	No	No	No

Analytical Remarks:

No analytical issues to report.

QUALITY ASSURANCE
PEER-REVIEWED

INITIALS: 2-2-04

Validator:

Printed: 2/2/2004 4:14:48 P

Frontier Geosciences

Dataset for CV.AFS Analysis

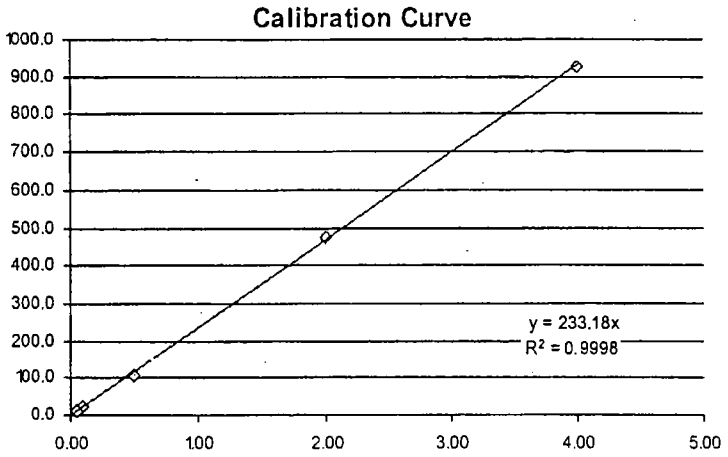
Dataset ID: THg08-040202-1
Analyst: cindym
Date: 2/2/2004

Calibration Data for THg

ng vs. Measured Intensity

Slope: 233.17705 *R:* 0.99988
SE: 5.38976 *Obs:* 5

True Value-x	IBC Intensity-y	Calc Value	Calc Intensity
0.1000	23.6000	0.1012	23.3177
0.5000	109.2000	0.4683	116.5885
2.0000	475.2000	2.0379	466.3541
4.0000	929.2000	3.9850	932.7082
0.0500	11.8000	0.0506	11.6589



Instrument Blank (IB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	Intensity
1	THg	5	0.034	0.021	0.063	ng/L	0.8

Preparation Blank (PB) Sets

Group	Analyte	Count	Avg	St Dev	EMDL	Units	PB1	PB2	PB3	PB4
2	THg	3	0.053	0.017	0.052	ng/L	0.034	0.056	0.069	

MSA Sets

QC Sets

Sample	Analyte	Sample	Duplicate	Triplicate	Spike	Spike Dup.	Spike TV	Spike Dup. TV
KEKAULANA 1/10/04 AMB	THg	1.922	1.944		9.407	9.580	8.061	8.061
	ng/L	Avg=1.933	1.1% RPD			2.3% RPD	92.5%Rec	94.6%Rec
LK O A DAM BTM MD	THg	0.666	0.735					
	ng/L	Avg=0.701	9.9% RPD					
LK O MN BTM	THg	0.675			6.072	6.028	5.051	5.050
	ng/L	Avg=0.675				0.8% RPD	106.9%Rec	106.0%Rec

Frontier Geoscie

Dataset for CV.AFS Analysis

Dataset ID: THg08-040202-1
Analyst: cindym
Date: 2/2/2004

Run	Trap	Pos	Sample Group	Sample ID	Type	Aliquot	Inten.	Inst Value	Dil.	[Liquid Gross]	%Pres	[Liquid Net]	Rec.	TV
1	1	1	{Analysis}	0.10 ng	CAL	100.000 mL	24.4	0.101 ng	1.	1.012 ng/L		1.012 ng/L	101.2%	0.1000
2	2	2	{Analysis}	0.50 ng	CAL	100.000 mL	110	0.468 ng	1.	4.683 ng/L		4.683 ng/L	93.7%	0.5000
3	3	3	{Analysis}	2.00 ng	CAL	100.000 mL	476	2.038 ng	1.	20.379 ng/L		20.379 ng/L	101.9%	2.0000
4	4	4	{Analysis}	4.00 ng	CAL	100.000 mL	930	3.985 ng	1.	39.850 ng/L		39.850 ng/L	99.6%	4.0000
5	5	1	{Analysis}	0.05 ng	CAL	100.000 mL	12.6	0.051 ng	1.	0.506 ng/L		0.506 ng/L	101.2%	0.0500
6	6	2	{Analysis}	ICV	CV	100.000 mL	352	1.506 ng	1.	15.062 ng/L		15.062 ng/L	100.4%	15.0000
7	7	3	{Analysis}	ICB/BB	IB	100.000 mL	1	0.004 ng	1.	0.043 ng/L		0.043 ng/L		
8	8	4	{BATCH QC}	NIST 1641d (200X)	LCS	0.200 mL	358	1.532 ng	200.	1531883.146 ng/L	2.0	1562520.702 ng/L	97.6%	1601000.0000
9	9	1	{BATCH QC}	PBW1	PB	100.000 mL	1.6	0.003 ng	1.	0.034 ng/L		0.034 ng/L		
10	10	2	{BATCH QC}	PBW2	PB	100.000 mL	2.1	0.006 ng	1.	0.056 ng/L		0.056 ng/L		
11	1	3	{BATCH QC}	PBW3	PB	100.000 mL	2.4	0.007 ng	1.	0.069 ng/L		0.069 ng/L		
12	2	4	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 AMB	S	100.000 mL	46.4	0.196 ng	1.	1.956 ng/L	1.0	1.922 ng/L		
13	3	1	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 COMP	S	100.000 mL	45.4	0.191 ng	1.	1.913 ng/L	1.0	1.879 ng/L		
14	4	2	PARAMETRIX 1/13/04	KEKAULANA 1/09/04 AMB	S	100.000 mL	36.4	0.153 ng	1.	1.527 ng/L	1.0	1.489 ng/L		
15	5	3	PARAMETRIX 1/13/04	KEKAULANA 1/09/04 COMP	S	100.000 mL	36.8	0.154 ng	1.	1.544 ng/L	1.0	1.506 ng/L		
16	6	4	PARAMETRIX 1/23/04	KEKAULANA 1/21/04 AMB	S	100.000 mL	24	0.099 ng	1.	0.995 ng/L	1.0	0.952 ng/L		
17	7	1	PARAMETRIX 1/23/04	KEKAULANA 1/21/04 COMP	S	100.000 mL	27	0.112 ng	1.	1.124 ng/L	1.0	1.082 ng/L		
18	8	2	{Analysis}	CCV1	CV	100.000 mL	472	2.021 ng	1.	20.208 ng/L		20.208 ng/L	101.0%	20.0000
19	9	3	{Analysis}	CCB1	IB	100.000 mL	1	0.004 ng	1.	0.043 ng/L		0.043 ng/L		
20	10	4	CDWR 1/22/04	LK O A DM SFC	S	100.000 mL	12.4	0.050 ng	1.	0.497 ng/L	1.0	0.450 ng/L		
21	1	1	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 AMB MD	MD	100.000 mL	46.9	0.198 ng	1.	1.977 ng/L	1.0	1.944 ng/L		
22	2	2	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 AMB MS	MS	50.000 mL	110	0.468 ng	1.	9.366 ng/L	1.0	9.407 ng/L		8.0808
23	3	3	PARAMETRIX 1/13/04	KEKAULANA 1/10/04 AMB MSD	MSD	50.000 mL	112	0.477 ng	1.	9.538 ng/L	1.0	9.580 ng/L		8.0808
24	4	4	CDWR 1/22/04	LK O A DM MID	S	100.000 mL	15	0.061 ng	1.	0.609 ng/L	1.0	0.562 ng/L		
25	5	1	CDWR 1/22/04	LK O A DM BTM	S	100.000 mL	17.4	0.071 ng	1.	0.712 ng/L	1.0	0.666 ng/L		
26	6	2	CDWR 1/22/04	LK O MN SFC	S	100.000 mL	12.2	0.049 ng	1.	0.489 ng/L	1.0	0.441 ng/L		
27	7	3	CDWR 1/22/04	LK O MN BTM	S	100.000 mL	17.6	0.072 ng	1.	0.720 ng/L	1.0	0.675 ng/L		
28	8	4	CDWR 1/22/04	LK O SF SFC	S	100.000 mL	17.8	0.073 ng	1.	0.729 ng/L	1.0	0.683 ng/L		
29	9	1	CDWR 1/22/04	LK O SF BTM	S	100.000 mL	17	0.069 ng	1.	0.695 ng/L	1.0	0.649 ng/L		
30	10	2	{Analysis}	CCV2	CV	100.000 mL	472	2.021 ng	1.	20.208 ng/L		20.208 ng/L	101.0%	20.0000
31	1	3	{Analysis}	CCB2	IB	100.000 mL	1.4	0.006 ng	1.	0.060 ng/L		0.060 ng/L		
32	2	4	CDWR 1/22/04	T AFBY N SFC	S	100.000 mL	16.5	0.067 ng	1.	0.673 ng/L	1.0	0.627 ng/L		
33	3	1	CDWR 1/22/04	LK O A DAM BTM MD	MD	100.000 mL	19	0.078 ng	1.	0.781 ng/L	1.0	0.735 ng/L		
34	4	2	CDWR 1/22/04	LK O MN BTM MS	MS	50.000 mL	71.5	0.303 ng	1.	6.064 ng/L	1.0	6.072 ng/L		5.0505
35	5	3	CDWR 1/22/04	LK O MN BTM MSD	MSD	50.000 mL	71	0.301 ng	1.	6.021 ng/L	1.0	6.028 ng/L		5.0500
36	6	4	CDWR 1/22/04	T AFBY N BTM	S	100.000 mL	20	0.082 ng	1.	0.823 ng/L	1.0	0.779 ng/L		
37	7	1	CDWR 1/22/04	T FOBY S SFC	S	100.000 mL	17	0.069 ng	1.	0.695 ng/L	1.0	0.649 ng/L		
38	8	2	CDWR 1/22/04	T FOBY S BTM	S	100.000 mL	18	0.074 ng	1.	0.738 ng/L	1.0	0.692 ng/L		
39	9	3	CDWR 1/22/04	T AFBY S SFC	S	100.000 mL	17.7	0.072 ng	1.	0.725 ng/L	1.0	0.679 ng/L		
40	10	4	CDWR 1/22/04	T AFBY S BTM	S	100.000 mL	19.1	0.078 ng	1.	0.785 ng/L	1.0	0.740 ng/L		
41	1	1	CDWR 1/22/04	T FOBY N BTM	S	100.000 mL	16.8	0.069 ng	1.	0.686 ng/L	1.0	0.640 ng/L		
42	2	2	{Analysis}	CCV3	CV	100.000 mL	466	1.995 ng	1.	19.951 ng/L		19.951 ng/L	99.8%	20.0000
43	3	3	{Analysis}	CCB3	IB	100.000 mL	0.4	0.002 ng	1.	0.017 ng/L		0.017 ng/L		
44	4	4	CDWR 1/22/04	GLEN POND	S	100.000 mL	64.4	0.273 ng	1.	2.728 ng/L	1.0	2.702 ng/L		
45	5	[illegible]	CDWR 1/22/04	GLEN C US GLEN POND	S	100.000 mL	46.6	0.196 ng	1.	1.964 ng/L	1.0	1.931 ng/L		
46	6	[illegible]	CDWR 1/22/04	MORRIS RAVINE	S	100.000 mL	63.5	[illegible] ng	1.	2.689 ng/L	1.0	2.663 ng/L		

...eosciences

Dataset for CV.AFS Analysis

Dataset ID: THg08-040202-1
Analyst: cindym
Date: 2/2/2004

Run	Trap	Pos	Sample Group	Sample ID	Type	Aliquot	Inten	Inst Value	Dil.	[Liquid Gross]	%Pres	[Liquid Net]	Rec.	TV
47	7	3	ENSR 12/4/03	RFIMW-09-6-1203-EB	S	100.000 mL	7	0.030 ng	1.	0.300 ng/L	1.0	0.303 ng/L		
48	8	4	CDWR 1/22/04	T FOBY N SFC	S	100.000 mL	18.5	0.076 ng	1.	0.759 ng/L	1.0	0.714 ng/L		
49	*9*	*1*	*{Analysis}*	*CCV4*	*CV*	*100.000 mL*	*470*	*2.012 ng*	*1.*	*20.122 ng/L*		*20.122 ng/L*	*100.6%*	*20.0000*
50	10	2	{Analysis}	CCB4	IB	100.000 mL	0.2	0.001 ng	1.	0.009 ng/L		0.009 ng/L		

end 1614

CCB4 CCV4

T FOBY N SFC

RFIMW-09-6-1203 EB

Morris Ravine @

Glen CUS Glen Pond

Glen CUS Glen Pond

Glen Pond

CCB3 CCV3

T FOBY N BTM

T AFBY S BTM

T AFBY S SFC

T FOBY S BTM

~~T FOBY SFC S~~ @ T FOBY S SFC

T AFBY N BTM

LK O MN BTM MSD

LK O MN BTM MS

LK O A DM BTM MD

T AFBY N SFC

CCB2 CCV2

LK O SF btm

LK O SF SFC

LK O mn Btm

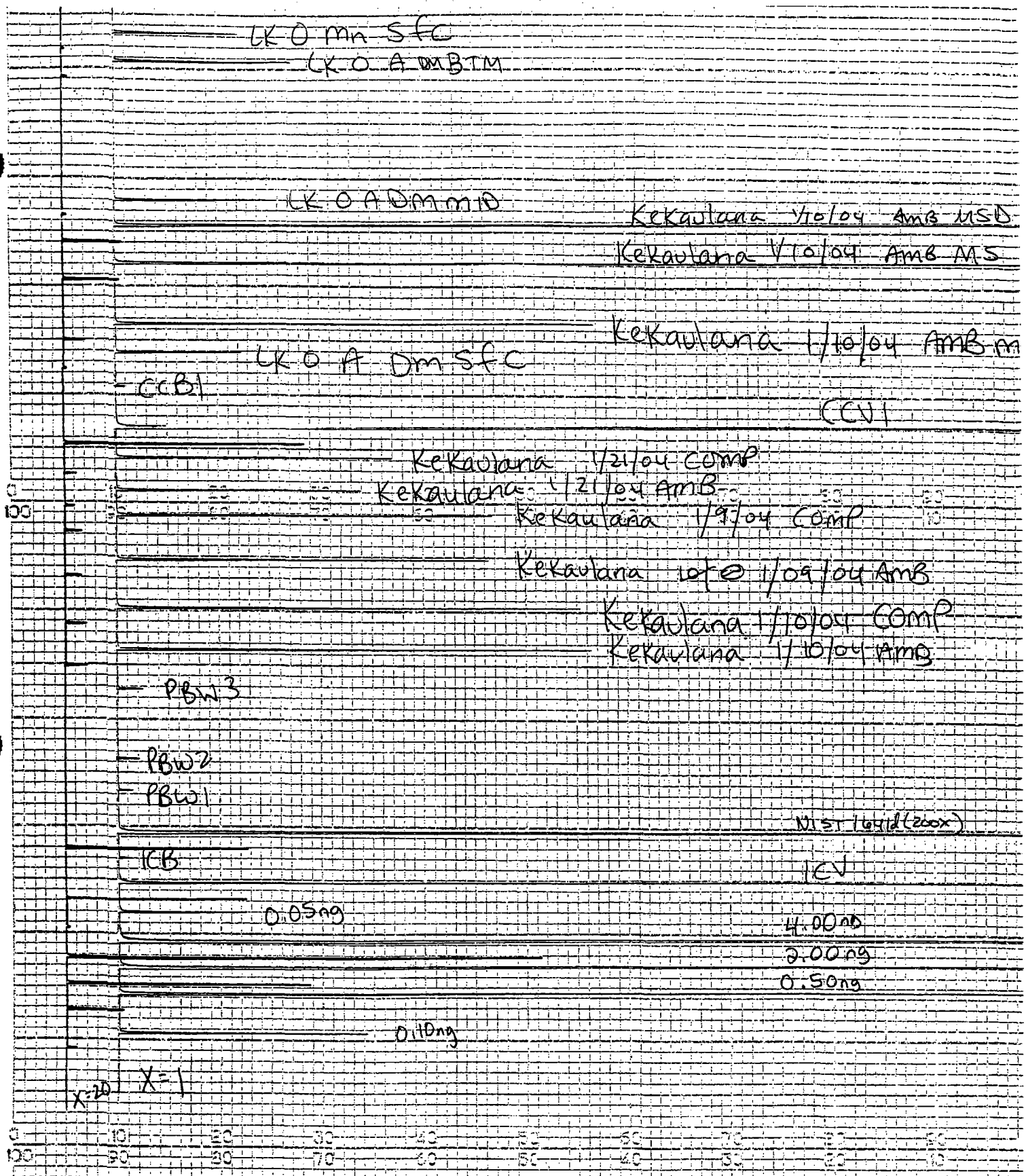
LK O mn SFC

LK O A DM BTM

LK O A DM MD

Kekaulana 1/10/04 AMB MSD

Kekaulana 1/10/04 AMB MS



THg8-040202-1

Chart Speed = 1mm/min.

Start 1011

Cindy Moulder

Cindy Moulder

CMS Supplemental Groundwater Sampling Plan

for the

BASF NORTH WORKS FACILITY
WYANDOTTE, MICHIGAN
USEPA ID NUMBER MID 064197742

Prepared for:

BASF CORPORATION
1609 BIDDLE AVENUE
WYANDOTTE, MICHIGAN

NOVEMBER 2003

Prepared by:

ENSR International
27755 Diehl Road, Suite 100
Warrenville, IL
60555-3998

ENSR Project No. 00760-127-320

Groundwater Sampling Program

A total of 25 groundwater monitoring wells will be sampled during this activity. Of the 25 wells, one is a proposed new background well located at an upgradient parcel of land owned by BASF and six are located in the region of groundwater inflow onto the site (based upon WHI's groundwater model). The remaining 18 wells are located in the region of potential groundwater outflow from the site. Seven of the wells are completed in the Fill Unit. The remaining 18 wells are completed in the Native Sand Unit. Figure 1 shows the location of the proposed background monitoring well to be installed and sampled. The locations of the 24 onsite monitoring wells to be sampled are shown on Figure 2. Table 1 – Proposed Groundwater Monitoring Wells and Analytical Parameters presents the identification, location (i.e., groundwater inflow or outflow), well completion unit and analytical program for the 25 wells to be sampled. Table 2 – Analytical Parameters, Methods and QA/QC Samples Sample Volumes and Containers, Preservatives and Holding Times presents the number and type of investigative and QA samples, sample volumes and containers, preservatives and holding times for the groundwater sampling program.

Quality assurance (QA) objectives

Quality assurance (QA) objectives for the supplemental groundwater sampling will be implemented in accordance with the Quality Assurance Project Plan (QAPP) Revision 2 prepared for the RCRA Facility Investigation (RFI). Additional quality assurance objectives for field sampling and analytical procedures proposed herein are presented below and in attached Standard Operating Procedures (SOPs).

Field Sampling Procedures

Field sampling procedures will be performed in accordance with SOPs presented in the RFI Work Plan or attached to this supplemental work plan. Field sampling activities will be conducted in accordance with health and safety protocol presented in the RFI Health and Safety Plan (HASP) and quality assurance procedures presented in the RFI QAPP.

Monitoring Well Installation and Development

One groundwater monitoring well will be installed in a background location on the parcel of land owned by BASF as shown in Figure 1. The groundwater monitor well will be installed using continuous flight hollow stem augers that have been steam cleaned using a pressurized washer prior to installation. The monitor well will be constructed of 2-inch in diameter, stainless steel riser with 2 feet of wire-wrapped stainless steel slotted well screen containing 0.010-inch slots. The well screen and riser will be pre-cleaned using a 5 to 10 percent hydrochloric acid solution. The well screen well will be installed to intersect the water table estimated to occur at a depth of 5 to 10 feet below ground surface. Drilling and construction of the background monitoring well will follow

procedures described in RFI QAPP SOP-02, SOP-04 and SOP-05. Soil samples will not be collected for analysis during installation of the background monitoring well. However, a well construction material blank will be collected for total mercury analysis by rinsing the interior well casing with ultra pure deionized water (supplied by the laboratory) prior to installation.

Within 24 to 48 hours after the background monitoring well has been constructed, the well will be developed to remove any fine-grained materials. Development of the well will be performed in accordance with procedures described in RFI QAPP SOP-07 using pumping, surging, or bailing techniques. Well development details will be recorded on individual well development forms. Wastewater generated during well development will be managed in accordance with RFI QAPP SOP-12.

Groundwater Sampling

The collection of groundwater samples during the supplemental groundwater sampling program will be based on the Michigan Department of Environmental Quality (MDEQ) Standard Operating Procedure for Groundwater Sampling from Monitoring Wells for Low Level Analysis of Mercury as presented in SOP-22 (Attachment A). Groundwater samples will be collected from the one background and six upgradient wells constructed of similar materials as downgradient wells to distinguish the potential mercury contribution of both natural background conditions and well construction materials. A peristaltic pump and pre-cleaned Teflon tubing will be used to collect groundwater samples from each monitoring well to minimize the potential for introducing mercury from sampling equipment. A monitoring well sampling sequence will also be established to allow for the sampling of monitoring wells containing historically non-detect to low levels of mercury before wells that historically exhibit higher levels of mercury in groundwater. Table 1 presents the order in which the wells will be sampled. Finally, appropriate field, equipment and laboratory blanks will be analyzed to identify potential contaminant sources for mercury and other COCs.

All necessary expendable and non-expendable equipment and supplies will be assembled for use at the site prior to initiating sampling activities. This equipment includes peristaltic pump(s), sample tubing, sample containers, coolers, ice, and appropriate sample labels, in addition to all necessary forms as described in the QAPP. All sampling and monitoring equipment including flow-through cell and groundwater monitoring equipment will be decontaminated following procedures described in SOP-22. Monitoring equipment will be calibrated daily before use according to procedures shown in RFI QAPP SOP-10.

Prior to sample collection, an initial water level measurement will be taken from each well using procedures contained in RFI QAPP SOP-06. Monitoring wells will be pumped before sampling in order to purge water in the sampling system that may not be representative of the aquifer groundwater. Groundwater will be purged and sampled at

a rate of 75 to 150 milliliters per minute (ml/min). A well can be considered sufficiently purged when one system volume (volume within the sampling tubing) has been extracted and water parameters including turbidity, temperature, pH, and dissolved oxygen, have remained stable as provided in SOP-22. Handling and disposal of purge water should follow RFI QAPP SOP-12. Field parameters will be measured and logged according to RFI QAPP SOP-10. Once a well has been sufficiently purged, sampling will begin according to SOP-22, using a pumping rate no higher than that at which the well was purged and which does not exceed a draw-down of 0.1 meters. Groundwater will be sampled upstream from the flow-through cell, either by disconnecting the tubing from the cell, or by using a by-pass valve.

Sample bottles will be filled in the following order: mercury, VOCs, dissolved gases (carbon dioxide and methane), total organic carbon (TOC), metals, and other natural attenuation parameters. Ferrous iron will be measured in the field using a Hach (or equivalent) test kit. Table 2 provides the analytes for testing, a summary of the field QC samples, and container and preservation requirements. Each groundwater sample will be assigned a unique sample identification as described in RFI QAPP SOP-01 and the QAPP. Sample bottles will then be placed on ice, packaged, and prepared for shipment according to RFI QAPP SOP-01. Following sample collection, expendable supplies will be disposed of in on-site trash receptacles and reusable equipment will be decontaminated according to RFI QAPP SOP-14.

Analytical Parameters and Methods

Groundwater samples collected from each of the 25 wells will be analyzed by Frontier Geosciences, Inc., in Seattle, Washington, for total mercury. Analysis will be performed using Frontier SOPs FGS-012.3 (Oxidation of Aqueous Samples for Total Mercury Analysis) and FGS-069.3 (Total Mercury Analysis by Cold Vapor – Atomic Fluorescence [CV-AFS]), which are based on USEPA Method 1631, Revision E. The laboratory reporting limit for total mercury will be 0.15 parts per trillion. Frontier SOPs are included as Attachment B. Groundwater samples collected from 14 of the 25 wells will be analyzed by Severn Trent Laboratories (STL) in North Canton, Ohio for volatile organic compounds (VOCs) by SW-846 Method 8260B. STL will also analyze 13 of the 14 samples for select metals using SW-846 Method 6010B. Analyses and laboratory reporting limits for these parameters will be performed per the QAPP.

Samples collected from these 14 wells will also be analyzed by Microseeps in Pittsburgh, Pennsylvania for water chemistry/monitored natural attenuation parameters (Table 2). The Microseeps SOPs for these parameters, which include detection limits and quality control criteria, are included as Attachment C.

Table 2 summarizes the analytical parameters and methods for each well. Validation of 100 percent of the laboratory data will be performed as described in the QAPP using

validation protocols developed by ENSR and based on the USEPA Region 5 validation guidelines and current USEPA National Functional Guidelines.

Deviations from QAPP and Field Sampling Procedures

Activities performed as part of the supplemental groundwater sampling program will adhere as closely as possible to the QAPP and field sampling procedures presented herein. Deviations from these field sampling procedures and QAPP will be documented in the field logbook. Deviations will also be documented in a data validation report that summarizes the sample analytical results. The data validation report will be submitted to USEPA upon completion of the supplemental groundwater sampling program.

Project Schedule

Field activities for the supplemental groundwater sampling program for the BASF North Works facility are scheduled to be conducted during November 2003. The sample analytical data are expected to be received from the laboratory within 30 days of sample shipment. Sample analytical data will be validated and entered into the project database after they are received from the laboratory. Results of the supplemental groundwater sampling program will be incorporated into the Draft CMS Report for submittal to USEPA.

TABLE 1

Proposed Groundwater Monitoring Wells and Analytical Parameters
BASF North Works Facility, Wyandotte, MI

Monitoring Well (In Sequential Sampling Order)	Location of Groundwater Inflow or Outflow	Stratigraphic Unit	Total Mercury	Metals	VOCs	Water Chemistry, Natural Attenuation Parameters
Background	Offsite	Native Sand	X	X		X
WHI2-1S	Inflow	Native Sand	X			
CMSMW-08	Outflow	Fill	X			
CMSMW-02	Outflow	Fill	X	X	X	X
RFIMW-28	Outflow	Native Sand	X			
WHI9-2S	Outflow	Native Sand	X			
RFIMW-09	Outflow	Native Sand	X	X	X	X
RFIMW-08	Outflow	Native Sand	X			
RFIMW-02	Outflow	Native Sand	X			
RFIMW-01	Outflow	Native Sand	X	X	X	X
RFIMW-13	Outflow	Native Sand	X	X	X	X
RFIMW-22	Outflow	Native Sand	X	X	X	X
RFIMW-04	Outflow	Fill	X			
RFIMW-07	Outflow	Fill	X	X	X	X
WHI3-2S	Inflow	Native Sand	X			
RFIMW-26	Inflow	Native Sand	X	X	X	X
WHI3-1S	Inflow	Native Sand	X	X	X	X
WHI4-2S	Inflow	Native Sand	X			
RFIMW-06	Outflow	Fill	X			
PM1NA	Outflow	Native Sand	X	X	X	X
RFIMW-15	Outflow	Native Sand	X	X	X	X
WHI9-2F	Outflow	Fill	X	X	X	X
RFIMW-11	Outflow	Native Sand	X			
RFIMW-12	Outflow	Fill	X	X	X	X
WHI4-1S	Inflow	Native Sand	X	X	X	X

TABLE 2

Analytical Parameters, Methods and QA/QC Samples
Sample Volumes and Containers, Preservatives and Holding Times
BASF North Works Facility, Wyandotte, MI

Analytical Parameter and Method	Sample Container [1]	Preservation	Holding Time [2]	Field Duplicate Samples	Field Blanks	Trip Blanks	MS/MSD Samples[1]
Total Mercury EPA Method 1631 Revision E	1-500 ml amber glass or Teflon bottle with Teflon-lined lid	No headspace; cool 4°C; 5 ml/L BrCl in lab	28 days	1 per 10 samples	1 per Day	None	1 per 10 samples
VOCs EPA Method 8260B	3-40 ml glass vials with Teflon-lined septum lid	HCl to pH <2; no headspace; cool 4°C	14 days	1 per 10 samples	None	1 per cooler	1 per 20 samples
Metals and hardness EPA Method 6010B	1-500 ml plastic	HNO3 to pH <2; cool 4°C	180 days	1 per 10 samples	None	None	1 per 20 samples
TOC EPA Method 9060	1-250 ml plastic	H2SO4 to pH <2; cool 4°C	28 days	1 per 10 samples	None	None	1 per 20 samples
Carbon dioxide and methane RSK-175	2-40 ml amber glass vials	Cool 4°C	14 days (advisory)	1 per 10 samples	None	None	1 per 20 samples
Alkalinity EPA Method 310.1	1-125 ml plastic	Cool 4°C	14 days	1 per 10 samples	None	None	1 per 20 samples
Nitrate, nitrite, sulfate, and chloride EPA Method 9056	2-40 ml amber glass vials	Cool 4°C	28 days (chloride and sulfate); 2 days (nitrite and nitrate)	1 per 10 samples	None	None	1 per 20 samples
BOD EPA 405.1	1-1 L plastic	Cool 4°C	2 days	1 per 10 samples	None	None	1 per 20 samples
Sulfide EPA Method 376.1	4-125 ml plastic	Zn acetate + NaOH to pH >9; cool 4°C	7 days	1 per 10 samples	None	None	1 per 20 samples
COD EPA Method 410.4	1-125 ml plastic	H2SO4 to pH <2; cool 4°C	28 days	1 per 10 samples	None	None	1 per 20 samples

[1] Triple volume will be collected for MS/MSD samples.
[2] Holding time begins from date of sample collection.

Natural Attenuation Parameters include: pH (field), temperature (field), specific conductivity (field), dissolved oxygen (field), redox potential (field), TOC, carbon dioxide, alkalinity, hardness, nitrate, nitrite, sulfate, sulfide, total iron, ferrous iron (field), methane, BOD, COD, and chloride.

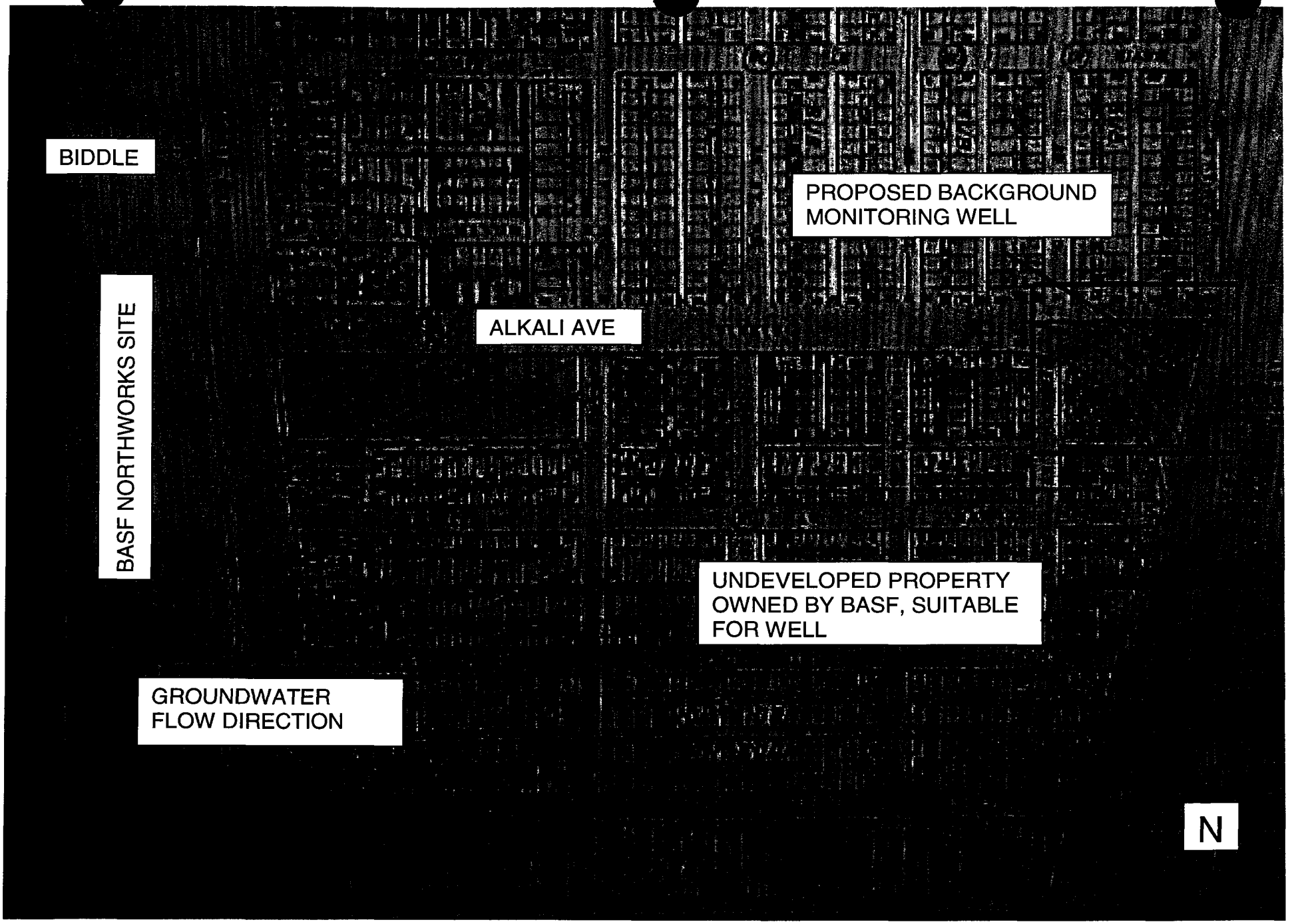
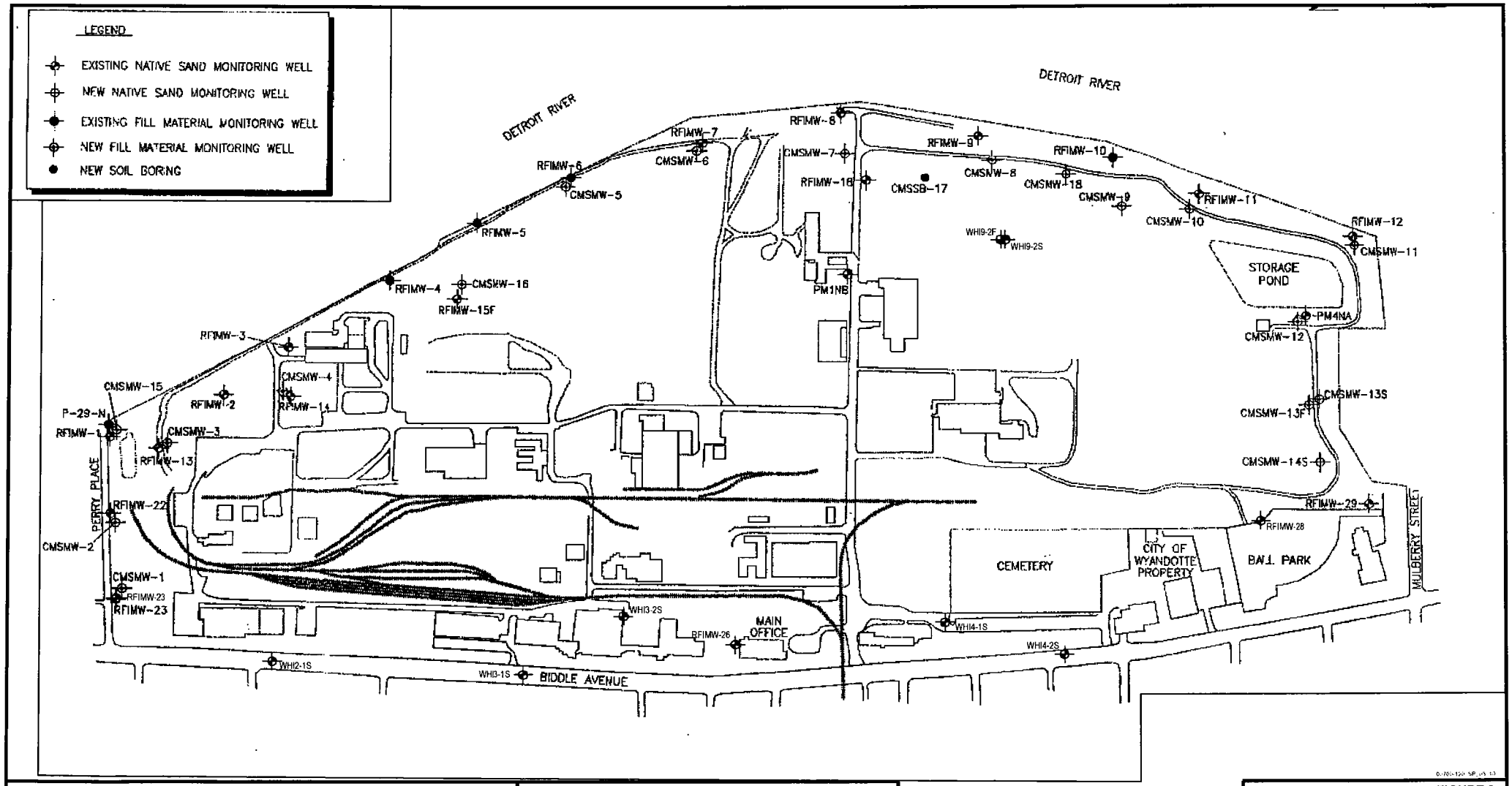


FIGURE 1 – PROPOSED OFFSITE BACKGROUND MONITORING WELL



BASF CORPORATION
WYANDOTTE, MICHIGAN
EXISTING GROUNDWATER
MONITORING WELL LOCATIONS

0 100 200 400 800
SCALE IN FEET

October 2003

00760-120

FIGURE 2

ENSR INTERNATIONAL
CONSULTING • ENGINEERING • REMEDIATION

GROUNDWATER SAMPLE COLLECTION FROM MONITORING WELLS FOR LOW LEVEL MERCURY ANALYSIS

SOP Number: SOP – 22
Effective Date: 10/2003

Technical Approval: Date: 11/04/03

QA Management Approval: Date: 11/04/03

1.0 SOP Description

This standard operating procedure (SOP) is concerned with the collection of valid and representative samples of groundwater for low level mercury analysis from monitoring wells at the BASF Northworks Facility in Wyandotte, Michigan. Samples will be collected using a low-flow purge and sample methodology and "clean-hands, dirty-hands" sample collection protocol that was developed by the Michigan Department of Environmental Quality (MDEQ) based on U.S. EPA Method 1669. The scope of this document is limited to field operations and protocols applicable during groundwater sample collection.

2.0 General Procedures

2.1 Related SOPs

This SOP is to be used in conjunction with other SOPs relevant as follows:

SOP No.	SOP Title
SOP – 01	Analytical Sample Handling Protocols
SOP – 06	Water Level Measurements in Wells and Piezometers
SOP – 10	Field Measurement of Groundwater Field Parameters
SOP – 12	Handling of Purge and Development Water and Decontamination and Wash Water
SOP – 14	General Equipment Decontamination
SOP – 19	Field Data Recording and Management Procedures

2.2 Equipment and Apparatus

Well Purging and Sampling Equipment

- Peristaltic pumps
- Pre-cleaned, pre-cut sample tubing in double-bag containers
- Bladder pumps and compressor/controller

Field Instruments

- Flow through cell
- Multi-parameter water quality meter and/or individual meters
- Water level measuring device
- Turbidity meter

Sample Preparation Equipment

- Sample kit (i.e., bottles, labels, preservatives, custody records, cooler)

General Equipment

- Project-specific sampling plans (SAP, QAPP, HASP)
- Sample collection records
- Field notebook and waterproof marker pens
- Deionized water dispenser bottle
- Sample cup
- Buckets
- Coolers
- Instrument calibration solutions
- Power source (generator or 12V marine battery)
- Decontamination supplies (Alconox CITRANOX® soap and hydrochloric acid)
- Health and Safety supplies and equipment
- First-Aid kit
- Tool box

Expendable Materials

- Ultrapure deionized water
- Plastic sheeting
- Ice for sample preservation
- Disposable polyethylene, PVC or latex powder-free glove liners
- Disposable PVC gloves
- Tyvek® suits
- Plastic trash bags

- Ziplock® bags

3.0 Activities to Perform

Groundwater sample collection for low level mercury analysis is a very involved procedure requiring formal training and a variety of specialized equipment. The need to avoid contamination when collecting and handling samples is of the utmost priority. Potential sources of mercury contamination include metallic equipment, containers, reagants, deionized water, improperly cleaned equipment, and atmospheric sources such as dirt, dust and automobile exhaust. The best way to control contamination is to minimize exposure of collected samples and sampling equipment to possible sources of contamination. Sampling activities will be supervised by ENSR staff that are experienced in low-flow purge and sampling techniques. Sampling technicians will be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous waste materials are considered to be present.

Sample Collection Equipment

A peristaltic pump will be used to collect groundwater samples. A bladder pump may be used to collect groundwater samples if sampling performance standards (purge and sample flow rate and/or well drawdown) cannot be achieved with a peristaltic pump. Specialized, pre-cleaned fluoropolymer (FEP, PTFE) and styrene/ethylene/butylene/ silicone (SEBS) resin tubing must be used with a peristaltic pump. Pre-cleaned tubing must be provided by the laboratory in pre-cut lengths and stored in double polyethylene bags. Bladders for bladder pumps must be pre-cleaned by the supplier and stored in double polyethylene bags.

Pre-cleaning Equipment

Tubing and bladders used in sample collection apparatus must be pre-cleaned by soaking in a 30 percent hydrochloric acid (HCl) solution for 8 to 24 hours and rinsed with ultra-clean reagent water. Equipment cleaning must be performed on a clean bench in a clean room. Once clean, the equipment must be double-bagged in clear polyethylene bags and serialized with a unique number to identify it in case of contamination problems.

Clean Hands, Dirty Hands

Operations involving contact with the sample container and transfer of samples from the sample collection device to the sample container are handled by one member of the sampling team designated as "Clean Hands". A second individual, designated as "Dirty Hands", is responsible for preparation of the sampling equipment, operation of machinery and all other activities that do not involve direct contact with the sample.

Instrument Calibration

Field instruments will be calibrated in accordance with the associated SOPs.

Sampling Preparation

Before opening the well, a clean working surface shall be set up around the well head using a plastic sheet with a slit cut in the middle. Prior to opening the well, the required health and safety gear (as specified in the HASP) shall be donned.

Well Security and Condition

At each monitoring well location, observe the conditions of the well and surrounding area. The following information shall be noted in the field records:

- Condition of the wells identification marker
- Condition of the well lock and associated locking cap
- Integrity of the well - protective outer casing, obstructions or kinks in the well casing, presence of water in the annular space, and the top of the interior casing
- Condition of the general area surrounding the well

Measuring Point Determination

Before collecting a water level measurement, check for an existing measuring point (notch, or other visible mark) established either at the time of well installation or by the latest survey. Generally, the measuring point is referenced from the top of the well casing (TOC) not the protective casing. If no measuring point exists, a measuring point

will be established, clearly marked, and identified in the field records. The same measuring point will be used for subsequent sampling events.

Water Level and Depth of Well Measurement

- To obtain a water level measurement, lower the probe of a water level measuring device into the well until the audible sound of the unit is detected or the light on, which is an electronic sounder illuminates.
- At this time the precise measurement should be determined (to nearest 0.01 feet) by repeatedly raising and lowering the tape to converge on the exact measurement.
- Obtain the water level measurement by reading the water level measuring device at the TOC measuring point. The water level measurement will be entered in the field records.
- Continue to lower the probe of the water level measuring device to the bottom of the well. Raise the probe until the probe is just touching the bottom of the well.
- Obtain the depth of well measurement by reading the water level measuring device at the TOC measuring point. The depth of well measurement to the nearest 0.1 foot will be entered in the field records.
- Raise the probe of the water level measuring device and remove from the well. Examine the probe for the presence of sediment. If present, record this information in the field records.

Decontamination

The measurement device will be decontaminated immediately after each use. Dirty Hands prepares the decontamination solutions and cleans the device in a tub containing soap solution. Clean Hands transfers the device to a separate tub containing tap water, rinses the device, transfers it to a third tub, rinses it three times with reagant water and double-bags it in new polyethylene bags for storage. At a minimum, the portion of the tape, which enters the water table, will be cleaned. It is important that the measuring tape is never placed directly on the ground surface or allowed to become kinked.

Well Purging and Sampling Procedures

Prior to sample collection, purging must be performed for all groundwater monitoring wells to remove stagnant water from within the casing and gravel pack and to ensure

that a representative groundwater sample is obtained. Low purge and sample rates should be maintained (0.5 liters/minute) to minimize drawdown (<0.1 meter) in the well.

Purge water temperature, pH, specific conductance, dissolved oxygen, oxidation-reduction potential (ORP), and turbidity will be monitored and recorded in the field records. Purging will be considered complete when the field parameters have stabilized to the criteria identified in Sections 3.2 and 3.3. Purging a well to dryness may occur under some low-yield conditions. If a well is purged dry, sampling will be performed after it has recovered.

3.1 Sampling Sequence

When possible, prior knowledge of mercury levels at sampling locations will be used to design a monitoring well sampling sequence to minimize the chances of contamination from high sources, cross-contamination resulting from sequentially sampling locations of high and low mercury levels, and cross contamination during storage and transportation. The monitoring well sampling sequence should be established to allow for the sampling of monitoring wells containing historically non-detect to low levels of mercury before wells that historically exhibit higher levels of mercury in groundwater.

3.2 Sample Collection Using Peristaltic Pump

Well purging using a peristaltic pump located at the ground surface can be performed if the water level in the well is within approximately 20 feet of the top of the well. Peristaltic pumps provide a low rate of flow typically in the range of 0.02-0.2 gallons/minute (75-750 ml/min). Peristaltic pumps are suitable for purging situations where disturbance of the water column must be kept minimal for particularly sensitive analyses. The procedures to purge and sample a well with a peristaltic pump will be as follows:

3.2.1 Upon arrival at the sample location, one member of the two-person sampling team is designated as "Dirty Hands," and the other as "Clean Hands."
3.2.2 The team opens the well to be sampled.
3.2.3 An area, expected or known to be free of high levels of mercury, is selected.
3.2.4 The team removes the bags containing the pump, batteries, monitoring instruments, tubing, gloves, plastic wrap, and wind suits, from the coolers or storage containers in which they are packed.
3.2.5 The team puts on Wind Suits and PVC gloves.
3.2.6 Dirty Hands removes the pump from its storage bag and opens the bag containing the tubing.
3.2.7 Clean Hands installs the tubing in the well. Lower the tubing slowly and carefully to the middle of the screened interval or slightly above the middle, to

minimize excessive mixing of the stagnant water above the screen with water in the screened interval and to minimize resuspension of solids from the bottom of the well.

3.2.8 Clean Hands installs tubing on the pump.

3.2.9 Dirty Hands opens bag with water level meter.

3.2.10 Clean Hands removes water level meter and lowers it into the well.

3.2.11 Clean Hands connects the multi-parameter meter flow through the cell to the pump outlet.

3.2.12 Dirty Hands turns on the peristaltic pump and slowly pumps the water while monitoring the water level to assure that they pumping rate does not result in excessive drawdown of the water level (not to exceed 0.1 meters). As the well is pumped, water quality parameters are monitored to determine when formation water is flowing through the pump. Formation water is considered to be flowing if three consecutive measurements of the water quality parameters, meet the following requirements:

3.2.12.1 Turbidity, within ± 10 percent.

3.2.12.2 pH, within ± 0.1 pH units.

3.2.12.3 Specific conductance, within 3 percent.

3.2.12.4 Redox, within ± 10 mV.

3.2.12.5 Dissolved oxygen, within ± 10 percent. If dissolved oxygen is used for comparison to criteria or a mixing zone calculation, the dissolved oxygen calibration must be corrected for local barometric pressure reading and elevation. The equipment in this procedure (YSI multi-parameter meter) automatically corrects the dissolved oxygen for these conditions.

3.2.13 After stabilization, Clean Hands disconnects the meter.

3.2.14 The team changes gloves.

3.2.15 Dirty Hands opens the cooler containing the sample bottle, and unzips the outer bag containing the sample container. If the sample is to be split, a large size container is required, see Section 7.4, Split Samples. If filtering is necessary, a field blank is being generated, or a duplicate sample is to be taken, Dirty Hands unzips the outer bag of another sample container.

3.2.16 Dirty Hands prepares the sample label(s).

3.2.17 Clean Hands opens the inner bag, removes the sample container, and reseals the inner bag.

3.2.18 Clean Hands unscrews the cap, and while holding the cap upside down, discards the diluted acid into a waste carboy, or empties the reagent water onto the ground.

3.2.19 If a field blank is being generated, proceed as follows:

3.2.19.1 Clean Hands places the sample bottle and its cap in its bag. This is to be identified as the field blank.

3.2.19.2 Clean Hands obtains another sample bottle from its bag, unscrews and discards the cap.

3.2.19.3 Clean Hands retrieves the field blank bottle, and pours the contents of the other bottle into the field blank bottle, discards this

other bottle, retrieves the cap of the field blank and caps the field blank.

3.2.19.4 Skip to step 3.2.23 below.

3.2.20 Clean Hands rinses the sample bottle and cap three times with the formation water, and collects the sample from the flowing tube.

3.2.21 Clean Hands caps the sample, places a label on the sample container, and places it in its inner bag.

3.2.22 If filtering is required, or a duplicate sample is to be taken, steps in Sections 3.2.16 through 3.2.21 are repeated to immediately take another sample.

3.2.23 For samples required to be filtered, and samples requiring preservation at the laboratory, skip to step 3.2.25 below.

3.2.24 Preserve sample as follows:

3.2.24.1 Dirty Hands opens the outer bag containing the preservative, pipette, and tips.

3.2.24.2 Clean Hands opens the inner bag, opens the preservative, retrieves the pipette, prepares it for dispensing, and pipettes the required amount of preservative. Samples are transported on ice during the shipment to the laboratory. Samples are preserved in the filed using 10ml/L 6N HCl per liter of sample. If filtering and preservation is required at the laboratory, equivalent amounts of HCl per liter of sample can be used.

3.2.24.3 Clean Hands ejects the pipette tip into the waste container, places the pipette back into its inner bag, and seals the inner bag.

3.2.24.4 Clean Hands caps the preservative, places it in its inner bag, and seals the inner bag.

3.2.24.5 Dirty Hands seals the outer bags for the pipette and preservative.

3.2.25 Clean Hands caps the sample(s), opens the inner bag(s) for the sample(s), places the sample bottle(s) into the inner bag(s), and seals the inner bag(s).

3.2.26 Dirty Hands seals the outer bag(s), writes sample identification information on the outer bag, places the sample(s) in the cooler (on Ice), and closes the cooler.

3.2.27 Dirty Hands measures and records the depth to the bottom of the well.

3.2.28 Dirty Hands records the sample number(s) in the sampling log, water quality parameters, and notes any unusual observations.

3.2.29 Clean Hands removes the equipment from the well, removes the water level meter, and places them into bags for transportation.

3.2.30 Both Dirty Hands and Clean Hands move to the decontamination area with the equipment.

3.2.31 Use the step in Section 3.5.17, Decontamination Between Sampling Locations, to decontaminate the water level meter and multi-parameter meter. The tubing is replaced prior to sampling each new monitoring well.

3.2.32 If other samples are to be collected, the team proceeds to the next sampling location, and collects another sample beginning with the step in Section 3.2.6, Sample Collection Using Peristaltic Pumps.

3.2.33 If samples are to be split, follow the steps in Section 3.3, Sample Collection Using Bladder Pumps, starting with step 3.3.34.

3.3 Sample Collection Using Bladder Pump

Groundwater withdrawal using dedicated bladder pumps will be performed for wells constructed with dedicated sampling equipment.

3.3.1 Upon arrival at the sample location, one member of the two-person sampling team is designated as "Dirty Hands," and the other as "Clean Hands."

3.3.2 An area, expected or known to be free of high levels of mercury, is selected.

3.3.3 The team removes the bags containing the pump, monitoring instruments, tubing, carbon dioxide (CO_2) cartridges, gloves, plastic wrap, and wind suits, from the coolers or storage containers in which they are packed.

3.3.4 The team puts on Wind Suits and PVC gloves.

3.3.5 The team generates the Initial Equipment Blank, using steps in Section 3.5, Decontamination and Initial Equipment Blank.

3.3.6 The team proceeds to the sampling location.

3.3.7 The team opens the well.

3.3.8 The team changes gloves.

3.3.9 Keeping both bags together, Dirty Hands opens the outer bag containing the pump.

3.3.10 Clean Hands opens the inner bag and removes the pump.

3.3.11 Clean Hands lowers the submersible sampling pump into the monitoring well. Lower the pump slowly and carefully to the middle of the screened interval or slightly above the middle. This should minimize excessive mixing of the stagnant water above the screen with water in the screened interval and minimize suspension of solids from the bottom of the well.

3.3.12 Dirty Hands opens bag containing static water level meter. Clean Hands removes water level meter. Clean Hands sets up the water level meter.

3.3.13 Clean Hands connects the multi-meter flow through cell to the pump outlet.

3.3.14 Dirty Hands turns on the submersible pump, sets the pump for the allowable water level draw-down (not to exceed 0.1 meters), and slowly pumps the water while monitoring the water level to assure that they pumping rate does not result in draw-down of the water level. With the QED bladder pump in this SOP, the pump will turn off automatically if this level is exceeded. As the well is pumped, water quality parameters are monitored to determine when formation water is flowing through the pump. Formation water is considered to be flowing if three consecutive measurements of the water quality parameters, meet the following requirements.

3.3.14.1 Turbidity, within ± 10 percent.

3.3.14.2 pH, within ± 0.1 pH units.

3.3.14.3 Specific conductance, within 3 percent.

3.3.14.4 Redox, within ± 10 mV.

3.3.14.5 Dissolved oxygen, within ± 10 percent. If dissolved oxygen is used for comparison to criteria or a mixing zone calculation, the dissolved oxygen calibration must be corrected for local

barometric pressure reading and elevation. The equipment in this procedure (YSI multi-parameter meter) automatically corrects the dissolved oxygen for these conditions.

3.3.15 After stabilization, Clean Hands disconnects the meter.

3.3.16 The team changes gloves.

3.3.17 Dirty Hands retrieves the sample containers required, and unzips their outer bags. Two sample containers are required if duplicate or field blanks are being taken. A larger size container is required if split samples are taken, see Section 7.4, Split Samples.

3.3.18 Dirty Hands prepares the label(s).

3.3.19 Clean Hands opens the inner bag, removes the sample container, and reseals the inner bag.

3.3.20 Clean Hands removes the cap for the sample being collected, and while holding the cap upside down, discards the diluted acid into a waste carboy, or empties the reagent water onto the ground.

3.3.21 If a field blank is being generated, proceed as follows:

- 3.3.21.1 Clean Hands places the emptied sample bottle and its cap in its inner bag. This bottle is to be identified as the field blank.
- 3.3.21.2 Clean Hands obtains another sample bottle from its inner bag, removes and discards its cap.
- 3.3.21.3 Clean Hands retrieves the field blank bottle, and pours the contents of the sample bottle into the field blank bottle. Clean Hands retrieves the cap of the field blank and caps the field blank. Clean Hands discards the sample bottle.
- 3.3.21.4 Skip to step 3.3.24 below.

3.3.22 Clean Hands rinses the sample bottle and cap three times with the formation water flowing from the pump, and collects the sample from the flowing tube. Clean Hands caps the sample and places it in its inner bag.

3.3.23 If filtering is required or a duplicate sample is to be taken, Steps 3.3.19 through 3.3.22 are repeated to <u>immediately</u> take another sample.

3.3.24 For samples required to be filtered or preserved at the laboratory, skip to step 3.3.26 below.

3.3.25 Preserve sample(s) as follows:

- 3.3.25.1 Dirty Hands opens the outer bag containing the preservative, pipette, and tips.
- 3.3.25.2 Clean Hands opens the inner bag, opens the preservative, retrieves the pipette, and prepares it for dispensing.
- 3.3.25.3 Clean Hands pipettes the required amount of preservative, see Section 15, Sample Preservation and Holding Time, into the sample container(s), ejects the pipette tip into the waste container, placed the pipette back into its inner bag, recaps the preservative, and seals the inner bag.
- 3.3.25.4 Dirty Hands seals the outer bag for the preservative.

3.3.26 Clean Hands caps the sample(s), opens the inner bag(s) for the sample(s), places the sample bottle(s) into the inner bag(s), and seals the inner bag(s).

3.3.27 Dirty Hands seals the outer bag(s), writes sample identification information in permanent ink on the outside of the plastic bag, places the sample(s) in the cooler (on ice), and closes the cooler.

3.3.28 Dirty Hands measures and records the depth to the bottom of the well.

3.3.29 Dirty Hands records the sample number(s) in the sampling log, water quality parameters and notes and unusual observations.

3.3.30 Clean Hands removes the equipment from the well, removes the water level meter, and places them into bags for transportation.

3.3.31 Both Dirty Hands and Clean Hands move to the decontamination area with the equipment.

3.3.32 The steps in Section 3.5, Decontamination Between Sampling Locations, are used to decontaminate the equipment and steps in Section 3.8, Equipment Blank, are used to collect an equipment blank.

3.3.33 If other samples are to be taken at the site, the team proceeds to the next sampling location, and collects another sample beginning with step 3.3.7 above.

3.3.34 If samples are to be split, proceed as follows:

- 3.3.34.1 The team selects a suitable place for splitting samples.
- 3.3.34.2 The team changes gloves.
- 3.3.34.3 Dirty Hands opens the cooler, removes the bag containing the sample to be split. As indicated above in 3.3.17, this sample must have at least twice the volume of a normal sample.
- 3.3.34.4 Dirty Hands removes two bags with sample containers, and unzips their outer bags. These containers will hold the split samples.
- 3.3.34.5 Dirty Hands prepares the label(s).
- 3.3.34.6 Clean Hands opens the inner bags holding all containers, removes the containers, removes the caps of all containers and places them in their respective inner bags.
- 3.3.34.7 Clean Hands discards the diluted acid from the two sample containers into a waste carboy, or empties the reagent water onto the ground.
- 3.3.34.8 Clean Hands pours from the container holding the sample to be split, into each of the sample containers.
- 3.3.34.9 Clean Hands discards the container that held the sample to be split.
- 3.3.34.10 Clean Hands retrieves the caps, seals the samples with their respective caps, places the samples into their inner bags, and seals the inner bags.
- 3.3.34.11 Dirty hands seals the outer bag(s), writes sample identification information in permanent ink on the outside of the plastic bag, places sample(s) in the cooler (on ice), and closes the cooler.
- 3.3.34.12 Equipment blanks associated with the respective samples must be provided to both parties receiving split samples.
- 3.3.34.13 Repeat all steps in 3.3.34 for each additional split sample.

3.4 Initial Decontamination

3.4.1 Dirty Hands prepares the decontamination solutions.
3.4.2 Dirty Hands opens outer bag containing tubing and pump bladder.
3.4.3 Dirty Hands opens bags containing pump and water level meter.
3.4.4 Dirty Hands removes the pump.

3.4.5 Dirty Hands holds the pump while Clean Hands removes the bladder from the inner bag and places the bladder on the pump. Clean Hands removes tubing from the inner bag and installs tubing on pump and controller.
3.4.6 Dirty Hands lowers pump into tub 1 containing the soap solution.
3.4.7 Dirty Hands turns on controller and pumps three volumes of soap solution through the pump and tubing.
3.4.8 Clean Hands moves the pump to tub 2 containing tap water.
3.4.9 Dirty Hands turns on controller to pump three volumes of tap water through the pump.
3.4.10 Clean Hands moves the pump to tub 3 and pumps three volumes of reagent water.
3.4.11 Clean Hands places the pump in tub 4 containing reagent water.
3.4.12 An equipment blank is taken following steps in Section 3.8, Equipment Blank.
3.4.13 Clean Hands removes the water level meter from its storage bag, decontaminates the water level meter by successively cleaning with solutions from tubs 1, 2, and 3, and places the meter into a clean storage bag.

3.5 Decontamination Between Sample Locations

3.5.1 The team changes gloves.
3.5.2 Dirty Hands prepares the decontamination solutions.
3.5.3 Dirty Hands lowers pump into tub 1 containing the Alconox CITRANOX®/tap water solution, prepared as a 2 percent solution as per the manufacturer's instructions.
3.5.4 Dirty Hands turns on controller and pumps three volumes of Alconox® solution through the pump.

3.5.5 Clean Hands moves the pump to tub 2 containing tap water (fresh tap water should be used between each sampling location.
3.5.6 Dirty Hands turns on controller to pump three volumes of tap water through the pump.
3.5.7 Clean Hands moves the pump to tub 3 and pumps three volumes of reagent water (fresh reagent water should be used between each sampling location.)
3.5.8 Clean Hands changes gloves.
3.5.9 Dirty Hands opens outer bag containing tubing pump bladder.
3.5.10 Dirty Hands changes gloves.
3.5.11 Dirty Hands removes the pump from tub 3.
3.5.12 With Dirty Hands holding the pump, Clean Hands removes the bladder from the inner bag and places the bladder on the pump. Clean Hands removes tubing from the inner bag and installs tubing on pump and controller.
3.5.13 Clean Hands places pump in reagent water in tub 4.
3.5.14 The team changes gloves.
3.5.15 An equipment blank is taken following steps in Section 3.8, Equipment Blank.
3.5.16 Clean Hands places the pump in the storage bag or proceeds to place pump in monitoring well.
3.5.17 Clean Hands removes the water level meter from its storage bag, decontaminates the water level meter by successively cleaning with solutions from tubs 1, 2, 3, and places the meter back into a clean storage bag or into the monitoring well.
3.5.18 Clean Hands changes gloves.

3.6 Sample Handling

All samples collected should be packaged and handled according to SOP-01 and the QAPP. Preservatives will be used where analytical methods require preservation. The QAPP indicates the type of sample preservation necessary.

3.7 Documentation

Specific information regarding sample collection should be documented in several areas: the sample chain-of-custody record, sample collection record, field notebook, and on sample labels and tags. Additional information regarding each form of documentation is presented in the following paragraphs:

3.7.1 Sample Chain-of-Custody Record. The information requested includes site name and location, project number, field notebook reference, collection date and type of analysis requested. Each sample submitted for analysis is also listed individually using its field identification number.
3.7.2 Groundwater Sample Collection Record - This form requires input of specific information regarding the collection of each individual sample including

sample identification, water quality parameters, collection method, and containers/preservation requirements.

3.7.3 Field Notebook - Documentation within the notebook will be thorough and sufficiently detailed to present a concise, descriptive history of the sample collection process.

3.7.4 Sample Labels/Tags - Sample labels and tags will be completed at the time each sample is collected and will include the information listed below.

- Client or project name/project number
- Sample number
- Sample designation
- Analysis type
- Preservative type
- Sample collection date and time
- Sampler's name

3.8 Procedures for Special Conditions

Equipment Blanks

3.8.1 With the submersible pump in tub 4 holding the fresh reagent water, Dirty Hands turns on the pump and allows several volumes of reagent water to be pumped.

3.8.2 The team changes gloves.

3.8.3 Dirty Hands opens the box or cooler containing the sample bottles, and unzips the bag containing a sample container. If a split sample is scheduled to be taken, Dirty Hands unzips another bag containing a sample container.

3.8.4 Clean Hands opens the inner bag, removes the sample container, and reseals the inner bag.

3.8.5 Dirty Hands reseals the outer bag.

3.8.6 Clean Hands unscrews the cap, and while holding the cap upside down, discards the diluted acid into a waste carboy, or empties the reagent water on the ground.

3.8.7 As reagent water is flowing through the pump, Clean Hands collects the sample by emptying the solution from the sample bottle, rinsing the sample bottle and cap three times with the flowing reagent water, and collecting the sample from the flowing tube.

3.8.8 If preservation is performed at the laboratory, skip to step 3.8.9. Preservation is performed in the field as follows:

3.8.9 Dirty Hands opens the outer bag holding the automatic pipette and preservative.

3.8.10 Clean Hands opens the inner bag containing the preservative and automatic pipette, opens the preservative bottle, and pipettes 10 ml of the preservative into the sample bottle.

3.8.11 Clean Hands recaps the preservative bottle, removes the pipette tip, and places the preservative and pipette back into its bag.
3.8.12 Clean Hands seals the inner bag holding the preservative and pipette.
3.8.13 Dirty Hands seals the outer bag.
3.8.14 Clean Hands opens the inner bag for the sample, places the sample bottle into the inner bag, and seals the inner bag.

3.8.15 Dirty Hands seals the outer bag, opens the sample cooler, places the equipment or field blank in the cooler (on ice), and closes the cooler.
3.8.16 Dirty Hands records the sample in the sampling log as the "Equipment Blank".
3.8.17 If the scheduled sample to be taken is a split sample, perform steps 3.8.4 through 3.8.11 again.
3.8.18 Clean Hands removes the pump from the tub, places it in a clean protective bag, seals the bag.

Filtering Samples

If filtering is necessary to collect representative groundwater samples, collect duplicate samples and identify one of these to be filtered and preserved upon receipt at the laboratory. Appropriate arrangements must be made with the laboratory to ensure that filtering and subsequent preservation is accomplished for specified samples immediately upon receipt by the laboratory.

3.9 Contamination Avoidance

During sample handling, appropriate Personal Protective Equipment (PPE) will be worn by personnel as described in the approved site specific Health and Safety Plan (HASP).

Sampling and measuring equipment will be decontaminated as described in the associated SOP.

3.10 Health and Safety

Health and safety issues are addressed in the project HASP. This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

All field personnel will be outfitted in the appropriate protective clothing and safety equipment required by the HASP during field efforts.

3.11 QA/QC

Sampling personnel will follow specific quality assurance guidelines as outlined in the QAPP. Proper quality assurance requirements are provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements typically suggest the collection of a sufficient quantity of field duplicate, field blank and other samples for analysis. These requirements are outlined below and in the QAPP.

3.11.1 Equipment Blank: The equipment blanks are used to verify the equipment is free from contamination prior to the collection of the sample.

- 3.11.1.1 Collection: The procedure for the collection is provided in Section 3.8, Equipment Blank.
- 3.11.1.2 Frequency of Collection: Collect on initial equipment blank, and an equipment blank per monitoring well sampled.
- 3.11.1.3 Evaluation Criteria: If the mercury concentration in the blank is greater or equal to 0.5 ng/L, or greater than one-fifth of sample concentration, whichever is higher, the associated sample result is an estimate and is unusable for regulatory application.
- 3.11.1.4 Corrections: If the initial equipment blank indicates contamination, above 0.5 ng/L, review the process used for cleaning, and have reagents replaced as appropriate.

3.11.2 Field Blanks: The purpose of field blanks is to assess the suitability of the container, preservative, and sample handling.

- 3.11.2.1 Collection: The field blank is generated by simply pouring the solution provided in one of the sample containers into another sample container whose contents have been emptied at the site. If sample preservation is performed at the laboratory, then the field blank should also be preserved at the laboratory.
- 3.11.2.2 Frequency of Collection: One per site, per day, or one per sampling event, whichever is greater.
- 3.11.2.3 Evaluation Criteria: Evaluate as per 3.11.1.3.

3.11.3 Field Duplicates: The purpose of field duplicates is to assess the precision for the field sampling and analytical process.

3.11.3.1 Collection: A field duplicate is collected by filling a second sample container, in rapid succession after the first sample, from the outlet of the sampling stream.

3.11.3.2 Frequency of Collection: Collect duplicates at the frequency specified in the project objectives, minimally one for every 10 samples collected. If possible, select a location with detectable amounts of mercury.

3.11.3.3 Evaluation: Calculate the absolute percent difference in the results as follows:

Percent Difference = (A-B)/[(A+B)/2], where A and B are the duplicate results. The percent difference is an estimate of the sampling and analytical error. Compare with any acceptance criteria established using project objectives.

3.11.4 Split Samples: Split samples are used to independently confirm results of the laboratory performing the analysis. Typically, a laboratory known to produce valid, unbiased results, is selected as the laboratory to which the split samples are sent.

3.11.4.1 Frequency of Collection: Split samples are created by dividing one sample collected in the field into two aliquots. This requires the collection of at least twice the volume of sample normally collected, properly preserved if field preservation is performed. Because of the influence that equipment blanks may have upon the use of the data, and equipment blank associated with the sample should be provided along with the split sample. This will require the generation of two equipment blanks prior to the collection of the sample to be split.

3.11.4.2 Evaluation: Calculate the absolute percent difference in the results as follows:

Percent Difference = (A-B)/[(A+B)/2], where A and B are the duplicate results. The percent difference is an estimate of the sampling and analytical error. Compare with any acceptance criteria established using project objectives. If acceptable, use the average concentration for regulatory purposes. If unacceptable, sample results should be considered estimates, and not be used for regulatory purposes.

3.12 Comments and Notes

None at this time.

3.13 Attachments

None at this time.

3.14 References

EPA, Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA-600/4-82-029, September 1982.

EPA, RCRA Groundwater Monitoring Technical Enforcement Guidance, Nov. 1992.

EPA, Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels, EPA 821-R-95-034, April 1995.

Geotrans, Inc., RCRA Permit Writer's Manual, Groundwater Protection, prepared for the U.S. EPA, Contract No. 68-01-6464, October 1983.

Michigan DEQ, Standard Operating Procedure – Groundwater Sampling from Monitoring Wells for Low Level Analysis of Mercury, April 2001.

Oxidation of Aqueous Samples for Total Mercury Analysis
FGS-012.3

Frontier Geosciences Inc.
414 Pontius Avenue North
Seattle, WA 98109

Originated by: Nicolas S Bloom and Efronsini Tsalkitizis
Revised by: Caroline Christy
April 3, 2001

Effective Date: June 29, 2001

On June 29, 2001, this procedure was reviewed and validated by Michelle L. Gauthier, Laboratory Manager and Beverly H. van Buuren, Quality Assurance Program Director. Signatures are on file.

1.0 SCOPE AND APPLICATION

1.1. This method of sample preparation is for the determination of total mercury (Hg) in aqueous media (i.e., natural waters, precipitation, pore waters, industrial and municipal effluents) at concentrations less than 1 ng/L. With the analysis of smaller aliquots, contaminated water samples up to 10,000 ng/L can be directly measured.

1.2. Total mercury as defined by this method means all bromine monochloride-oxidizable mercury forms and species found in aqueous solutions. This includes, but is not limited to, Hg(II), Hg^0, strongly organo-complexed Hg(II) compounds, adsorbed particulate Hg, and several tested covalently bound organomercurials (i.e., CH_3HgCl, $(CH_3)_2Hg$, and $C_6H_5HgOOCCH_3$). The recovery of Hg bound within microbial cells may require additional preparation steps (i.e., UV oxidation).

2.0 SUMMARY OF METHOD

2.1. Samples are collected using ultra-clean sample handling protocols (Frontier SOP

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence & shall not be used or appropriated to benefit any party without prior written consent to Frontier.

FGS-007) into glass or rigorously cleaned Teflon bottles. Samples are typically oxidized with [redacted] bromine monochloride (BrCl) at a level of 1% of its volume (higher levels of BrCl may be necessary depending on the amount of turbidity and particulate matter in the samples). All samples are allowed to react/digest for at least 12 hours at room temperature.

3.0 INTERFERENCES

3.1. Under no circumstances should ordinary plastic (i.e., polyethylene, polypropylene, polycarbonate, or vinyl) containers be used, as they are very diffusive to Hg^0 gas from the air. Containers should be made of acid-cleaned Teflon with Teflon caps or borosilicate (or quartz) glass bottles with Teflon-lined caps. It is critical that the bottles have very tightly sealing caps to avoid diffusion of atmospheric Hg through the threads.

3.2. The low detection limit of the THg analytical method depends on the stringent cleaning of equipment used for sample collection and storage.

3.3. High levels of organics or turbidity in a sample can cause the BrCl to become exhausted before complete oxidation of the sample can occur. In these cases (indicated by the sample fading to a pale yellow or clear color), the addition of more BrCl and a longer oxidation time is required.

4.0 SAFETY

4.1. The toxicity or carcinogenicity of each chemical used in this method has not been precisely determined. However, each compound should be treated as a potential health hazard. Exposure to these compounds should be reduced to the lowest possible level. Chemists should refer to the MSDS for each chemical they are working with.

4.1.1. Use particular caution when preparing and using BrCl, as it releases extremely irritating, corrosive fumes similar in effect to free chlorine. Always handle this reagent in an approved fume hood.

4.2. Personnel will don appropriate laboratory attire according to the Chemical Hygiene Plan. This includes, but is not limited to, laboratory coat, safety goggles,

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence & shall not be used or appropriated to benefit any party without prior written consent to Frontier.

and latex gloves under clean gloves.

4.3. All personnel handling environmental samples known to contain or to have been in contact with human waste should be immunized against known disease-causative agents. Frontier will reimburse the expense of Hepatitis A and B immunizations for any laboratory staff member who desires this protection.

4.4. Waste Management and Pollution Prevention: Any wastes generated by this procedure should be disposed of according to SOPs FGS-099 and FGS-100, which provide instruction on dealing with laboratory and client waste. Pollution prevention information can be found in the current Frontier Geosciences Hazardous Materials Management Plan (HMMP), which details and tracks various waste streams and disposal procedures.

5.0 EQUIPMENT

5.1. Sampling and Oxidation Bottles:

5.1.1. It is imperative for accurate low-level mercury measurements that appropriately cleaned Teflon or glass bottles with tight-fitting lids are used for all steps contacting the aqueous sample. It is good practice to use 1000-mL or 500-mL bottles to collect the samples in, and to fill bottles as full as possible to eliminate air headspace within the bottle. Teflon bottles are cleaned according to Frontier SOP FGS-007. No special pre-cleaning is necessary before using glass bottles as long as the bottles are from a lot that has been tested and is confirmed to be contamination-free. Testing procedures are described in Frontier SOP FGS-007.

5.1.2. For samples with expected concentrations of THg of 100 ng/L or more, glass bottles (and not Teflon bottles) should be used for sample collection.

6.0 REAGENTS

6.1. Reagent Water: 18 MΩ ultra-pure reagent water starting from a pre-purified (distilled, R.O., etc.) source is used. As a final mercury and organics removal step, an activated carbon cartridge is placed between the final ion exchange bed and the 0.2-µm filter. Reagent water is monitored for THg weekly, in addition to

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence & shall not be used or appropriated to benefit any party without prior written consent to Frontier.

monitoring after ion exchange beds are changed. Reagent water should typically contain less than 0.2 ng/L total Hg and remedial action should be taken if the total Hg exceeds 1 ng/L.

6.2. Hydrochloric Acid: Trace metal purified reagent-grade HCl is purchased and pre-analyzed for THg before use. It is possible to obtain acid containing less than 5 ng/L Hg. When a lot number meeting this specification is found, several cases are purchased, and stored in a low Hg atmosphere. Generally, lower values can be obtained in this manner, rather than by re-distilling acid in the laboratory. So-called "ultra-purified" acids are often the most irreproducibly Hg-contaminated grade of acid commercially available and should be avoided.

6.3. Potassium Bromide (KBr), neat: This reagent should be pre-analyzed and have tested low for Hg.

6.4. Potassium Bromate ($KBrO_3$), neat: This reagent should be pre-analyzed and have tested low for Hg.

6.5. 0.2 N Bromine Monochloride (BrCl):

6.5.1. [redacted] of KBr is added to a [redacted] bottle of concentrated HCl that has been analyzed and found to be low in Hg (< 5 ng/L). A clean magnetic stir bar is placed in the bottle, and stirred for 1 hour (or longer if time permits), in a fume hood. As an alternative, after adding the KBr, the solution can be allowed to set for 12 hours with periodic shaking before the addition of $KBrO_3$.

6.5.2. [redacted] of $KBrO_3$ is slowly added to the acid while stirring. Although this procedure does not adhere to the proper stoichiometric ratio for preparing BrCl, it results in a strong orange color. This dark orange is easier to see in an oxidized sample, thus preventing cloudier samples from being oxidized twice. When all of the $KBrO_3$ has been added, the solution should have gone from yellow to orange.

6.5.3. Loosely cap the bottle, and allow to mix for at least another hour before tightening the lid. CAUTION: *This process generates copious quantities of free halogens (Cl_2, Br_2, BrCl) that are released from the bottle. Add the*

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence & shall not be used or appropriated to benefit any party without prior written consent to Frontier.

$KBrO_3$ SLOWLY and in a well operating fume hood!

7.0 PROCEDURES

7.1. After sample receipt, the sample set is checked against the chain-of-custody (COC) form and the project sheet for sample ID, count, preservation requirements, and analytical requests.

7.2. For the preservation/oxidation of aqueous samples to be analyzed for low-level THg, samples are oxidized in their original sample bottle. The sample volume within the bottle is determined and a percentage (typically 1%) of the volume is calculated. This is the amount of [redacted] BrCl that is added to the sample bottle as a preservative/oxidizer. This percentage is recorded on the COC form for each sample.

7.3. The samples are logged into a sample storage cupboard and are left to oxidize for at least 12 hours before analysis is performed.

7.4. Prior to analysis, the analyst evaluates each sample for complete oxidation. If the color of the sample has faded from dark or bright orange to a pale yellow or clear, then more BrCl is required. The Mercury Group Leader should be consulted. The additional amount added is recorded on the COC form, and the samples must be stored for at least another 12 hours prior to analysis.

8.0 QUALITY ASSURANCE

8.1. For each new bottle of BrCl that is prepared, an analyst performs analysis on a 1-mL aliquot of the concentrated form. In the analysis spreadsheet, a volume of 100 mL is assigned, based on 1 mL of concentrated BrCl in a 100-mL sample aliquot preserved at 1%-BrCl.

8.2. Based on the volumes above, if the concentration is less than 0.25 ng/L, then the BrCl is approved for use. The analyst marks the BrCl bottle "Tested Low" with the date and their initials. The dataset ID and date the BrCl was made is also recorded in the Reagent Testing Logbook. Any bottle of BrCl without these markings should never to be used for sample preservation.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence & shall not be used or appropriated to benefit any party without prior written consent to Frontier.

8.3. Should a bottle of BrCl test higher than the 0.25 ng/L, it is re-tested. If it still fails the above criteria, it is labeled "For Bottle Cleaning Only" with the date and the analyst's initials, and it is removed from the analytical laboratory (usually given to the Bottle Washing Group). This information is also recorded in the Reagent Testing Logbook

9.0 CORRECTIVE ACTIONS

9.1. If the THg concentration in a bottle of prepared BrCl is determined to be above the action limits, an incident report should be filled out and submitted to the QA Office. In addition, there should be some investigation into the probable causes of the contamination, such as reagent contamination or preparation technique.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence & shall not be used or appropriated to benefit any party without prior written consent to Frontier.

Total Mercury Analysis by Cold Vapor - Atomic Fluorescence Spectrometry (CV-AFS)
FGS-069.3

Modified EPA Method 1631E

Frontier Geosciences Inc.
414 Pontius Avenue North
Seattle, WA 98109

Originated by: Sarah DuBord, Lucas Hawkins, Dustin Leen, and Amber Steward
Revised by: Amber Steward and Will Hagan
May 15, 2003

Effective Date: May 16, 2003

On May 16, 2003, this procedure was reviewed and validated by Michelle L. Gauthier, Laboratory Manager, and Will Hagan, Quality Assurance Officer.

1.0 SCOPE AND APPLICATION

1.1. This SOP is designed to ensure that reproducible, traceable procedures are followed in the standardization of the total mercury analyzers and in the analysis of samples for total mercury, as well as to establish the bounds wherein data will be considered acceptable.

1.2. This method provides for the determination of total mercury in a wide range of matrices including aqueous, biological, and geological media. In general, using clean handling and reagents, the typical detection limit for the method is less than 0.2 ng/L for aqueous samples and 0.5 ng/g for digested solid samples. A typical detection limit of below 0.5 ng/g can also be achieved for the analysis of Hg(II) in tissues.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

2.0 SUMMARY OF METHOD

2.1. Preparation of Total Mercury Standards

2.1.1. Mercury (Hg) standard solutions are prepared using ultra-clean volumetric glassware and gravimetrically calibrated pipettors. To ensure traceability, they must be logged in the Mercury Standard Logbook and assigned a unique identification number.

2.1.2. Any standard, along with its original certification, should be labeled with its receipt date and the receiver's initials. Current, as well as archived certifications, will be kept on file in the QA Office.

2.2. Total Mercury Analyzer Calibration Sequence

2.2.1. The calibration sequence for the determination of total mercury consists of a 5-point calibration curve, an initial calibration verification (ICV) standard, and an initial calibration blank (ICB).

2.2.2. The calibration standard is made from a dilution of a certified stock mercury standard. In most cases, the highest calibration standard limits the range of sample concentrations that are considered valid.

2.2.3. The ICV standard is made from a dilution of a secondary-source stock mercury standard. It verifies the accuracy of the standard used for the calibration curve.

2.2.4. The ICB is used to confirm that the system is low in total mercury and to enable blank correction of the standard curve.

2.3. Total Mercury Analysis

2.3.1. Total mercury analyses are split into two categories: waters and solids. For analysis of aqueous samples, an aliquot of oxidized sample is neutralized with hydroxylamine-hydrochloride (NH_2OH-HCl) and added to a bubbler. For solids, an aliquot of digested sample is directly pipetted into the bubbler.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

2.3.2. For the analysis of waters and solids, stannous chloride ($SnCl_2$) is added to reduce the aliquot, and the bubblers are sealed with Keck clips. Blanked gold traps are placed at the end of soda-lime pre-traps. The bubbler is purged with nitrogen (N_2) for 20 minutes. All gas that flows into the bubbler should only leave the system through the soda-lime pre- trap and then gold trap.

2.3.3. The gaseous mercury amalgamates to the gold traps, which are removed and individually placed in the analytical train. The gold trap is heated, thus releasing the mercury into the argon gas stream, which flows into the analyzer.

3.0 INTERFERENCES

3.1. Due to the high levels of acid and halogens (i.e., bromine) in digested solids, it is recommended that aliquots of no more then 5.0 mL (1.0 mL if hydrofluoric acid or iodated carbon is present at significant concentrations) of the digestates be analyzed, unless otherwise specified.

3.2. When running digested solid samples, bubbler water should be changed and purged after a total of 10 mL of digestate has been added to the bubbler. This is done to avoid a build up of acidity and halogens in the bubbler water that can result in low sample recoveries as well as a drop in analyzer sensitivity.

3.3. Water has the potential to create recovery interference. To prevent interference from water, ensure that the soda-lime pre-traps remain dry.

3.4. The presence of high concentrations of silver and/or gold can cause $SnCl_2$ to precipitate out of solution and adhere to the bubbler walls. High concentrations of these metals can sometimes be found in the matrix spike samples from digestion sets that are being shared with the Trace Metals Group. When analyzing digestates where the matrix spike samples have been spiked with silver or gold, the matrix spike samples should not be analyzed for mercury. Instead, an analytical spike/analytical spike duplicate (AS/ASD) should be analyzed. Alternatively, a separate mercury-specific MS/MSD digest can be prepared

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

4.0 SAFETY

4.1. Personnel will don appropriate laboratory attire according to the Chemical Hygiene Plan. This includes, but is not limited to, laboratory coat, safety goggles, and nitrile gloves under clean gloves.

4.2. The toxicity or carcinogenicity of reagents used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure to these compounds should be minimized. Chemists should refer to the MSDS for each chemical with which they are working.

4.3. All personnel handling environmental samples known to contain or to have been in contact with human waste should be immunized against known disease-causative agents. Frontier will reimburse the expense of Hepatitis A and B immunizations for any laboratory staff member who desires this protection.

4.4. Any wastes generated by this procedure should be disposed of according to SOP FGS-099, which provides instruction on dealing with laboratory and client waste. Pollution prevention information can be found in the current Frontier Geosciences Hazardous Materials Management Plan (HMMP), which details and tracks various waste streams and disposal procedures.

5.0 EQUIPMENT

5.1. Atomic fluorescence spectrophotometer (AFS): A very sensitive (IDL < 1pg Hg) AFS detector with a wavelength of 253.7 nm is required. Such systems can be built in-lab or purchased from Tekran Inc. (Toronto, Ontario).

5.2. Flow meter/needle valve: A unit capable of controlling and measuring gas flow to the cold-vapor generator at 200-500 mL/min.

5.3. Teflon fittings: Connections between components and columns are made using 6.4 mm OD Teflon FEP tubing, and Teflon friction-fit or threaded tubing connectors. Connections between components requiring mobility are made with 3.2 mm OD Teflon tubing due to its greater flexibility.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

5.4. Soda-lime pre-trap: A 10 cm x 0.9 cm diameter Teflon tube containing 2-3 g of reagent grade, non-indicating 8-14 mesh soda-lime ($Ca(OH)_2$+NaOH) aggregates, packed between portions of silanized glass wool. This trap is purged of Hg by placing it on the output of a clean cold vapor generator and purging it with ~3-5% HCl and ~600µL of $SnCl_2$ for approximately 20 minutes with N_2 at 40 mL/min.

5.5. Cold-vapor generator (bubbler): A 150 mL, tall, flat-bottom borosilicate flask with standard taper 24/40 neck, fitted with a sparger having a coarse glass frit which extends to within 0.2 cm of the flask bottom.

5.6. Gold-coated sand traps: Made from 10 cm lengths of 6.5 mm OD x 4 mm quartz tubing, with a quartz wool plug 2.0 cm from one end. The tube is filled with 3.4 cm of 60/80 mesh gold-coated quartz sand, the end of which is then plugged with quartz wool. Gold-coated sand traps are heated to 450-500 ^{o}C (the coil should have a barely visible red glow when the room is darkened) with a coil consisting of 75 cm of 24-gauge nichrome wire at a potential of 10 VAC. Potential is applied and finely adjusted with an auto-transformer. Refer to SOP FGS-061 regarding the construction of gold traps used for total mercury analysis.

5.7. Recorder: Any multi-range chart recorder or integrator with 0.1-5.000 mV input and variable speeds is acceptable.

5.8. Micro-pipettors: All-plastic pneumatic fixed volume and variable pipettors in the range of 5 µL to 5 mL. Pipettors are to be calibrated weekly according to SOP FGS-003.

5.9. Analytical Balance: Capable of accurately weighing to the nearest 0.1 milligram, and able to tare at least 1 gram.

6.0 REAGENTS

6.1. Reagent Water: Reagent water (18-MΩ minimum) must be ultra-pure deionized water starting from a pre-purified source. Reagent water used in the mercury lab is checked weekly for total mercury concentrations, and must test below 0.25 ng/L.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

6.2. Hydrochloric Acid (HCl): Hydrochloric acid must be trace-metal purified and reagent grade. Total mercury concentration in HCl must be < 5.00 ng/L.

6.3. Potassium Bromide (KBr), neat: This reagent should be pre-analyzed and have tested low for Hg.

6.4. Potassium Bromate ($KBrO_3$), neat: This reagent should be pre-analyzed and have tested low for Hg.

6.5. 0.2N Bromine Monochloride: (BrCl): In a fume hood, dissolve 37.5 g of reagent grade KBr into 2.5 liters of HCl that has been determined to be low in mercury. Invert occasionally and let sit over night. After the KBr has nearly dissolved, slowly add 27.5 g reagent grade $KBrO_3$ to the acid while stirring. When all the $KBrO_3$ has been added, the solution should change from yellow to red to orange in color. Loosely cap and allow solution to stir for another hour. **WARNING, This process generates copious quantities of free halogens that are released from the bottle upon the addition of $KBrO_3$. Add KBrO3 slowly in the fume hood**!

6.6. Hydroxylamine Hydrochloride: (NH_2OH-HCl): Dissolve 300 g of NH_2OH-HCl in reagent water and bring to 1 liter. This solution may be purified by the addition of 1 mL $SnCl_2$ solution and purging overnight at 500 mL/min with Hg free N_2. The working reagent is a 25% solution that is made by adding one part reagent water to one part 50% hydroxylamine hydrochloride.

6.7. Stannous Chloride ($SnCl_2$): Dissolve 500g $SnCl_2$ with three 100-mL aliquots of concentrated HCl and transfer to a 1 liter glass bottle, which contains approximately 300 mL of reagent water. Bring this solution up to 1 liter and purge overnight with mercury free N_2 at 500 mL/min. to remove all traces of mercury. Store tightly capped. The working reagent is a 25% solution that is made by adding one part reagent water to one part 50% stannous chloride.

6.8. Nitrogen (N_2): Grade 4.5 (standard laboratory grade) nitrogen that can be further purified of mercury using a gold or iodated carbon trap that is located in line between the gas output and bubbler.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

6.9. Argon (Ar): No less than Grade 4.7 argon that has been further purified by the removal of mercury using a gold or iodated carbon trap that is located in line between the gas output and the analyzer gas input.

7.0 PROCEDURES

7.1. Documentation of Standards and Reagents

7.1.1. All freshly prepared standards, as well as purchased standards, are logged into the Mercury Standards logbook and are assigned a unique identification number. The ID is composed of the number of the logbook, the page number on which the standard was logged, followed by the line number given to that standard. For example, HG2-1-13 would indicate a standard documented in the Mercury Standard Logbook-Volume 2, on page 1, on line 13. The date of receipt or creation, as well as the analyst's initials, should be noted on the standard bottle and on the certification shipped with the standard.

7.1.2. The standard is entered into the first available line in the logbook and the following information is recorded:

7.1.2.1. Stock concentration – for liquid standards, record the stock concentration and unique ID used to create working/spiking standards. For solid standards, write the name of the compound used to create working/spiking standards.

7.1.2.2. Aliquot – record the amount of the original standard used to create working/spiking standards.

7.1.2.3. Final volume – record the final working/spiking standard volume.

7.1.2.4. Diluent – record the type of diluent used to bring initial volume up to final volume.

7.1.2.5. Final Concentration – record the final concentration of the standard made.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

7.1.2.6. Dataset ID – after a standard has been tested, record all dataset ID's that contain the standard test results.

7.1.2.7. Date – record the date on which the standard is being created.

7.1.2.8. Initials – record the initials of the person making the standard.

7.1.2.9. Expiration – record the expiration of the created standard. For stock solutions, this information is based on the manufacturer's certificate of analysis. For dilutions, expirations are set according to section 7.2.

7.1.3. All reagents used for total mercury analyses are recorded in the Reagent Testing Logbook. The name of the reagent, the date made, and the initials of the person who made the solution are recorded.

7.1.3.1. The solution is tested to ensure that the reagent is low in mercury. When the solution tests low, the analyst enters into the logbook that the solution tested low and records the corresponding dataset ID. The actual reagent bottle gets labeled with the reagent name, the initials of the person who prepared the solution, and the date made.

7.1.3.2. If a reagent does not test sufficiently low, it is re-tested once. If it is still testing high, it is marked "not for laboratory use", and a note is made in the Reagent Testing Logbook. The reagent is then appropriately disposed of and a new batch is made.

7.2. Preparation of Total Mercury Standard Solutions

7.2.1. Mercury standard solutions are prepared using ultra-clean class-A volumetric glassware and gravimetrically calibrated pipettors. The volume of prepared standards can vary from the descriptions below so long as the concentrations do not. Resulting solutions must be stored in Teflon or glass bottles. Prior to use, replicates of newly made standard solutions must test within 5% of the existing ICV standard. Standard preparations and calibrations must be recorded in the Mercury Standard Logbook.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

7.2.2. *Total Mercury Stock Standard Solutions:* Certified mercury standards are purchased from High Purity Standards (1000 µg/mL) and Absolute Standards (100 µg/mL).

7.2.3. *Total Mercury Spiking Standard Solutions:* Total mercury spiking standards are used to spike samples with high mercury concentrations without adding an appreciable volume to the sample. Unless otherwise specified, total mercury spiking standards are prepared by dilutions of the above stock standards, and are considered stable for 18 months or until the stock standard expires.

7.2.3.1. The total mercury spiking standard containing 100,000 ng/mL consists of the undiluted Absolute Standards stock solution.

7.2.3.2. The total mercury spiking standard containing 10,000 ng/mL is a 100x dilution of the High Purity Standards stock solution. 1 mL of this 1,000 µg/mL stock solution is diluted in 100 mL of reagent water containing 2% BrCl.

7.2.3.3. The total mercury spiking standard containing 1000 ng/mL is a 1000x dilution of the High Purity Standards stock solution. 0.1 mL of this 1,000 µg/mL stock solution is diluted in 100 mL of reagent water containing 2% BrCl.

7.2.3.4. The total mercury spiking standard containing 100 ng/mL is a 1000x dilution of the Absolute Standards stock solution. 0.1 mL of this 1,000 µg/mL stock solution is diluted in 100 mL of reagent water containing 2% BrCl.

7.2.4. *Total Mercury Calibration Standard Solution:* The 10 ng/mL total mercury calibration standard (used for the 5-point calibration curve) is prepared by diluting 1 mL of the 10,000 ng/mL total mercury spiking standard into 1000 mL of reagent water containing 2% BrCl. The total mercury calibration standard is considered stable for 3 months or until the stock standard expires.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

7.2.5. *Initial Calibration Verification (ICV) Standard Solution:* A 7.5 ng/mL ICV solution is prepared by diluting 37.5 mL of the Absolute Standards stock solution into 500 mL of reagent water containing 2% BrCl. The ICV solution is considered stable for 3 months or until the stock standard expires.

7.2.6. *Certified Reference Material (CRM):* A 1.610 mg/L solution (1.590 mg/kg at a density of 1.007 g/mL) is prepared by adding 5.0 mL of CRM NIST 1641d into a 1000 mL volumetric flask. This solution is diluted to 1000 mL, and then 20 mL of concentrated BrCl is added, giving a final volume of 1020 mL. Preparing the solution in this manner makes a 1/200 dilution of the stock CRM. This solution is considered stable for one year, or until the stock CRM expires.

7.2.7. *Ongoing Precision and Recovery (OPR) Total Mercury Standard Solution:* A 100 ng/mL OPR total mercury standard is prepared by diluting 0.1 mL of the Absolute Standards stock solution into 100 mL of reagent water containing 2% BrCl. This solution is considered stable for one year or until the stock standard expires.

7.3. Instrument Start-up

7.3.1. Begin blanking your sample gold traps. To do this you attach one trap at a time to the analytical train and burn to instrument. Ensure that argon flow is at appropriate levels (~25-40 mL/min). Pinched portion of gold trap should be on the left (closest to the analytical trap). Continue to burn traps while doing the steps 7.3.2 and 7.3.3.

7.3.2. Rinse out each bubbler (but not the bubbler top) three times with reagent water and fill with about 100 mL reagent water. Using a pre-purged repipettor, add 3-5 mL HCl. Initially add 600 µL of $SnCl_2$ and purge with nitrogen (N_2) gas.

7.3.3. Prepare one soda-lime trap for each bubbler. To prepare soda-lime traps, hold soda-lime between two glass wool plugs in a Teflon tube. Cap the tubes with Teflon through plugs and attach to bubbler. Once the soda-lime traps have been attached, the bubbler system must purge for a minimum of 20 minutes before beginning analyzer calibration sequence.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

7.3.4. Analyst should label strip chart/integrator print out with the corresponding dataset ID, as well as print and sign their name. For strip chart print outs, analyst should label the baseline ratios accordingly (usually X=1 and X=20) and label with the analysis day start time and strip chart drum speed (usually 1 mm/min). Analyst should note the end time as well.

7.4. Analyzer Calibration Sequence

7.4.1. The sequence starts with a 5-point (0.05 ng, 0.10 ng, 0.50 ng, 2.00 ng, 4.00 ng) standard calibration curve using the total mercury working standard solution. Immediately following the standard calibration curve, an initial calibration verification (ICV) and an initial calibration blank (ICB) are performed.

7.5. The instrument can be calibrated following the protocols below. These protocols can be modified by the analysts in terms of the concentrations of calibration points. Additional calibration points may be added (even mid-run) to extend the linear range of the calibration in order to accommodate higher concentration samples.

7.5.1. Using the 10 ng/mL Hg working standard solution; add 10 µL, 50 µL, 200 µL and 400 µL to the bubblers sequentially from left to right. Add 300 µL $SnCl_2$ to bubblers and seal bubbler tops using Keck Clips to insure nominal sample leakage.

7.5.2. Blanked gold traps are securely placed at the end of the soda-lime trap (pinched section of gold trap is closest to the soda-lime trap). Bubblers are purged with N_2 for a minimum of 20 minutes.

7.5.3. Attach gold trap to analytical train and burn in sequential order. Peaks produced should be labeled as well as recorded in the dataset spreadsheet.

7.5.4. Add 5 µL of the 10 ng/mL Hg working standard to the first bubbler. Add 200 µL of the Initial Calibration Verification (ICV) standard solution to the second bubbler. The third bubbler is the Initial Calibration Blank (ICB) and nothing should be added to this bubbler (to ensure that

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

you do not add anything to this bubbler, it is helpful to keep the bubbler top sealed with Keck Clips).

7.5.5. Add 300 µL $SnCl_2$ to all bubblers except the third and seal bubbler tops using Keck Clips. Repeat sections 7.5.2 and 7.5.3.

7.5.6. This completes the instrument calibration for Total Mercury analysis.

7.6. Pre-analysis and Organization

7.6.1. When analyzing samples, it is imperative to check the project sheets. Within these sheets the analyst will find a summary of all the information to analyze the samples properly. These sheets can list the QC format required for the samples, suggested aliquot size, project manager information, as well as listing information regarding spiking levels.

7.6.2. Analyst should then locate samples and their chain of custody (COC), any internal COC when applicable, as well as any digestion bench sheets used for solids.

7.6.3. Analyst should compare the project sheet to the COC and see that all samples are accounted for, and notify the Project Manager of any discrepancies in analysis required, sample identification, etc.

7.6.4. All total mercury analyses receive a unique dataset identifier. This is composed of the instrument type and number, the date, and the calibration number for that day. The format is as follows: THG8-010224-1, where "THG" refers to a total mercury analyzer, "8" refers to total mercury analyzer number 8, "010224" refers to the date (February 24, 2001, in YYMMDD format), and "1" refers to the first calibration of that day.

7.6.5. Analyst should then organize their samples in the order listed on the COC or the digestion bench sheet, or in numerical order, depending on the preference of the PM. The first samples analyzed should be the preparation blanks then the digested CRM if analyzing solid samples, followed by actual samples. Field blanks should be analyzed before their associated samples. If there are total and dissolved samples with the same sample ID, run these

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

side by side to ease in checking that total concentration is greater than dissolved concentration. Should a dissolved fraction be greater than its total concentration, both portions should be reanalyzed for confirmation.

7.6.6. All samples specified as being High QA should be analyzed prior to any Standard QA projects that are being analyzed on the same instrument on the same day.

7.6.7. If it is absolutely necessary to analyze both aqueous and solid samples on the same analyzer, it is important to analyze the aqueous samples first.

7.7. Analyzing Aqueous Samples

7.7.1. All aqueous samples should be preserved with BrCl according to Frontier SOP FGS-012 at least 24 hours prior to analysis. In special cases where rush turn-around-time is required and an oxidation period of less than 24 hours may be used, the analyst should consult a supervisor for approval. The supervisor must be able to confirm (based on past experience) that that particular matrix type is completely oxidized before analysis.

7.7.2. While bubbling and burning the standard curve, the analyst should prepare three 1% BrCl water preparation blanks (PBW). Rinse and fill three clean, 7-mL Teflon vials with ~3 mL reagent water. Add 200 µL hydroxylamine hydrochloride (NH_2OH-HCl) and 1 mL BrCl to each vial.

7.7.3. All known field, equipment, and trip blanks should be analyzed before any other sample types, usually after the PBWs. 100-mL sample aliquots should be analyzed providing there is adequate sample volume collected. 125-mL sample aliquot sizes can be analyzed upon request by the PM.

7.7.4. For all waters except blanks, select appropriate aliquot volume (refer to project sheets, historical data, etc.).

7.7.4.1. For sample aliquots of 5 µL to 10.0 mL, use calibrated pipettes to dispense the aliquots directly into bubbler. Due to minimal amounts of BrCl in aliquots of 10 mL or less, NH_2OH-HCl is not added. It is highly recommended that analyst should not pipette less than 25 µL. A

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

dilution of the sample should be made to allow a larger aliquot to be analyzed.

7.7.4.2.For sample aliquots greater that 10 mL, gravimetrically weigh out the selected volume (± 0.2 g) into a clean 125-mL Teflon split bottle. Once volume is weighed out, neutralize BrCl with 200 µL NH_2OH-HCl no more than 5 minutes prior to adding the sample to bubblers. Sample should turn from a yellowish color to a clear/cloudy solution, depending on the matrix.

7.7.4.3. If the material happens to be seawater or a highly dense liquid, it is necessary to account for the density if the aliquot is gravimetrically determined.

7.7.5. The procedure for analysis is similar to that of the calibration process.

7.7.5.1.Selected and neutralized aliquots are poured/pipetted into bubbler (one sample per bubbler). 300 µL $SnCl_2$ is added to each bubbler. Bubblers are sealed with Keck Clips to insure nominal sample leakage. Blanked gold traps are securely placed at the end of the soda-lime trap. Purge bubblers with N_2 for a minimum of 20 minutes. After 20 minutes, individual traps are sequentially burned to the analyzer, and resulting peaks are labeled with corresponding sample IDs.

7.7.5.2. Sample IDs, BrCl percentages, aliquot volume, peak height/peak area, and dilution factor (if applicable) associated with each sample and analysis sequences should be entered into the Total Mercury spreadsheet template. Unless otherwise stated, all aqueous samples should be PBW corrected.

7.7.5.3.While bubbling and burning one set of sample traps, the analyst should begin preparing the next round of water samples in the same fashion to maximize efficiency.

7.7.6. Quality Control procedures for aqueous samples

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

7.7.6.1.A high-QA analytical batch is defined as 20 or fewer field samples, not including PBWs, ICB, CCV, CCB and MD/MS/MSD. A standard-QA batch is 25 or fewer field samples.

7.7.6.2.A minimum of three PBWs are prepared and analyzed per analytical day.

7.7.6.3.One CRM (200 µL of 1/200 diluted NIST 1641d) must be analyzed per analytical day.

7.7.6.4.One CCV/CCB set must be prepared and analyzed every 10 analytical runs for High-QA samples (can be stretched to 11-12 samples for standard-QA) and at the end of the analytical day.

7.7.6.5.One Matrix Spike/Matrix Spike Duplicate (MS/MSD) must be prepared and analyzed every 20 samples (25 for standard QA). MS/MSDs are spiked at 1-5 times the ambient concentration, with 0.1 ng being the minimum spiking level. Sample aliquots for MS/MSDs should be the same as the ambient sample aliquot. Spikes are added to the split aliquots for volumes of 10 mL or greater. For less than 10 mL aliquots, spikes are added directly to the bubbler. **NEVER ADD SPIKE DIRECTLY TO ORIGINAL SAMPLE VESSEL UNLESS OTHERWISE STATED.**

7.7.6.6. A Matrix Duplicate (MD) analysis is required every 20 samples (25 for standard QA). A Matrix Triplicate (MT) sample may be requested by the PM. MD/MT should be performed using the same sample aliquots as the ambient sample

7.7.6.7.Upon request, a blank spike may also be analyzed. A blank spike consists of 100 mL of reagent water (1-2% BrCl) spiked according to client-request or historical data.

7.7.6.8.All standards used for analysis must be noted on the dataset spreadsheet.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

7.8. Analysis of Digested Solids (soils, tissue, sediments, etc.)

7.8.1. With this method it is possible to determine the concentration of total mercury in solid samples with proper digestion. For tissues, refer to Frontier SOP FGS-011 for the nitric acid/sulfuric acid digestion and SOP FGS-058 for the concentrated nitric acid digestion. For soils/sediments, refer to Frontier SOP FGS-011 for the nitric acid/sulfuric acid digestion, SOP FGS-066 for the cold aqua regia digestion, and SOP FGS-053 for the hydrofluoric acid/nitric acid microwave bomb digestion. For coal, refer to Frontier SOP FGS-066 as well.

7.8.2. After the analyzer calibration sequence, preparation blanks and the digested CRM should be analyzed. The analyst should use 5 mL (1 mL for HF digestates) of each preparation blank. Analysts are to calculate the appropriate aliquot volume for the digested CRM, ensuring that the sample concentration stays within the calibration curve.

7.8.3. Analysts should begin analyzing samples by the order of the digestion sheet, with the exception of the sample that has separate QC digested for MD/MS/MSD. This sample should be analyzed first to determine its concentration in order to calculate a spiking level for the MS/MSD (1-5 times the sample concentration).

7.8.4. The procedure for analysis is similar to that of the calibration process.

7.8.4.1. Selected digest samples are pipetted into bubbler (1 sample per bubbler). Add 300 µL $SnCl_2$ to each bubbler. Bubbler tops are sealed with Keck Clips to insure nominal sample leakage. Blanked gold traps are securely placed at the end of the soda-lime trap. Purge bubblers with N_2 for a minimum of 20 minutes, remove gold traps and sequentially place sample traps in analytical train. Sequentially burn individual traps to analyzer, labeling resulting peaks with corresponding sample IDs.

7.8.4.2. Sample IDs, aliquot volume, digest volume, digested solid weight, peak height/peak area, and dilution factor if applicable associated with

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

each sample should be entered into the Total Mercury spreadsheet template.

7.8.4.3. While purging one set of samples, the analyst should begin preparing the next round of digested solid samples in the same fashion to maximize efficiency.

7.8.5. Quality Control procedures for digested solid samples

7.8.5.1. A minimum of three preparation blanks and one CRM that is matrix specific (if available) must be digested and analyzed per digestion batch.

7.8.5.2. One CCV/CCB set must be prepared and analyzed every 10 analytical runs for high-QA samples (can be stretched to 11-12 samples for standard-QA) and at the end of the analytical day.

7.8.5.3. One MS/MSD per 20 samples (25 for standard QA) should be digested separately. Total mercury spiking standard solutions should be used to spike the MS/MSD at 1-5 times the sample concentration. Spike directly into the separate MS/MSD digests and bring up to volume with the proper diluent. Please refer to the section of this SOP regarding interferences when analyzing digestates that are shared with the Trace Metals Group.

7.8.5.4. Upon request, a blank spike may also be performed. A blank spike consists of 100 mL of reagent water (1-2% BrCl) spiked according to client request or historical data.

7.8.5.5. One MD must be prepared and analyzed for every 20 samples (25 for standard QA). Upon request, a MT may be performed. Separate digests should have been prepared using the same aliquot size as the original sample.

7.8.5.6. All standards used during analysis must be noted on the dataset spreadsheet.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

7.9. Analysis of Iodated Carbon (IC) Traps and Particulate Filters

7.9.1. IC traps and particulate filters are digested and analyzed as if they were solids (see section 7.8.5), with a few exceptions. The IC matrix can cause recovery problems, as well as questionable blanks. Therefore there are a few modifications to the analysis and QC requirements. Due to the complexity of this analysis, inexperienced analysts should not analyze IC digests.

7.9.1.1. IC traps or particulate filters should be digested according to SOP FGS-011.

7.9.1.2. Aliquot sizes used for analysis should be 1 mL or less. 5 mL may be used at PM request, but not recommended. Should the bubbler contain more than 2 mL of digestate, the water must be changed and repurged before continuing analysis. It is recommended that the smallest possible aliquot sizes be used for this matrix, ensuring that you maintain quality data. All blanks, blank spikes, and low level/non-detect samples must be analyzed at the same aliquot size.

7.9.2. At the end of this analysis, bubblers must be cleaned using approximately 5% (w/v) potassium hydroxide (KOH).

7.10. Quality Control Requirements for IC Traps and Particulate Filters

7.10.1. A minimum of three preparation blanks must be prepared and analyzed per batch: PBIC for IC traps, PBF for filters.

7.10.2. A CCV/CCB set must be analyzed every 10 analytical runs and at the end of the analytical run.

7.10.3. Due to sample design, a digested MS/MSD isn't possible. Therefore, one AS/ASD set (post-digestion spikes) must be prepared and analyzed every 20 samples (25 for standard QA).

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

7.11. Analysis of Tissue Samples for Hg(II)

7.11.1. With this method it is possible to determine the inorganic mercury species in tissues that have been digested with KOH/Methanol (Frontier SOP FGS-010). Inorganic ionic mercury, as defined by this method, means all species found in the tissue matrix which are directly reducible by $SnCl_2$ in water. This includes, but is not limited to, Hg(II) salts, weakly organo-complexed Hg(II) compounds, and probably the analogous soluble Hg(I) compounds, although this has not been confirmed.

7.11.2. Calibration is performed as above in section 7.5. To prepare the samples for analysis, use the following steps:

7.11.2.1. Pipette up to 1.0 mL of sample into the freshly blanked bubbler water. As the KOH/Methanol digest is somewhat sticky, do not condition the pipette tips before injecting the samples. Instead, draw up the solution only once, making sure the tip penetrates the solution a minimal amount (1-2 mm). When injecting the sample into the bubbler, place the pipette tip below the surface of the bubbler water and inject slowly. To assure that the entire sample is transferred, rinse the tip at least 2x with bubbler solution.

7.11.2.2. Repeat the last step for all bubblers and add 300 µL of $SnCl_2$. Tighten all bubbler heads and attach gold blanked gold traps. Attach nitrogen lines and allow bubblers to purge for 20 minutes. Remove traps and burn to instrument.

7.11.2.3. Rinse out bubblers and add 60-75 mL of reagent water. Add ~3 mL of HCl and 300 µL of $SnCl_2$. This step is very important, as there are matrix issues with tissue digests. Allowing this matrix to accumulate in the bubblers will cause interferences. Purge the fresh bubbler water for at least 10 minutes. Proceed with next round of samples, ensuring that bubbler water is changed after each round.

7.11.3. For quality control procedures for regarding Hg(II) analysis, refer to section 7.8.6.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

8.0 QUALITY ASSURANCE

8.1. Analysts are to verify QC sample results in "real-time" as they come off the instrument. This allows for correction of any analytical problems immediately.

8.2. Of particular importance to the client is Frontier's position that a **single non-compliant result on a QC sample does not automatically invalidate a data set.** All data points noted as invalid for known reasons may be discarded if rerun during the same analysis day. In the event that the system becomes out of control during the analysis day, all results bracketed between valid QC data points shall still be considered valid.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

Quality Control Limits for Determination of Total Hg *

QC Item	Acceptance Criteria
Initial/Continuing Calibration Verification (ICV/CCV)	80-120% recovery (Goal: 90-110%)
Initial/Continuing Calibration Blank (ICB/ CCB)	Individual limit of ≤ 0.25 ng/L (Instrument blanks are not blank corrected)
Certified Reference Material (CRM)	75-125% recovery
Calibration Curve Correlation Coefficient (minimum of 5 points)	r ≥ 0.995, linear regression forced through zero
Preparation Blank Water (PBW)	Each blank ≤ 0.25 ng/L with SD ≤ 0.15 ng/L; 3 per analytical day (3 per calibration curve)
Preparation Blank Sediment/Tissue (PBS/PBT)	Mean ≤ 1.0 ng/g (or <0.1x lowest sample) Standard deviation < 0.3 ng/g 3 per analytical batch of ≤ 20 samples (≤ 25 for standard QA)
Matrix Spike/Spike Duplicate (MS/MSD)	75-125% recovery with RPD ≤ 25 1 per analytical batch ≤ 20 samples (≤ 25 for standard QA)
Matrix Duplicate/Triplicate (MD/MT)	≤ 25 RPD/RSD
Blank Spike (if requested)	75-125%

***Client QC requirements may be more stringent. Please refer to project sheets prior to analysis.**

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

9.0 CORRECTIVE ACTION

9.1. The quality control data gathered throughout the analytical day provides an indication of overall data quality. Therefore, corrective action is required if quality control results are outside of acceptable limits. First, a careful re-examination of the calculations is performed to assure that there are no numerical errors. The Project Manager is informed of any data issue and decides what, if any, corrective action, is warranted. The Quality Assurance Officer oversees this process and has the final say in what corrective action is to be performed.

9.2. If insufficient sample volume remains to repeat analysis for samples analyzed after the last acceptable CCV, professional judgment is used to estimate values (usually through CCV correction). Affected samples are bracketed from previous acceptable QC data points, and a narrated explanation is provided on the dataset coversheet.

9.3. The above corrective actions apply only to events which have unknown causes. If the analyst is aware of the cause, no corrective action is necessary other than sample reanalysis.

10.0 EQUATIONS

10.1. Total Mercury in Water

10.1.1. Average all bubbler blanks (B) using the peak height/peak area values from the strip chart/integrator.

10.1.2. The slope of the calibration curve (A) is calculated using the chart units per ng of mercury. A standard statistical package is used to determine the slope, using the five initial calibration points. The calibration points are first corrected by subtraction of the mean bubbler blank. The statistical program forces the regression line through zero (0,0). Results are then corrected for the average chart values of at least three preparation blanks (PBs).

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

10.1.3. To calculate total mercury in waters (ng/L), use the following equations:

10.1.3.1. THg/Aliquot (ng) = [(Peak Height or Peak Area)-B]/A

10.1.3.2. THg Gross (ng/L) = [(THg/Aliquot)/V_a/D]*(1000 mL/L)

10.1.3.3. THg Net (ng/L) = [(THg Gross)/F]-(PB*X)

Where:

- **B** is the average bubbler blank peak height or peak area (in units)
- **A** is the slope of the calibration curve (in ng/units)
- $\mathbf{V_a}$ is the volume of sample analyzed (the aliquot size) in mL
- **D** takes into account any dilution of the sample and is expressed as a fraction (0.2 = 1/5 dilution)
- **F** equals: 1-[BrCl%/(1+BrCl%)]; F is expressed as a fraction which accounts for the dilution of a sample from the addition of BrCl. Taking a 100 mL aliquot of a sample preserved at 5% BrCl would result in F = 0.9524. This corresponds to the percentage of the 100 mL volume which is actual sample
- **PB** is the average of the preparation blanks in ng/L
- **X** is an integer related to the preservation level of the samples (i.e., X=2 for a sample which is preserved at 2% BrCl), thus accounting for the extra contribution of mercury from the BrCl

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

10.2. Total Mercury in Solids

10.2.1. To calculate total mercury in a solid (ng/g), use the following equations:

10.2.1.1. THg/Aliquot (ng) = [(Peak Height Or Peak Area)-B]/A

10.2.1.2. THg Gross (ng/L) = [(THg/Aliquot)/V_a/D]*(1000 mL/L)

10.2.1.3. THg/Digest (ng) = [(THg Gross-PB)*V_d/(1000 mL/L)]

10.2.1.4. THg Solid (ng/g) = (THg/Digest)/m

Where:

- **B** is the average bubbler blank peak height or peak area (in units)
- **A** is the slope of the calibration curve (in ng/units)
- $\mathbf{V_a}$ is the volume of sample analyzed (the aliquot size) in mL
- $\mathbf{V_d}$ is the final digested volume of the digest in mL
- **D** takes into account any dilution of the sample and is expressed as a fraction (0.2 = 5x dilution)
- **m** is the mass of the sample that can be expressed as either a dry or wet weight. (in grams)
- **PB** is the average of the preparation blanks in ng/L

11.0 REFERENCES

11.1. EPA Method 1631, Revision B: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, **1999**.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

11.2. Bloom, N.S. and Tsalkitzis, E. Standard Operating Procedure FGS-012: Determination of Total Mercury in Aqueous Media (Modified EPA Method 1631). *Frontier Geosciences Inc., Quality Assurance Manual* **1996**.

11.3. Bloom, N.S. Ultra-Clean Sample Handling, *Environmental Lab* **1995,** March/April, 20.

11.4. Bloom, N.S., Horvat M., and Watras C.J. Results of the International Mercury Speciation Intercomparison Exercise. *Wat. Air Soil Pollut.* **1995,** 80, 1257.

11.5. Bloom, N.S.; Crecelius, E.A. Determination of Mercury in Seawater at Sub-nanogram per Liter Levels. *Mar. Chem.* **1983**, 14, 49.

11.6. Bloom, N.S.; Crecelius, E.A. Distribution of Silver, Lead, Mercury, Copper, and Cadmium in Central Puget Sound Sediments *Mar. Chem* **1987**, 21, 377-390.

11.7. Bloom, N.S.; Fitzgerald, W.F. Determination of Volatile Mercury Species at the Picogram Level by Low-Temperature Gas Chromatography with Cold-Vapor Atomic Fluorescence Detection. *Anal. Chem. Acta.* **1988**, 208, 151.

11.8. Cossa, D.; Couran, P. An International Intercomparison Exercise for Total Mercury in Seawater. *App. Organomet. Chem.* **1990**, 4, 49.

11.9. Fitzgerald, W.F.; Gill, G.A. Sub-Nanogram Determination of Mercury by Two-Stage Gold Amalgamation and Gas Phase Detection Applied to Atmospheric Analysis. *Anal. Chem.* **1979**, 15, 1714.

11.10. Gill, G.A.; Fitzgerald, W.F. Mercury Sampling of Open Ocean Waters at the Picogram Level. *Deep Sea Res.* **1985**, 32, 287.

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

EPA Method 1631 E	Frontier SOP FGS-069	Comments
BrCl-preserved samples are stable for 90 days from collection	BrCl-preserved samples have demonstrated stability for up to 6 months	Frontier routinely analyzes samples well within EPA hold-time specifications
MS/MSD spiking level set at HIGHER of compliance limit or 1-5x sample concentration. 10% spike frequency required	MS spiking level set at 1-5x sample concentration, or 1-5x the reporting limit. 4-5% spike frequency required	A spiking level discrepancy only exists in rare instances in which a compliance limit is specified by the client. Clients may also request an increase in spike frequency
Three bubbler blanks required (one per bubbler) for every 20 samples	One bubbler blank after ICV and each CCV required	Frontier's bubbler blanks are distributed throughout the analytical run, and allow for more representative correction
Field, filter, and equipment blanks required	Field, filter, and equipment blanks are analyzed at client request, and are billable	Frontier recommends field, filter, and equipment blanks
Ongoing Precision and Recovery (OPR): before and after every 20 samples), followed by bubbler blank	ICV/CCV and ICB/CCB run at the beginning of each run, after every 10 samples, and at the end of the run. Additionally, at least one matrix-specific CRM is run per analytical day	Frontier exceeds the EPA frequency requirement for calibration verification
3 method blanks representing each preservation level are required for every 20 samples	3 method blanks representing 1% BrCl preservation are analyzed for each analytical day	Frontier corrects for higher preservations using a product of the 1% preservation data
Calibration based on the mean of at least 5 non-zero calibration factors with an RPD ≤15%	Calibration based on a linear regression analysis of at least 5 non-zero calibration points forced through the origin, with an $r > 0.995$	The use of regression analysis is automated for all of Frontier's methodologies, and results in no loss of statistical significance.

APPENDIX A: Summary of Differences Between the Requirements of EPA Method 1631 E and this SOP (Frontier SOP FGS-069)

All Frontier SOPs are Proprietary Information and protected by WA state law. Proprietary Information shall be kept in the strictest confidence and shall not be used or appropriated to benefit any party without prior written consent to Frontier.

Microseeps, Incorporated

Analytical Method AM20GAx Standard Operating Procedure for the Analysis of Biodegradation Indicator Gases

Controlled Copy No. ____

Controlled Document
Confidential

Dominic Nestasie
Laboratory Director

Signature of Final Approval:

Patrick McLoughlin, Ph.D.
Author and Technical Director

3-17-03
Date

1.0 Scope and Application

Method AM20GAx is used to determine the concentration of biodegradation indicator gases in vapor samples. Specifically, Method AM20GAx is used to determine the dissolved concentration of the following gases:

Gases	CAS Number
Carbon dioxide	124-38-9
Oxygen	7782-44-7
Nitrogen	7727-37-9
Hydrogen	1333-74-0
Methane	74-82-8
Ethane	74-84-0
Ethene	74-85-1
Propane	74-98-6
Propene	115-07-1
n-Butane	106-97-8
i-Butane	75-28-5
Carbon Monoxide	630-08-0

This method is recommended for use by, or under the supervision of, analysts experienced in sample preparation, the operation of gas chromatographs and in the interpretation of chromatograms.

2.0 Method Summary

The sample gas is analyzed with a gas chromatograph capable of simultaneous analysis of all of the target analytes from a single 10 mL gas sample. A single injection of gas from integral, simultaneously filled sample loops is used to assure consistent injection volume. The permanent gases are analyzed using a thermal conductivity detector (TCD). The light hydrocarbons are analyzed using a flame ionization detector (FID). Hydrogen is analyzed using a reduction gas detector (RGD). The data are transferred to a microcomputer, converted to digital format, stored, and processed using a chromatography data system.

2.1 Definitions

Instrument Flush: The front end of the sample loop is flushed with ultra high purity helium injected into the loop directly from the cylinder to remove possible interference by ambient air and to avoid cross contamination between samples.

Method Blank: A sample analyzed by all three detectors that consists of ultra high purity helium. The method blank is free from the analytes of interest

Laboratory Control Sample: A sample spiked with verified known amounts of analytes. A LCS is used to assess the performance of the measurement system.

Matrix Spike and Matrix Spike Duplicate: A sample prepared by adding a known concentration of target analyte to a specific amount of sample. Matrix spikes are used to determine the effect of sample matrix on a method's recovery efficiency.

3.0 Apparatus and Materials and Operating Conditions

3.1 Apparatus

Gas Chromatograph: The chromatograph designed and built by Microseeps is equipped with multiple packed columns and multi-port valves, a TCD, a FID, a RGD, and multiple sample loops. The FID, which is also built by Microseeps, is of a special design that allows considerably more sensitivity than commercially available models. To increase the working range of the system, there are two outputs to the FID. Thus, it is a four-channel system: (1) FID low; (2) TCD; (3) RGD; and (4) FID high. As discussed in Section 5.3, each channel is calibrated separately. This instrument provides rapid turn-around for consecutive analyses and a clean baseline for accurate, reproducible results.

3.2 Materials

- Sample vials (Supelco, Inc, Bellefonte, PA or equivalent)
- Syringe: locking gas tight

3.3 Operating Conditions

Gas Chromatograph:

• Sample Loop Temperature:	ambient
• Thermal Conductivity Detector Temperature:	100°C
• Flame Ionization Detector Temperature:	ambient
• Reduction Gas Detector Temperature:	280°C
• Oven Temp.:	100 °C. isothermal
• TCD Signal Range:	1
• FID Signal Range:	variable depending on concentrations
• RGD Signal Range:	1
• He Carrier Gas Regulator Pressure:	60 psig
• Sample carrier flow:	30 mL/min.
• Reference flow:	30 mL/min.
• N2 Carrier Gas Regulator Pressure:	25 psig

- Sample carrier flow: 25 mL/min
- Valve Air Pressure: 60 psig.

3.3.1 Interferences

The most likely source of "interference" is ambient air. Due to the relatively high concentrations of oxygen and nitrogen, a very small amount of air as a contaminant will dramatically affect the results. The analyst must take great care to ensure that air is flushed from the gas tight syringe before sample preparation and that no air has entered the syringe or needle prior to injection of the sample into the gas chromatograph.

Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. An unrestricted flow (Instrument flush) of pure carrier gas from a 10 psig source should be allowed to flow through each sample loop for 30 seconds prior to each analysis.

As required, the analyst should demonstrate the absence of carryover contamination by analysis of the contents of the sample loop when purged with carrier gas. This demonstration should be performed when carryover contamination is suspected (after high samples). In the event that 'ghost peaks' (peaks similar to previous sample) appear when a pure carrier gas sample is analyzed (method blank), measures should be taken to eliminate the carryover contamination.

4.0 Reagents

- Helium (UHP Gas)
- Nitrogen (UHP Gas)
- Certified Commercial Gas Standards

4.1 Standard Preparation Procedures

Calibration standards are prepared by using the procedures below:

4.1.1 Vial Preparation

Headspace vials used for instrument calibration standards for this method are prepared as follows:

- Crimp and cap each vial, with stopper septa.
- Evacuate each vial to vacuum below 100 millitorr.
- Flush each vial to atmospheric pressure with the vial preparation gas. The gas used depends upon the detector that is being calibrated and is specified in Table 4.1 below:

Table 4-1

Detector	Vial Preparation Gas	Standard Mix Vendor
FID	Nitrogen	Spectra
TCD	Helium	Scotty
RGD	Nitrogen	Spectra and Scotty

4.1.1 Preparing Calibration Standards

Instrumentation is calibrated using dilutions of custom certified gas mixes. (Refer to Table 4-2 for the correct amounts of standard mix and vial preparation gas to inject into prepared vials.)

- Prepare the correct number of vials as specified above for the detector being calibrated.
- Inject the specified amount of standard by extracting it from the standard mix gas cylinder using a gas-tight syringe and injecting it into a prepared vial.
- Then the specified amount of vial preparation gas is added to the same vial.

The dilution factor of one is achieved by directly injecting the standard gas mix from the cylinder into the GC.

Table 4-2

Dilution Factor	FID		TCD		RGD	
	Standard Gas Mix	Prep. Gas	Standard Gas Mix	Prep. Gas	Standard Gas Mix	Prep. Gas
1	Direct inject mix into GC		Direct inject mix into GC		Direct inject Spectra mix into GC	
2	21cc	0 cc	21cc	0cc	21cc Scotty	0cc
3	15cc	9cc	N/A	N/A	N/A	N/A
10	4cc	15cc	4cc	15cc	4cc Spectra	15cc
100	0.5cc	28.5cc	0.5cc	28.5cc	0.5cc Spectra	28.5cc

4.2 Quality Control Sample Preparation

Quality control samples are prepared as indicated below.

4.2.1 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

The LCS and LCSD are directly injected into the sample port from a second source certified standard gas mix. A needle is plumbed to the cylinder and used to inject the gas into the sample loop.

4.2.2 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS and MSDs are prepared when clients' request and send sufficient numbers of aliquots to prepare them (e.g. one 40 ml vial each for the MS and the MSD). They are prepared, one at a time, as follows:

- Using a clean 50ml gas-tight locking syringe, withdraw a volume of water from the bottom of the sample vial.
- Withdraw 10 cc of the certified standard gas used for preparing the LCSs and lock the syringe.
- Shake the syringe by hand (for use a wrist action shaker) for five minutes.
- The equilibrated MS and/or MSD is/are now ready to be analyzed.

4.2.3 Method Blank

Method blanks are made up of ultra high purity helium injected into a vial and then into the instrument.

4.3 Glassware and Storage Requirements for Reagents and Standards

Reagents are stored at ambient room temperature and all standards are prepared shortly before analyses.

5.0 Procedure

The sample must be received and processed via Microseeps SOP for those procedures. Gas samples are shipped and received at a positive pressure, which eliminates a cross-contamination issue during sample shipment. They are stored at ambient temperature to avoid creating a pressure reduction in the samples upon cooling. Such a pressure reduction could lead to a drawing of atmospheric gas into the sample. A sample batch consists of twenty or fewer samples run during an eight-hour work shift.

Analysts who use this method have been certified for the method by running Initial Demonstration of Proficiency Samples. The IDOPs are an identical set of 4 samples (PM01/AM20Gax uses tap water and AM20Gax uses known standard concentrations) run

consecutively. IDOPs are run any time there is significant change to an instrument, method, or in the Training procedure for training a new analyst.

The percent relative standard deviation (%RSD) is calculated for the IDOPs by:

$$\%RSD = \frac{\sigma_{n-1}}{S} \times 100\%$$

Where:

% RSD = the percent relative standard deviation.
σ_{n-1} = the standard deviation about the mean.
S = the mean response $(X_1 + X_2 + X_3 + X_4)/4$

The %RSD must be less than 20%. If this criterion is not met, the system is checked and the IDOP samples are re-analyzed.

5.1 Sample Preparation

Samples that are collected using the Bubble Strip Sampling Technique, Microseeps Sampling Method SM9, do not require additional preparation prior to analysis.

Samples that are collected as waters and are to be analyzed for dissolved gases (CO_2, N_2, O_2) must be prepared using Microseeps Standard Operating Procedure PM01G.

Samples that are collected as gases, for example from a soil gas survey or from the headspace of a microcosm sample, need not be collected by a Microseeps sampling method, nor do they require additional preparation.

5.2 Analysis

5.2.1 If the sample is prepared via DGPM 01, it can be injected from the gastight syringe in which it is prepared by inserting the needle of the syringe through the septum on the "sample in" port. If the sample is a calibration standard, a bubble strip sample (SM9), or a gas, the septum inlet to the "sample in" port of the GC must be removed and a luer-lock needle receptacle is plumbed to the "sample in" port in place of the needle. A needle is attached to the luer-lock receptacle and inserted through the septa of the calibration standard, bubble stripped sample, or gas sample.

In order to initiate analysis and introduce the sample into the GC sample loop, a needle is attached to the entry port on the GC and inserted through the sample septum. The flow through the sample loop is monitored by a flow meter connected to the sample-loop vent-port on the gas

chromatograph. If the loop is not properly pressurized, this is reflected on the flow meter immediately.

5.2.2 If the flow is insufficient the vial is rapidly removed. A clean, gas-tight syringe is flushed with He, the plunger of that syringe is completely depressed, and the needle of that syringe is inserted through the sample septum. The plunger of that syringe is allowed to expand completely. The syringe is removed from the sample and its contents are discharged into an appropriate receptacle. 22 ml. of nitrogen are then used to pressurize the sample vial, the dilution is noted, and the sample is injected onto the GC as though it were a properly over-pressurized sample.

5.2.3 Once the flow out of the sample loop ceases (3 seconds if DGPM 01 is used) the sample loop valves are activated.

5.2.4 Once the sample loop valves are activated, the ports to and from the sample loop are flushed with ultra high purity helium injected into the loop directly from the cylinder to remove any interference from ambient air and to avoid cross contamination between samples.

5.3 Calibration and Results

5.3.1 The standard calibration gas should be introduced in the same manner as described in section 5.2.1 above. Measured peak areas are converted to concentrations using certified commercial gas standards. Dilutions are made to achieve multi-point calibration curves for each detector.

5.3.2 Initial calibration is accomplished by analyzing multiple standards of appropriate calibration ranges. Table 5.1 specifies the approximate concentrations of calibration standards for each detector.

Note: Due to the nature of preparing custom gas standards, the component concentration can fluctuate between purchased lots. This is accounted for during method/calibration development. These results will be used to establish a multi-point calibration curve.

Acceptance Criteria: A linear fit to an area response versus concentration plot is formed with the origin forced to zero, and the calibration is accepted for use if r^2, the coefficient of determination is ≥ 0.995.

Corrective Action: If the acceptance criteria specified above is not met, the reason is determined and a new set of calibration standards are analyzed.

5.3.3 An Initial Calibration Verification (ICV) standard immediately follows the initial calibration. The ICV is made up separately from the same stock standards used to make up the ICAL. (Second source requirement in LCS) Acceptance criterion for the ICV is an instrument response of $\leq$ (less than or equal to) 20% (%D).

Acceptance Criteria and Corrective Action: If the instrument response for the ICV standard varies by more than 20% (%D), the analyst will not analyze samples until either the reason is determined and the problem is corrected, or a new multi-point calibration is analyze

Table 5.1

COMPOUND	FID-LOW (ppmv)	FID-HIGH (ppmv)	TCD (% V)	RGD (ppmv)
carbon dioxide	-	-	15, 7.5, 0.15	-
oxygen	-	-	7, 3.5, 0.07	-
nitrogen	-	-	66.5, 33.3, 0.665	-
hydrogen	-	-	-	100, 25, 2.5, 0.25
methane	300, 100, 30, 3	1000, 300, 100, 30	4.5, 2.25, 0.045	-
ethane	100, 33.3, 10, 1	1000, 100, 33.3, 10	-	-
ethene				
propane	100, 33, 10, 1	100, 33.3, 10	-	-
propene				
i-butane				
n-butane				

5.3.4 An initial calibration blank follows the ICV. The blank is made up of the carrier gas. Compounds must not be detected above the reporting limits.

Corrective Action: If the blank does not meet the acceptance criterion, another blank is injected until the results are within the acceptance criterion.

5.3.5 The analytes of this method are indicators. Every attempt to achieve and deliver precise results is made. However, it is realized that for indicator parameters measuring the range of the analyte concentration (*i.e.* is the concentration of methane gas >1 mg/l or < 0.1 mg/l?) is the primary goal of employing these analyses. The calibration range is chosen to extend over the entire useful bio-indicator concentration range. If the concentration of an analyte exceeds that of the highest calibration standard, the concentration is calculated by assuming detector response linearity and using an extrapolation of the calibration plot.

5.3.6 The unique combination of analytes used in this method makes it impractical to find a second source for the calibration mix. To insure that the calibration is accurate, the first use of a new standard is as a CCV against a calibration prepared with the old standard. If this CCV passes the standard CCV criteria, the new standard is placed into routine use. This insures that as the original source of the master mix from which our standards are prepared is switched,

Microseeps checks the reported calibration of the new against the old. If the client requests a formalized check of the standard, a calibration check standard can be analyzed and included in the clients report provided that the request for this service is made prior to collection of the samples.

5.4 Quality Control

The following quality control samples shall be analyzed with each analytical batch of twenty or fewer samples.

5.4.1 A Continuing Calibration Verification: The CCV is made up separately from the same stock standards used to make up the initial calibration. The acceptance criterion for the CCV is a percent drift of ± 20%.

Corrective Action: If the CCV fails, the instrument shall be recalibrated, and all samples since the last acceptable calibration shall be reanalyzed, provided sufficient sample volume is present and the samples have not been compromised by exposure to air.

5.4.2 A Continuing Calibration Blank: A CCB follows each CCV. The blanks are made up of the carrier gas. The acceptance criterion for the blank is the result must be less than the reporting limits for all compounds.

Corrective Action: If the blank does not meet the acceptance criterion, another blank is injected until the results are within the acceptance criterion.

5.4.3 Laboratory Control Sample and Laboratory Control Sample Duplicate: The LCS and LCSD are prepared at a mid-calibration range and comes from a source other than the calibration standards. The acceptance criterion is a percent recovery between 75% and 125% and a Relative Percent Difference of less than or equal to 20%.

$$Percent\,\mathrm{Recovery} = \frac{MeasuredValue}{TrueValue} \times 100\%$$

$$RPD = \frac{|C1 - C2|}{\frac{C1 + C2}{2}} \times 100\%$$

Where: C1=LCS
C2=LCSD

Corrective Action: If the LCS fails, a new LCS is prepared and analyzed. If the new LCS falls within the acceptance criterion, analysis continues. If the new LCS fails, analysis is stopped and the instrument is checked with a series of standards to determine the cause. Once the cause is determined and the instrument repaired, calibration is conducted and analysis continues.

5.4.4 Matrix Spike and Matrix Spike Duplicate: Matrix spikes and spike duplicates are analyzed for water samples only when requested by a client and sufficient sample aliquots are provided. Acceptance criterion is a percent recovery between 70% and 130%, and a relative percent difference of less than or equal to 20%.

Corrective Action: If the matrix spike and spike duplicate fails but all the other quality control samples are within the acceptance criteria, a matrix interference is noted in the Case Narrative.

5.4.5 Method Blank: A method blank is analyzed with each sample batch. The blanks are made up of UHP helium. The acceptance criterion for the blank is the result must be less than the reporting limits for all compounds.

Corrective Action: If the blank does not meet the acceptance criterion, another blank is injected until the results are within the acceptance criterion.

5.4.6 Contingency for Handling Out of Control or Unacceptable Data

If the requirements set forth in section 5.4 are not met, the analytical program will be terminated until the cause is determined and a solution is affected. All samples associated with out of control quality control samples (with the exception of matrix interference) must be reanalyzed provided another vial of sample has been provided by the client. If quality control acceptance criteria cannot be met using the corrective action above, a detailed check of the analytical system is made. Reagents, standards, and other quality control samples are re-prepared and analyzed. If problems persist, sample analysis will be halted and the Technical Director shall be contacted immediately to determine the cause and implement corrective action.

Any data submitted with unacceptable quality control sample results shall be qualified in a case narrative. The narrative should indicate the out of control event that occurred, the corrective action that was taken, and any other pertinent information to inform the client of exactly what occurred.

5.4.7 An experienced analyst shall examine all chromatograms.

5.4.8 Through out analysis the gas samples are injected mechanically into the GC flow path utilizing a sample loop to achieve a uniform sample size from a flow directly from the sample preparation syringe. The uniform sample size achieved using the sample loop assures consistent and accurate results. Table 5.2 (see next page) gives example data from a study performed via this analysis. That data can also be used for accuracy and precision estimates.

Table 5.2
Example Data for Precision and Accuracy Studies

	Carbon Dioxide	Oxygen	Nitrogen	Methane	Hydrogen	Methane	Ethane	Ethylene	Propane	Propylene	Iso-Butane	N-Butane
REP. #	(%v)	(%v)	(%v)	(%v)	(PPMV)	(PPMV)	(PPMV)	(PPMV)	(PPMV)	(PPMV)	(PPMV)	(PPMV)
1	0.1221	0.0670	0.5744	0.0410	0.1118	0.2512	0.0525	0.0453	0.0461	0.0581	0.0473	0.0358
2	0.1267	0.0690	0.6020	0.0428	0.1122	0.2608	0.0518	0.0468	0.0521	0.0465	0.0439	0.0407
3	0.1207	0.0657	0.5838	0.0446	0.1247	0.2812	0.0509	0.0485	0.0529	0.0588	0.0436	0.0405
4	0.1193	0.0667	0.6036	0.0444	0.1244	0.2779	0.0549	0.0460	0.0461	0.0536	0.0549	0.0476
5	0.1261	0.0703	0.5860	0.0439	0.1120	0.2894	0.0551	0.0497	0.0520	0.0549	0.0417	0.0460
6	0.1193	0.0665	0.5861	0.0478	0.0943	0.2970	0.0515	0.0467	0.0458	0.0542	0.0435	0.0514
7	0.1227	0.0732	0.5748	0.0353	0.1296	0.3053	0.0532	0.0473	0.0485	0.0584	0.0483	0.0535
AVERAGE	0.1224	0.0683	0.5872	0.0428	0.1156	0.2804	0.0528	0.0472	0.0491	0.0549	0.0462	0.0451
KNOWN	0.1500	0.0700	0.6649	0.0450	0.0999	0.1500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500
STD. DEV.	0.003	0.003	0.012	0.004	0.012	0.019	0.002	0.001	0.003	0.004	0.004	0.006

5.4.9 The gas matrix for this analysis minimizes the opportunity for matrix effects. If the gas is prepared from a matrix other than that which is injected into the GC (*e.g.* prepared through headspace extraction via Microseeps SOP-PM01), the client should request that matrix spike (MS) and matrix spike duplicate (MSD) analyses be conducted and should supply sufficient sample volume. Since matrix effects are extremely site dependent, the MS and MSD are not part of the regular analytical quality assurance program.

In order to determine analytical precision, relative percent difference (RPD) is calculated between the matrix spike and matrix spike duplicate results using the following formula:

$$\%RPD = \frac{|C_1 - C_2|}{\left|\frac{C_1 + C_2}{2}\right|} x100$$

Where: C_1= Matrix Spike Result
C_2= Matrix Spike Duplicate Result

In order to determine accuracy, percent recovery of the matrix spike is calculated using the following formula:

$$\% \text{ Recovery} = \frac{\text{concentration found}}{\text{concentration added}} \text{ X } 100$$

5.4.10 All of the target analytes are gases at room temperature so the opportunity for carry over is negligible. Because of the configuration of the GC used in this analysis, any possible carryover would only manifest itself as a ghost peak, well out of the RT windows of any analytes and thus never misinterpreted. For these reasons, samples that have high concentrations of analytes do not need to be followed by a blank analysis.

5.5 Capturing and Submitting Data

5.5.1 The output of the chromatograph is directed to a microcomputer where the signal is converted to digital format, stored, and processed using a chromatography data system.

5.5.2 Automated valve control: Digital control is provided by the microcomputer though the chromatography data-system software. This control provides constant start and stop times for directing carrier gas flow. The event times are programmed and saved using the method editor module of the software.

5.5.3 Calibration records are generated in electronic and hard copy formats and stored. All such records will be maintained in the laboratory during the course of the project and thereafter as determined by the client.

5.5.4 The instrument produces four channels of data, and an output is generated from each sample for each channel. Each channel is used for a distinct set of analytes, in a distinct range. The channel designations are listed in Table 5.3 below, as are the analytes and range specification for each analyte.

Table 5.3

FID	FID/10	TCD	RGD *
iso-butane (low)	iso-butane (high)	carbon dioxide	hydrogen
n-butane (low)	n-butane (high)	nitrogen	
propene (low)	propene (high)	oxygen	
propane (low)	propane (high)	methane (high)	
ethane (low)	ethane (high)	carbon monoxide	
ethene (low)	ethene (high)		
methane (low)	methane (high)		

* If hydrogen is not a required analyte, the GC may be run without this channel activated. This reduces the generation of unused records and the consumption of power.

If an analyte is not detected on the most sensitive channel, it is recorded as a non-detect. That channel, designated low, is used until the detector output as read from the chromatograph of the channel, exceeds 2V. At that point the next most sensitive detector ("mid" if available, or "high" otherwise) is used. If that saturates, the "high" detector is used if available. Otherwise, the sample is diluted and re-analyzed. The saturation limit, in terms of concentration, varies machine to machine and calibration-to-calibration, so universal cut-offs cannot be supplied here. The final choice of which channel to use when reporting results is up to the experienced analyst and depends upon the sample response, the calibration, and the history of the instrument.

5.5.5 This analysis produces concentration of the analyzed gas in PPMV or % V. If the sample was collected via the bubble-strip method (Microseeps SOP SM9) or prepared through static headspace preparation (Microseeps SOP DGPM 01), the gas phase concentrations can be used to specify sample water concentrations via the calculations presented in those Standard Operating Procedures.

6.0 Secondary Data Review

All analytical data must undergo a minimum of a two-tiered review. The analyst first reviews the data for completeness and accuracy. The data is then submitted to the Group Lead Analyst for final review and the data is entered into the LIMS. Once approved at this level, the data is released as a final report.

7.0 Reporting Limits

The reporting limits for this analysis are listed in table 7.1 below. The method detection limits for this procedure must be determined by conducting annual MDL Studies. Those MDLs must be less than the reporting limits specified below. MDL studies are also performed when there is reason to suspect that method sensitivity has changed. MDLs are determined by analyzing seven aliquots of a known standard (estimated to be 3 to 5 times the lowest concentration that can be seen above noise level) through the procedure, and calculating the mean and standard deviation. Once the seven aliquots are run the results are given to the Quality Systems Coordinator. The MDL studies are kept on file in the Quality Systems Office.

Reporting Limits
Table 7.1

Parameter	Reporting Limit	Units
Carbon Dioxide	0.02	%V
Oxygen	0.02	%V
Nitrogen	0.04	%V
Hydrogen	0.02	ppmv
Methane	0.06	ppmv
Ethane	0.01	ppmv
Ethene	0.01	ppmv
Propane	0.01	ppmv
Propene	0.01	ppmv
n-butane	0.01	ppmv
i-butane	0.02	ppmv

7.2 Conversion Factors

This procedure is used to measure the volume concentration of the analytes in a gas. Two methods are used to extract that gas from the groundwater. The conversion factors that are used to convert the concentration of the analytes in the water from the concentration of the analytes as they are measured using this method, are specific to the collection or preparation method and can be found in either SOP-SM9 or SOP-DGPM 01.

8.0 Safety

Gloves, proper eye protection, and a laboratory coat shall be worn when handling samples and standards. The major hazard in this laboratory area is stick from needles. All needles must be capped when not in use and when moving about the laboratory. The proper way of capping a needle is to place the cap on the laboratory bench and direct the needle into the cap. A needle is never to be directed into a cap while the cap is being held.

All compressed gases are to be moved using a dolly made for transporting gases and shall be chained in place when in the laboratory. The chain shall be tightened sufficiently to keep the cylinder upright if jostled.

9.0 Laboratory Waste

Samples are kept for 30 days following analysis. There is no hazardous waste generated during this analytical process. The analysts dispose of the sample vials in the general laboratory trash according to Microseeps Standard Operation Procedure for Waste Disposal (SOP-ADM 14).

9.1 Waste Minimization

Where possible, Microseeps takes steps to minimize the amount of waste generated in the laboratory by using substitution, where possible, and good chemical handling procedures. For specific information on waste minimization consult SOP-ADM 14.

10.0 References

U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste. SW-846, 3rd ed., Office of Solid Waste and Emergency Response, Washington, DC. 1986.

Newel, B.S., RSKSOP-175, Sample Preparation and Calculations for Dissolved Gas Analysis in Water Samples using a GC Headspace Equilibration Technique. Revision No. 0, August 1994.

Newel, B.S., RSK-SOP-147, Gas Chromatographic Analysis of Gaseous Samples for Part-Per-Million Levels of Nitrous Oxide, Methane, Ethylene, and Ethane. Revision No. 0, August 1993.

American Society for Testing and Materials, Standard Practice for Analysis of Reformed Gas by Gas Chromatography. Annual Book of ASTM Standards. Vol. 14.02, 1994.

Kampbell, D.H. and Vandegrift, S.A., Analysis of Dissolved Methane, Ethane, and Ethylene in Ground Water by a Standard Gas Chromatographic Technique. Journal of Chromatographic Science. Vol. 36, May 1998.

Microseeps, Inc.

Standard Operating Procedure For the Measurement of Sulfide

(Ref. Method EPA 376.1)

Controlled Copy No._____

Controlled Document

Dominic Nestasie
Laboratory Director

Signature of Final Approval:

Patrick McLoughlin Ph.D.
Technical Director

12-23-02
Date

1.0 Purpose and Application

The purpose of this method is to determine the concentration of sulfide present in environmental samples. Method references are cited in Section 10.0 of this standard operating procedure.

1.1 Analyte List

This method is used exclusively for determining sulfide.

1.2 Matrix

This method is applicable to the measurement of total and dissolved sulfides in surface and saline waters, and domestic and industrial wastes in concentrations above 2 milligram per liter (mg/l).

2.0 Method Summary

Sulfide concentration is determined by adding excess iodine to a sample and back titrating with sodium thiosulfate solution. One ml of 0.0250 N iodine solution reacts with 0.4 mg S^{-2}.

2.1 Definitions

Laboratory Control Sample: sample matrix free from analytes of interest, spiked with verified known amounts of analytes; used to assess the performance of the measurement system.

Matrix Spike and Spike Duplicates: samples prepared by adding a known concentration of target analyte to a specific amount of sample; used to determine the effect of sample matrix on a method's recovery efficiency.

Method Blank: a sample of similar matrix that is free from the analytes of interest that is processed through all the steps of the analysis with other samples. No target analytes should be present at concentrations that impact the analytical results.

2.2 Method Limitations

The largest interference potential arises from the oxidation of sulfide prior to analysis. This is facilitated by inadvertent introduction of oxygen into the sample. Sulfide samples should be taken with minimal aeration to the sample since sulfide is readily volatilized by aeration.

As preservation, four drops of zinc acetate solution and 0.1 ml or 2 drops of 1N sodium hydroxide (NaOH) solution are added to a 125 ml bottle. In basic solutions, zinc sulfide is insoluble; this combination of preservatives precipitates the sulfide out of the water. This reduces the chances for oxidation of the sulfide during storage.

3.0 Apparatus, Materials and Operating Conditions

3.1 Apparatus

- 50 ml burret
- 150 ml plastic specimen cups

3.2 Materials

- Miscellaneous glassware
- Serological pipettes

3.3 Operating Conditions

Not Applicable

4.0 Reagents

Standards and reagents that are produced in-house are made using laboratory-grade chemicals purchased from reputable chemical companies. All deionized water is processed through a filtration system that produces 18-Mohm water. The deionized water conforms to the specifications of ASTM Type II water. The sulfide stock standard solution is made using degassed deionized water processed as described below.

4.1 Reagent and Standard Preparation Procedures

4.1.1 Degassed water:

- Place the water to be degassed into a 4L side-arm vacuum Erlenmeyer flask with a clean, 18 Mohm water rinsed star bar. Stopper the top of the flask.
- Set the flask atop a stir plate. With the rotation initially at zero, gradually increase it so that the water throughout the entire flask is well stirred.
- Attach the side arm to mechanical vacuum pump inlet and turn on the pump. Make sure that there is a liquid trap between the flask and the pump.
- Pump-on and mix the solution for ~ 1hour, insuring that there are no bubbles coming out of solution by the time pumping is ceased.
- Clamp the line from the sidearm to the trap closed and break the connection after the clamp. Turn off the stir plate. Be sure to handle the water with a minimum of agitation and atmospheric exposure.

4.1.2 1:4 Sulfuric Acid (H_2SO_4): Carefully add 100 ml of concentrated sulfuric acid to 400 ml of de-ionized water.

4.1.3 6N Hydrochloric Acid (HCl): Carefully add 250 ml of concentrated hydrochloric acid to 250 ml of de-ionized water.

4.1.4 Standard Starch Indicator: Certified solution purchased commercially

4.1.5 Standard Sodium Thiosulfate: Certified solution purchased commercially.

4.1.6 Standardization of Sodium Thiosulfate:

Sodium thiosulfate shall be standardized prior to each use.

- Dissolve 2 g of KI in 150 ml of DI water in a 500 ml Erlenmeyer flask.
- Add 10.0 ml of (1:4 H_2SO_4).
- Add 20 ml of 0.0375 N Potassium biiodate and place in the dark for 5 minutes.
- Dilute the solution to approximately 300 ml with DI water and titrate to a pale yellow color with sodium thiosulfate.
- Add 1 ml of starch indicator solution and continue the titration until the blue color disappears.
- The concentration of the sodium thiosulfate can be calculated using the following:

$$Na_2S_2O_3\,(N) = \frac{0.75}{A}$$

Where:

A = ml $Na_2S_2O_3$ solution used in titration

4.1.7 Potassium biiodate solution: Dissolve 1.2182 g of potassium biiodate (that has been dried for two hours at 103 into de-ionized water and diluting the solution to 1000 ml. The potassium biiodate solution should be prepared fresh monthly.

4.1.8 Standard iodine solution - 0.025N (commercially available):

- Dilute to 1 liter and standardize against 0.0250 N sodium thiosulfate using a starch indicator.

4.1.9 Standardization of iodine solution:

The iodine solution shall be standardized once per month.

- Pipette 20 ml of 0.025 N Iodine into a 125 ml Erlenmeyer flask. Add 2 ml of 6 N HCl. Titrate with 0.025 N sodium thiosulfate to a pale yellow color. Add 1 ml of starch indicator solution and continue the titration until the blue color disappears.

$$(N)\text{Iodine} = \frac{(N)\,Na_2S_2O_3 \times (V)\,Na_2S_2O_3}{20}$$

(N) = Normality of sodium thiosulfate
(V) = Volume of sodium thiosulfate added

4.1.10 Sulfide Stock Solution: Dissolve 4.02g $Na_2S \cdot 9H_2O$ into de-ionized and degassed water and dilute to 1000 mL. This produces a solution with a concentration of 680ppm sulfide.

4.1.11 Calibration Standards: Calibration standards are made by adding 6.25ml of the 680ppm sulfide stock solution to 118.75ml deionized water to make a 34ppm initial calibration standard, and the continuing calibration verification.

4.2 Quality Control Sample Preparation

4.2.1 Laboratory Control Sample (LCSW): Prepared by diluting 5 ml of the sulfide reference solution to 100 ml with de-ionized water.

4.2.2 Matrix Spike: Prepared by adding 5 ml of the sulfide reference solution to 95 ml of sample.

4.2.3 Matrix Spike Duplicate: Prepared by adding 5 ml of the sulfide reference solution to 95 ml of sample.

4.3 Glassware and Storage Requirements for Reagents and Standards

All reagents and standards are stored in compatible containers. The only standard that is refrigerated is the sulfide stock solution. All storage containers are labeled with the reagent name, components and volumes used, date, and initials of the analyst by whom it was prepared. Iodine is stored in an amber jar to protect it from exposure to light.

All glassware used in this procedure is cleaned in a solution of Citranox® detergent.

5.0 Procedure

Samples are collected in zinc acetate and sodium hydroxide preserved 125 ml polypropylene bottles and cooled to 4°C. Sample should be shipped to the laboratory using a reliable overnight courier service. Samples may be stored for up to 7 days at 4°C +/- 2°C. Samples are allowed to warm to ambient room temperature before analysis.

Analysts who use this method have been certified for the method by running Initial Demonstration of Proficiency Samples. The IDOPs are an identical set of 4 LCSWs run consecutively. IDOPs are run any time there is significant change to an instrument, method, or in

the training procedure for training a new analyst.

The percent relative standard deviation (%RSD) is calculated for the IDOPs by:

$$\%RSD = \frac{\sigma_{n-1}}{S} \times 100\%$$

Where:

% RSD = the percent relative standard deviation.
σ_{n-1} = the standard deviation about the mean.
S = the mean response $(X_1 + X_2 + X_3 + X_4)/4$

The %RSD must be less than 20%. If this criterion is not met, the system is checked and the IDOP samples are re-analyzed.

5.1 Sample Preparation

If sample is dark in color, an initial dilution may be required in order to detect a color change during titration.

5.2 Calibration

Initial calibration is conducted by running one calibration standard at 34ppm. The acceptance criterion is a percent recovery of 50% to 150%. If the initial calibration fails, another standard should be prepared and run. If the second standard fails also, a new batch of sulfide stock standard should be prepared and initial calibration standard re-run.

5.3 Sample Analysis

5.3.1 Pipette 25ml of 0.025N Iodine Solution into a 150ml specimen cup. (The amount of iodine should be in excess of the amount of sulfide expected.)

5.3.2 If less than 25ml of Iodine Solution is used, add distilled water to bring the volume to 25ml.

5.3.3 Add 2.5 ml of 6 N HCl.

5.3.4 Gently swirl the uncapped sample bottle to mix the precipitate.

5.3.5 Immediately uncap the sample bottle and slowly pour the entire sample into the specimen cup, stopping and swirling the sample to ensure the precipitate gets poured out with the liquid (if precipitate remains in the sample bottle, a small amount of deionized, degassed water is added to the bottle and swirled and poured into the specimen cup). The color should be reddish yellow at this point.

5.3.6 If the iodine color disappears, add more iodine until the color remains. Record the amount of iodine standard used in milliliters.

5.3.7 Titrate with 0.0250 N $Na_2S_2O_3$ standard solution to a straw yellow color. Add 1ml of the starch solution and continue titrating until the blue color disappears. Record the amount (in ml) of standard used.

5.4 Quality Control

An analytical batch is a single set of twenty or fewer samples that is analyzed on a given day. For every batch, the following quality control samples shall be analyzed:

5.4.1 A Water Blank: using laboratory pure deionized water. Sulfide concentrations in the blank should be less than the reporting limit of 2 mg/l.

Corrective Action: If the blank is outside of the acceptance criteria, analysis is halted, the problem corrected, and another blank is analyzed.

5.4.2 Laboratory Control Sample (LCSW): prepared by diluting 6.25 ml of the sulfide reference solution to 125 ml with de-ionized water. Recovery on the LCSW should fall between 50% and 150%.

$$Percent\,\mathrm{Recov}ery = \frac{MeasuredValue}{TrueValue} \times 100\%$$

Corrective Action: If the LCSW falls outside of the acceptance criteria, sample analysis is halted and a detailed check of the deionized water and chemical purity is made. Reagents, standards, and other quality control samples are re-prepared. If problems persist, sample analysis will be halted and the Technical Director shall be contacted immediately to determine the cause and implement corrective action. A new LCSW must fall within the acceptance criteria in order for analysis to continue.

5.4.3 Matrix Spike and Spike Duplicate: prepared by adding 6.25 ml of the sulfide reference solution to 118.75 ml of sample. Recovery on the matrix spike should be between 50% and 120%. The relative percent difference between the MS and MSD should be no greater than 40%.

$$RPD = \frac{|C1 - C2|}{\frac{C1 + C2}{2}} \times 100\%$$

Corrective Action: If the matrix spike is outside of the acceptance criterion, but all other quality control samples are within their respective control limits, the cause is attributed to matrix interference. If other quality control is outside of control limits, analysis is halted, the analysis procedure is scrutinized to find the cause, the problem is corrected, and samples analyzed prior to the matrix spike must be reanalyzed.

5.4.5 Continuing Calibration Verification: A CCV is run every twenty samples or every sample batch whichever is more frequent. Acceptance criterion is a percent recovery of ±50%.

Corrective Action: If the CCV varies more than ± 50%, an initial calibration must be run and all samples since the last acceptable CCV must be reanalyzed.

5.4.6 Contingency for Handling Out of Control or Unacceptable Data

All samples associated with out of control quality control samples (with the exception of matrix interference) must be reanalyzed. If quality control acceptance criteria cannot be met using the corrective action above, a detailed check of the deionized water and chemical purity is made. Reagents, standards, and other quality control samples are re-prepared and analyzed. If problems persist, sample analysis will be halted and the Technical Director shall be contacted immediately to determine the cause and implement corrective action.

Any data submitted with unacceptable quality control sample results shall be qualified in a case narrative. The narrative should indicate the out of control event that occurred, the corrective action that was taken, and any other pertinent information to inform the client of exactly what occurred.

5.5 Capturing and Submitting Data

One ml 0.0250 N iodine solution reacts with 0.4 mg sulfide

$$\text{mg/l Sulfide} = \frac{[(A \times B) - (C \times D)] \times 16{,}000}{\text{ml Sample}}$$

Where:

A = ml iodine solution,
B = normality of iodine solution,

C = ml $Na_2S_2O_3$ solution, and
D = normality of $Na_2S_2O_3$ solution.

6.0 Secondary Data Review

The analyst is responsible for insuring that all calibrations, calibration checks, and quality control samples are within the specifications outlined in this SOP.

All data are validated by the analyst and the Lead Analyst. Both signatures are required on all raw data sheets that attest to the following: "Your signature indicates all data is within acceptance criteria or justified in narrative form."

The analyst checks all raw data and calculations for reasonableness and accuracy, making sure that sample dilutions are taken into account. Quality control results are rechecked for compliance with acceptance criteria. If any acceptance criteria cannot be met or if any atypical conditions are encountered, a Case Narrative detailing the conditions is written and handed in with the results.

6.1 Peer Review

All data derived from this method undergoes peer data review prior to being turned into the assistant laboratory director. This review served to catch potential errors prior to the data's entry into the Laboratory Information Management System. This review may only be done by another analyst who is certified in this method or the Lead Analyst.

6.2 Laboratory Director Review

The Laboratory Director reviews 10% of all laboratory data and calculations. This review includes sample results, quality control acceptance limits, and a review of the level of quality control required for the project.

6.3 Performance Evaluation Studies

Performance evaluation samples, if available, are analyzed a minimum of annually on this method. Successful analysis of these samples is a requirement for certifications and accreditations. Currently there is no PE sample available for sulfide.

7.0 Reporting Limits

The reporting limit for sulfide is 2 mg/L and has been determined by a method detection limit study.

Method detection limit studies are run annually and must be equal to or lower than the reporting limit. MDLs are determined by analyzing seven aliquots of a known standard (estimated to be 3 to 5 times the lowest concentration that can be seen above noise level) through the procedure, and calculating the mean and standard deviation. Once the seven aliquots are run the results are given to the Quality Systems Coordinator. The Quality Systems Coordinator puts the MDL data into a spreadsheet and makes recommendations for adjustments to reporting limits, if necessary. MDL studies are kept in the Quality Systems Office.

8.0 Safety

Safety glasses are required in all laboratory areas. Samples and reagents should always be handled with caution. For other safety concerns, consult Microseeps' Chemical Hygiene Plan. Material Safety Data Sheets (MSDS) for all compounds used in this procedure are available in the Microseeps' conference room.

9.0 Waste

Unused portions of samples are kept for thirty days following analysis. The samples are then removed from the laboratory and stored until disposal according to Microseeps Standard Operation Procedure for Waste Disposal (SOP-ADM 14).

9.1 Waste Minimization

Waste minimization is carried out in accordance with Microseeps' Standard Operating Procedure for Waste Disposal.

10.0 References

U. S. Environmental Protection Agency, 1983, Methods for Chemical Analysis of Water and Wastes. EPA600/4-79-020, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. Method 376.1, 1978.

Standard Methods for the Examination of Water and Wastewater, 17th Edition, p. 4-197, 4-198, Method 4500-S^2, 1989.

MICROSEEPS, Inc.

uncit

Standard Operating Procedure for the Determination of Alkalinity and its Three Principle Forms

(Reference Methods: EPA Method 310.1 and SM2320B)

Controlled Copy No.

Comm

Dominic Nestasie
Laboratory Director

Signature of Final Approval:

Patrick McLoughlin Ph.D.
Technical Director

Date: 7-16-03

1.0 Purpose and Application

The purpose of this method is the determination of total alkalinity, and the hydroxide, carbonate, and bicarbonate forms of alkalinity in accordance with EPA Method 310.1 and SM2320B. Alkalinity is a measure of the buffering capacity of the water. It is generally interpreted as the bi-carbonate content of the water, but it is an aggregate property that should be interpreted in terms of specific substances only when the chemical composition of the sample is known. The applicable range is 10 to 500 milligrams (mg) $CaC0_3$ per liter.

The purpose of this procedure is to define the procedure for calculating the

1.1 Analyte List

- total alkalinity
- hydroxide alkalinity
- carbonate alkalinity
- bicarbonate alkalinity

1.2 Matrix

This method is applicable to drinking, surface, waste, ground, and saline waters.

2.0 Method Summary

An unpreserved sample is titrated to a specific end-point with sulfuric acid. The progress of the titration is monitored with a pH meter. The sample is not filtered, diluted, or concentrated.

The relationship between the phenolphthalein and total alkalinity is used to calculate the hydroxide, carbonate, and bicarbonate concentrations.

2.1 Definitions

Batch: a single set of twenty or fewer samples that is analyzed on a given day.

Duplicates: two sub-samples of the same sample analyzed within a short time interval.

Laboratory Control Sample: sample matrix free from analytes of interest, spiked with verified known amounts of analytes, used to assess the performance of the measurement system.

Matrix Spike: sample prepared by adding a known concentration of target analyte to a specific amount of sample. Matrix spikes are used to determine the effect of sample matrix on a method's recovery efficiency.
Method Blank: a sample of similar matrix that is free from the analytes of interest that is

processed through all the steps of the analysis with other samples. No target analytes should be present at concentrations that impact the analytical results.

Phenolphthalein Alkalinity: the quantity of alkalinity measured by titration to pH 8.3.

2.2 Method Limitations

Interference may occur from the presence of large amounts of salts of weak organic and inorganic acids in the sample. The presence of oil or grease in a sample can also cause interference by coating the electrode and delaying response time.

3.0 Apparatus, Materials and Operating Conditions

3.1 Apparatus

- pH meter (AccuMet, model 50) and electrode

3.2 Materials

- 150 ml plastic specimen cups
- Magnetic stir plate
- Magnetic stirrers
- Pipettes
- 50 ml buret
- Alkalinity Bench Sheets (originals kept in Master Bench Sheet File in Wet Chemistry Laboratory)

3.3 Operating Conditions

- pH meter should be sensitive to 0.05 pH units.
- Standardize and calibrate pH meter according to manufacturer's instructions.

4.0 Reagents

All purchased reagents are laboratory grade chemicals purchased from a reliable chemical manufacturer and distributor.

4.1 Standard Preparation Procedures

All standards are prepared using Type II 18-mega ohm ultra-pure deionized water.

4.1.1 Blanks

Ultra-pure water obtained from the Microseeps ultra-pure system.

4.1.2 Titrant

Sulfuric acid, 0.020 normal (N) Acid is used as purchased. The date the bottle is opened is to be written on the label when the acid is put into use. Any remaining acid is to be standardized once a month to determine any change in normality.

4.1.3 pH buffer solutions

Buffer solutions at the following pH levels: 4.0, and 7.0 are used as purchased. The date the bottle is opened is to be written on the label when a bottle is put into use. Any remaining buffer is to be discarded after six months.

4.1.4 2500 ppm Sodium Carbonate Solution

Add 2.5g of Na_2CO_3 to 1 L of deionized water. This standard is prepared fresh monthly.

4.2 Quality Control Sample Preparation

4.2.1 Laboratory Control Sample (LCSW): The LCSW is purchased as a certified solution.

4.2.2 Matrix Spike: The matrix spike is prepared by adding 2 ml of the 2500 ppm sodium carbonate solution to a 50 ml aliquot of sample to obtain a 100 ppm spike.

5.0 Procedure

Samples are received in unpreserved polypropylene bottles with a minimum volume of 125 mL. The holding time for alkalinity is 14 days. Samples should be cooled upon collection, and shipped and stored at 4°C. Exposure of samples to air should be kept to a minimum.

Analysts who use this method have been certified for the method by running Initial Demonstration of Proficiency (IDOP) Samples in accordance with Microseeps Standard Operating Procedure for Administering and Documenting Training in Laboratory Procedures and Instrumentation (SOP ADM 02). IDOPs are run any time there is significant change to an instrument, method, or in the training procedure for training a new analyst.

The percent relative standard deviation (%RSD) is calculated for the IDOPs by:

The %RSD must be less than 20%. If this criterion is not met, the system is checked and the IDOP samples are re-analyzed.

5.1 Sample Preparation

Allow samples to reach room temperature.

5.2 Calibration

The pH meter used is self-calibrating. This is done by placing the electrode into each buffer and entering the pH, according to room temperature, of the buffer into the meter (while keeping the electrode in the buffer solution). The probe shall be rinsed using deionized water between buffer solutions and after every use.
After calibration, the slope of the electrode and efficiency factor shall be checked to ensure the probe is functioning properly. The efficiency factor must be in the range of 0.90 to 1.05 in order to analyze samples. If the efficiency factor is outside of this range, re-calibrate the pH meter. Record the slope of the electrode and the efficiency factor on the data sheet.

5.3 Sample Analysis

Important Notes:

- If carbonate, bicarbonate, or hydroxide alkalinity is required, phenolphthalein alkalinity **and** total alkalinity must be measured following the procedure in 5.3.1 below.
- If only total alkalinity is required, follow the procedure outlined in Section 5.3.2.

The relationship between total alkalinity and phenolphthalein alkalinity as outlined in Section 5.5 is used to calculate the three principle forms of alkalinity.

5.3.1 Phenolphthalein and Total alkalinity

Phenolphthalein alkalinity can only be measured if the sample pH is higher than 8.3.

5.3.1.1 Obtain and fill out a bench sheet for each batch of samples that is to be analyzed.

5.3.1.2 Fill a 50 ml buret with 0.02 N H_2SO_4.

5.3.1.3 Record the initial volume of acid in the buret and the lab sample ID onto the data sheet.

5.3.1.4 Measure 50 ml of sample into a 100 or 150 ml beaker. Add a stir bar to the beaker and place it onto a stir plate beneath the buret.

5.3.1.5 Insert the pH probe into the beaker while stirring the sample. The stir bar should not come in contact with the electrode. Record the initial sample pH on the worksheet.

5.3.1.6 Using the sulfuric acid in the buret, titrate the sample to a pH of 8.3. On the worksheet,

record the final volume of acid in the buret.

5.3.1.6 Measure the total alkalinity by continuing the titration to a pH of 4.5. On the worksheet, record the final volume of acid in the buret.

5.3.2 Total Alkalinity

5.3.2.1 Obtain and fill out a bench sheet for each batch of samples that is to be analyzed.

5.3.2.2 Fill a 50 ml buret with 0.02 N H_2SO_4.

5.3.2.3 Record the initial volume of acid in the buret and the lab sample ID onto the data sheet.

5.3.2.4 Measure 50 ml of sample into a 100 or 150 ml beaker. Add a stir bar to the beaker and place it onto a stir plate beneath the buret.

5.3.2.5 Insert the pH probe into the beaker while stirring the sample. The stir bar should not come in contact with the electrode. Record the initial sample pH on the worksheet.

5.3.2.6 Using the sulfuric acid in the buret, titrate the sample to a pH of 4.5. On the worksheet, record the final volume of acid in the buret.

5.4 Quality Control Requirements

The following quality control samples must be run with each analytical batch. Acceptance criteria for the quality control samples were generated using in-house data that consisted of a minimum of twenty data sets. The average and standard deviation for each quality control sample type were calculated. Control limits were set using the average percent recovery ± three times the standard deviation for the LCSW and matrix spikes, and three times the standard deviation of the RPDs of sample/duplicate sets.

5.4.1 Calibration of the pH meter (according to manufacturer's instructions) must be performed prior to analysis.

5.4.2 A Method Blank must be run with every analytical batch. The blanks must have an alkalinity concentration less than the reporting limit. If the blank has a concentration above the reporting limit, ensure that the pH probe is being thoroughly rinsed between uses, and reanalyze the blank.

Corrective Action: If the blank is outside of the acceptance criteria, analysis is halted, the problem corrected, and another blank is analyzed.

5.4.3 A LCSW must be run with every analytical batch. The percent recovery for the LCSW must be within 87%-113%.

$$Percent\,Recovery = \frac{Measured\,Value}{True\,Value} \times 100\%$$

Corrective Action: If the LCSW falls outside of the acceptance criteria, sample analysis is halted and a detailed check of the deionized water and chemical purity is made. Reagents, standards, and other quality control samples are re-prepared. If problems persist, sample analysis will be halted and the Technical Director shall be contacted immediately to determine the cause and implement corrective action. A new LCSW must fall within the acceptance criteria in order for analysis to continue.

5.4.4 A duplicate is run on a sample once each analytical batch. The relative percent difference between the original sample and the duplicate must be 14% or less.

$$RPD = \frac{2 \times |C1 - C2|}{C1 + C2} \times 100$$

Corrective Action: If the sample duplicate falls outside of the acceptance criteria, the analytical procedure is reviewed and another duplicate is analyzed provided sufficient sample volume is available. See note below for instructions on the procedure to follow when the second duplicate result is out of acceptance criteria.

5.4.5 A matrix spike is run on one sample per analytical batch. The percent recovery must be within 69% - 101%.

Corrective Action: If the matrix spike is outside of the acceptance criterion, but all other quality control samples are within their respective control limits, the cause is attributed to matrix interference. If other quality control is outside of control limits, analysis is halted, the analysis procedure is scrutinized to find the cause, the problem is corrected, and samples analyzed prior to the matrix spike must be reanalyzed.

Contingency for Handling Out of Control or Unacceptable Data: All samples associated with out of control quality control samples (with the exception of matrix interference) must be reanalyzed. If quality control acceptance criteria cannot be met using the corrective action above, a detailed check of the deionized water and chemical purity is made. Reagents, standards, and other quality control samples are re-prepared and analyzed. If problems persist, sample analysis will be halted and the Technical Director shall be contacted immediately to determine the cause and implement corrective action.

Any data submitted with unacceptable quality control sample results shall be qualified in a case narrative. The narrative should indicate the out of control event that occurred, the corrective action that was taken, and any other pertinent information to inform the client of exactly what occurred.

5.5 Capturing and Submitting Data

The total alkalinity as mg $CaCO_3$/l is calculated according to the following equation:

$$mg/l(CaCO_3) = \frac{AxB \times 50{,}000}{C}$$

Where:

A = the total volume of titrant used to establish the endpoint pH of 4.5.
B = normality of the titrant (H_2SO_4)
C = the volume of sample used.

The phenolphthalein alkalinity as mg $CaCO_3$/L is calculated according to the following equation:

$$mg/l(CaCO_3) = \frac{DxB \times 50{,}000}{C}$$

Where:

D = the volume of titrant used to establish the endpoint pH of 8.3.
B = normality of the titrant (H_2SO_4)
C = the volume of sample used.

To obtain hydroxide, bicarbonate, and carbonate alkalinity, use the relationships show below in Table 5.5.

Table 5.5

Result of Titration	Hydroxide Alkalinity as $CaCO_3$	Carbonate Alkalinity as $CaCO_3$	Bicarbonate Alkalinity as $CaCO_3$
P = 0	0	0	T
P = <½ T	0	2P	T-2P
P = ½ T	0	2P	0
P = >½ T	2P – T	2(T-P)	0
P = T	T	0	0

Where: P = phenolphthalein alkalinity
T = total alkalinity
(P = 0 when initial sample pH is less than 8.3)

Example: P = 10 mg/l
T = 30 mg/l
P = <½ T
Hydroxide Alkalinity = 0
Carbonate Alkalinity = 2P = 2x10 = 20 mg/l
Bicarbonate Alkalinity = T-2P = 30 – (2x10) = 10mg/l

6.0 Secondary Data Review

The analyst is responsible for insuring that all calibrations, calibration checks, and quality control samples are within the specifications outlined in this SOP. All data are validated by the analyst and the Lead Analyst. Both signatures are required on all raw data sheets that attest to the following: "Your signature indicates all data is within acceptance criteria or justified in narrative form."

The analyst checks all raw data and calculations for reasonableness and accuracy, making sure that sample dilutions are taken into account. Quality control results are rechecked for compliance with acceptance criteria. If any acceptance criteria cannot be met or if any atypical conditions are encountered, a Case Narrative detailing the conditions is written sand handed in with the results.

6.1 Peer Review

All data derived from this method undergoes peer data review prior to being turned into the assistant laboratory director. This review served to catch potential errors prior to the data's entry into the Laboratory Information Management System. This review may only be done by another analyst who is certified in this method or the Group Lead Analyst.

6.2 Laboratory Director Review

The Laboratory Director reviews 10% of all laboratory data and calculations. This review includes sample results, quality control acceptance limits, and a review of the level of quality control required for the project.

6.3 Performance Evaluation Studies

Performance evaluation samples are analyzed a minimum of annually on this method. Successful analysis of these samples is a requirement for certifications and accreditations.

7.0 Reporting Limits

The reporting limit for all forms of alkalinity is 4 mg/L.

Method Detection Limits studies are run annually and must be equal to or lower than the reporting limit. MDLs are determined by analyzing seven aliquots of a known standard (estimated to be 3 to 5 times the lowest concentration that can be seen above noise level) through the procedure, and calculating the mean and standard deviation. Once the seven aliquots are run the results are given to the Quality Systems Coordinator. The MDL studies are kept on file in the Quality Systems Office.

8.0 Safety

Safety glasses are required in all laboratory areas. Samples and reagents should always be handled with caution. For other safety concerns, consult Microseeps' Chemical Hygiene Plan. Material Safety Data Sheets (MSDS) for all compounds used in this procedure are available in the Microseeps' conference room.

9.0 Waste

Unused portions of samples are kept for thirty days following analysis. The samples are then removed from the laboratory and stored until disposal according to Microseeps Standard Operation Procedure for Waste Disposal (SOP-ADM 14).

9.1 Waste Minimization

Where possible, Microseeps takes steps to minimize the amount of waste generated by substitution and good chemical handling procedures. For specific information on waste minimization consult SOP-ADM 14.

10.0 References

U.S. Environmental Protection Agency, 1983, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. Method 310.1

Standard Methods for the Examination of Water and Wastewater, 2320 B. 1989, 17th Ed. American Public Health Association, Washington, DC.

Microseeps, Inc.

Standard Operating Procedures For the Analysis of Anions by Ion Chromatography

(Ref. Methods SW846-9056 and 9056A)

Controlled Copy_____

Dominic Nestasie
Laboratory Director

Signature of Final Approval:

Patrick McLoughlin Ph.D.
Technical Director

Date: 7-16-03

1.0 Purpose and Application

This method addresses the sequential determination of the anions in the collection solutions from groundwater, wastewater, and aqueous extracts. The method used for this procedure is EPA Method 9056A.

1.1 Analyte List

The following analytes can be determined using this method.

Bromide	Chloride
Nitrate	Nitrite
Phosphate	Sulfate
Fluoride	

1.2 Matrix

Applicable matrices for determination of anions by this method are collection solutions from groundwater, wastewater, and aqueous extracts.

2.0 Method Summary

Slightly more than 5 ml of sample solution are drawn into a plastic, luer-type syringe. A 0.45-µm filter (Acro-Disk, Gellman) is used to filter 5 ml of the sample into an autosampler vial. The autosampler then uses 2-3 ml of sample to flush the lines and fills the 50-µl-sample loop. The sample loop is put into the flow path for the ion-chromatograph, where it is carried in a sodium carbonate/sodium bicarbonate solution through a guard column, an analytical column, through a self-regenerating suppressor and into an electrical conductivity detector. The output of that detector is recorded by a data system that also controls the autosampler and the ion-chromatograph.

2.1 Definitions

Duplicates: two sub-samples of the same sample analyzed within a short time interval.

Laboratory Control Sample: sample matrix free from analytes of interest, spiked with verified known amounts of analytes. A LCS is used to assess the performance of the measurement system.

Matrix Spike: sample prepared by adding a known concentration of target analyte to a specific amount of sample. Matrix spikes are used to determine the effect of sample matrix on a method's recovery efficiency.

Method Blank: a sample of similar matrix that is free from the analytes of interest that is processed through all the steps of the analysis with other samples. No target analytes should be present at concentrations that impact the analytical results.

2.2 Method Limitations and Interferences

Any species with a retention time similar to that of the desired ion will interfere. Large quantities of ions eluting close to the ion of interest will also result in interference. Separation can be improved by adjusting the eluent concentration and/or flow rate.

Samples that contain particles larger than 0.45 um and reagent solutions that contain particles larger than 0.20 um require filtration to prevent damage to instrument columns and flow systems.

3.0 Apparatus, Materials, Operating Conditions

3.1 Apparatus

- Ion chromatograph system (Dionex DX-500), capable of delivering 1 to 5 ml of eluent per minute at a pressure of 200 to 3000 psi. The chromatograph shall be equipped with an injection valve, a 50 µL sample loop, and set up with the following components:
- Pneumatically and electrically driven autosampler for 5 ml samples (Dionex AS40).
- Electrochemical Detector, (Dionex ED40).
- Gradient Pump, capable of mixing up to four solutions and delivering a constant flow of approximately 1 to 5 mL/min throughout the analysis and tolerating a pressure of 200 to 3000 psi (Dionex GP 50 gradient pump).
- Self Regenerating Suppressor capable of converting the eluent and separated anions to their respective acid forms (Dionex Self Regenerating Suppressor ASRS-11).
- Ion Chromatography Oven, capable of housing the plumbing and chromatography columns in a temperature controlled environment (Dionex LC25).
- Data collection system: IBM-compatible PC with Dionex PeakNet software for data recording, autosampler operation, and automated pump gradient control.
- Filter-cap depression tool for vials for autosampler.
- Standard laboratory glassware: Pipettes, Class A volumetric flasks, and beakers in assorted sizes.

3.2 Materials

- Precolumn, a guard column placed before the separator column to protect the separator column from being fouled by particulates, metals, and some organic compounds (4 x 50 mm Dionex AG14).
- Separator column, a column packed with low capacity ion exchange resin (4 x 250 mm Dionex AS14).
- 5 ml and 10 ml plastic, luer tipped syringes.
- 0.45 µm filter disks (Acro-Disk; Gellman).

3.3 Operating Conditions

- Oven Temperature - The LC25 oven is set to 35C.
- Reservoir pressure - The eluents are kept under 5 psig of Helium.
- Pneumatic Supply to Autosampler - 550 psig, controlled via the regulator on the He tank.
- Suppressor current - The suppressor current is typically set to 100 milliamps (mA). While a higher current may produce better noise suppression, it also deteriorates the suppressor more rapidly. If problems with noise arise, the suppressor current may be stepped up to 300 mA, but the technical director must be notified if this is done.
- Eluent concentration program - The programmable, mixing, gradient pump is set with the program given in Table 3.3. The total pumping rate is always 1.00 ml/min. Solutions A and B are described in section 4.1.

Table 3.3
Gradient pump program

Time	% A	% B	Comments
Initial	50	50	
0.0	50	50	Begin analysis with linear increase in concentration.
0.1	50	50	Begin column conditioning
4.0 - 4.1	50	50	Activate autosampler
6.5	50	50	Begin linear increase in concentration
21.5	50	50	End

4.0 Reagents

All reagents are prepared from water with a resistivity of 18-mega ohm/cm (Mohm) that is obtained from the ion exchange Ultra-pure water system in Microseeps wet chemistry laboratory. Laboratory grade chemicals are used in preparing all reagents. All standards are labeled and documented in accordance with Microseeps Standard Operating Procedure for Standards and Reference Materials SOP-ADM 15. All purchased reagents are obtained from a reputable manufacturer.

4.1 Reagents

- Type II deionized water
- Sodium Bicarbonate ($NaHCO_3$); Fisher Scientific
- Sodium Carbonate (Na_2CO_3); Fisher Scientific

- Certified Anion Stock Solutions for Bromide, Chloride, Fluoride, Nitrate, Nitrite, Phosphate, and Sulfate (1000ppm); Accustandard

4.2 Eluent Degassing

Eluents are prepared from degassed 18 Mohm water. To degas the water use the following procedure:

- Place the water to be degassed into a 4L side-arm vacuum Erlenmeyer flask with a clean, 18 Mohm water rinsed stir bar. Stopper the top of the flask.
- Set the flask atop a stir plate. With the rotation initially at zero, gradually increase it so that the water throughout the entire flask is well stirred.
- Attach the side arm to mechanical vacuum pump inlet and turn on the pump. Make sure that there is a liquid trap between the flask and the pump.
- Pump-on and mix the solution for ~ 1hour, insuring that there are no bubbles coming out of solution by the time pumping is ceased.
- Clamp the line from the sidearm to the trap closed and break the connection after the clamp. Turn off the stir plate. Be sure to handle the water with a minimum of agitation and atmospheric exposure.

4.3 Eluent Preparation

Two eluent solutions are prepared, as follows:

- **Solution A** - Pure 18 Mohm water. This goes into a 2-liter bottle. The bottle should be filled to roughly within an inch of its neck.

- **Solution B** - A 3 millimolar (mM) solution of sodium bicarbonate $NaHCO_3$ and a 2.4 mM solution of sodium carbonate Na_2CO_3. This solution is prepared by weighing 1.008 g of $NaHCO_3$ and 1.0176 g of Na_2CO_3 and adding degassed deionized water to 2 L.

4.4 Stock Solutions

Solutions (1,000 mg/L) are purchased as certified solutions from Accustandard. Stock solutions are to be stored in chemical resistant glass or polyethylene bottles. Purchased solutions are stable for one year from date of purchase.

Anion Stock Solution (10 ppm) Dilute 1 ml of the 1000 ppm Br, Cl, Fl, NO3, NO_2, PO_4, and SO_4 solutions 100 ml using 18 Mohm deionized water to a volume of 100 ml.

4.5 Anion Working Solutions.

Prepare a blank and three solutions that contain the target analytes at the concentrations listed in Table 4.5. There are three levels of calibration. Group I analytes include bromide, fluoride, nitrate, and nitrite. Group II analytes include chloride and sulfate. Phosphate has separate levels.

Table 4.5
Concentration levels for working standards.
Concentrations are specified in mg/l.

Level	Concentration Group 1	Concentration Phosphate	Concentration Group II
Blank	0.0	0.0	0.0
Low	0.1	0.5	1.0
Mid	5.0	25	50
High	20	100	200

Use class A pipettes and volumetric flasks for the preparation of all standards.

- Prepare the high level standard by combining 1.0 ml of each of the stock standards for the group I analytes and 10.0 ml of the stock solution for the group II analytes and diluting that mixture to 500 ml with 18 Mohm degassed water.
- Prepare the mid level standard by diluting 25 ml of the high level standard to 100 ml with 18 Mohm degassed water.
- Prepare the low level standard by diluting 2.0 ml of the anion stock standard, 0.1 ml of the 1000 ppm PO_4 stock solution, and 0.1 ml of the 1000 ppm Cl, SO_4 stock solution to 100 ml with 18 Mohm degassed water.

4.6 Stability of standards

Prepared solutions are stable for at least 1 month when stored at 4 ± 2°C. Dilute working standards should be prepared weekly or more often if the CCV percent drift is greater than 10%, except those that contain nitrite and phosphate, which should be prepared fresh daily. The validity of standards can be confirmed through the analysis of a freshly prepared ICV.

4.7 Laboratory Control Sample

A stock solution in which each of the target anions are present at a 100-mg/l concentration is purchased from CPI. That solution is diluted with 18 Mohm water to produce an LCS solution in which all anions are present at 10 mg/l.

5.0 Procedure

All samples must have been collected with a minimum of sample aeration in two 40 ml VOA vials per well. Samples are to remain unpreserved, cooled to 4°C and shipped to the laboratory by an overnight courier service. Samples for anion analyses must be analyzed within 48 hours of collection. Samples are refrigerated at 4°C until analyzed.

Analysts who use this method have been certified for the method by running Initial Demonstration of Proficiency (IDOP) Samples in accordance with Microseeps Standard Operating Procedure for Administering and Documenting Training in Laboratory Procedures and Instrumentation (SOP ADM 02). IDOPs are run any time there is significant change to an instrument, method, or in the Training procedure for training a new analyst.

5.2 Sample Preparation

All samples are prepared by filtering through a 0.45-micron filter.

5.3 Calibration

- Insure that the instrument is setup as specified in section 3.
- Prepare calibration standards and a blank by labeling four vials with the concentration level specified in Table 2.
- From the working standards, fill a 5 ml luer-lock syringe and fit it with a 0.45 μm filter. Expel a few drops of solution through the filter and into a waste receptacle, then expel 5 ml of the solution through the solution through the filter and into the sample bottle.
- Load the calibration standards into an autosampler rack and begin a sequence file that identifies each bottle and its contents.
- Cap the vials, using the cap depression tool to completely insert the filter-cap into the vials.

Initially, the order of elution must be measured from the analysis of single component standards. With that information, the position and width of the retention time window used to make identifications should be based on measurements of actual retention time variations of standards over the course of a day. Three times the standard deviation of a retention time can be used to calculate a suggested window size for a compound. However, the experience of the analyst should weigh heavily in the interpretation of chromatograms.

The standards are analyzed as samples and then the PeakNet software is used to combine the calibration and the method file. The calibration is linear, with the calibration points (concentration vs. instrument response) fit via a linear regression routine. For further procedural details, please see the PeakNet software documentation. The correlation of determination must be at lease 0.995. If this criterion is failed, the system should be inspected and the calibration repeated.

5.3.1 Initial Calibration Verification

After initial calibration, the calibration curve must be verified by use of an ICV standard prepared from an independent (second source) material at or near the mid-range of the calibration curve.

5.3.1.1 ICV Acceptance Criteria

The acceptance criteria for the ICV standard must be no greater than ± 10% of its true value.

5.3.1.2 Corrective Action

If the calibration curve cannot be verified within the specified limits, the cause must be determined and the instrument recalibrated before samples are analyzed.

5.4 Analysis

An instrument run or batch is a single set of twenty or fewer samples that is analyzed on a given day.

5.4.1 Initiate the method from the computer terminal. Begin to pump the eluent through the columns. Begin monitoring the signal baseline.

5.4.2 While the baseline settles, load an autosampler rack with a blank, (CCB), and a mid-range standard (CCV) and an LCS. Place the rack into the front, left hand side (your left, as you face the instrument) compartment. Start a sequence file, insuring that the date, analyst's initials, etc. are accurate, and enter these three samples into it, in the order that they loaded into the autosampler. Save the sequence file.

5.4.3 After a stable baseline is obtained, start the run at the computer and initiate the autosampler by setting it to "run" (not "hold", depress the hold/run button if needed).

5.4.4 While the CCV, CCB, and LCS are running, gather sufficient autosampler racks, vials, and filter-caps for all client samples, dilutions, and QC samples as detailed in section 5.4. Fill the sample vials and autosampler racks. Set the filled racks into the order they will be set in the autosampler with the black dot on the right.

5.4.5 Check the response for the CCB, CCV, and LCS. The criteria for each of these samples and the corrective action that should be followed if these criteria are not met are described in Section 5.5.

5.4.6 Begin to load the sample racks into the autosampler. Racks by rack add the entries for the samples into the sequence file, with the sample in the rightmost position being the first

scheduled. When all entries for a rack are in the sequence file, slide the pressure arm for the autosampler back and load the rack into the first available front position on the left, again with the black dot to the right. After each rack is loaded into the autosampler, the schedule should be saved.
For proper quantification of an analyte, its concentration must be greater than that of the lowest calibration standard and less than that of the highest calibration standard. If the concentration of an analyte in a sample exceeds that of the highest calibration standard, 18 Mohm water should be used to dilute that sample and the diluted sample should be analyzed. Based on project history, workload, etc. the analyst may choose to make anticipatory dilutions of a sample and analyze the diluted samples in the same instrument run in which the original sample is analyzed.

If the resulting chromatogram fails to produce adequate resolution, or if identification of specific anions is questionable, spike the sample with an appropriate amount of standard and reanalyze.

5.5 Instrument Run QC

The following quality control sample shall be run as follows:

5.5.1 Continuing Calibration Verification

In order to verify the working calibration curve, a CCV shall be run at the beginning of each day, and after every ten samples. The CCV should be made from the same material as the initial calibration standards at or near mid-range. If the instrument response has changed more than ±10%, the instrument should be recalibrated.

Corrective Action: If the calibration cannot be verified within the specified limits, discontinue sample analysis, determine the cause, and recalibrate the instrument. All samples analyzed after the last acceptable CCV/CCB must be reanalyzed.

5.5.2 Continuing Calibration Blank

The CCV must be followed by a continuing calibration blank (CCB). The calibration blank must not contain target analytes at or above the reporting limit.

Every instrument run must include an acceptable analysis of the following samples:

5.5.3 Performance/Method Blank

A performance (PBW) or method blank (18 Mohm water) shall be analyzed for each analytical batch. Any analytes detected in this blanks must not be present in concentrations of that analyte in the lowest standard.

Corrective Action: If this criterion is not met, inspect all glassware, etc. and then prepare and analyze another blank. Blanks should be run until this criterion is met. If three blanks are analyzed in succession and this criterion is still not met, the laboratory director shall be notified.

5.5.4 Laboratory Control Sample (LCS)

A Laboratory Control Sample (LCS) as a QC reference sample shall be analyzed every twenty samples. The LCS should be spiked with each analyte of interest between the low and midlevel standards and must be carried throughout the entire sample preparation and analytical process. Acceptance criterion is a percent recovery between 80% and 120%.

Corrective Action: If the percent recovery for this sample is not between 80% & 120%, a fresh LCS solution should be made, and the LCS should be run again. If it fails again, all samples analyzed after the last acceptable LCS must be prepared again and reanalyzed.

5.5.5 Matrix Spike

A matrix spike (MS) sample shall be run for each analytical batch. The percent recovery must be between 70% and 130%.
Corrective Action: If this criterion fails, but all other instrument run criteria are passed, then it is simply noted in the case narrative for the instrument run and the analysis proceeds. Acceptance criteria shall be modified as in-house data is compiled.

5.5.6 Duplicate

A duplicate sample shall be analyzed every ten samples. The duplicate sample must be taken through the entire sample preparation and analytical process. The RPD between the sample and duplicate shall not exceed 20%.

Corrective Action: If the duplicate sample RPD exceeds 20% and all other quality control samples are within their respective acceptance criteria, then those results shall be noted in the case narrative. If the RPD is exceeded and other quality control samples are outside of their respective acceptance criteria, then the entire sample batch shall be reanalyzed after determining the cause of the problem.

Contingency for Handling Out of Control or Unacceptable Data: All samples associated with out of control quality control samples (with the exception of matrix interference) must be reanalyzed. If quality control acceptance criteria cannot be met using the corrective action above, a detailed check of the deionized water and chemical purity is made. Reagents, standards, and other quality control samples are re-prepared and analyzed. If problems persist, sample analysis will be halted and the Technical Director shall be contacted immediately to determine the cause and implement corrective action.

Any data submitted with unacceptable quality control sample results shall be qualified in a case narrative. The narrative should indicate the out of control event that occurred, the corrective action that was taken, and any other pertinent information to inform the client of exactly what occurred.

5.6 Capturing and Submitting Data

Acquisition of data for all standards, samples, blanks, and laboratory control samples is done using a Windows based personal computer outfitted with Dionex PeakNet software. The software collects data, plots the peaks, integrates the peaks, calculates the calibration curve associated with the target analytes, and calculates the concentrations of the analytes in mg/L. After review from the analyst, a standard report containing a chromatogram is printed.

The raw data from all analyses, including initial calibration, calibration verification, and method blanks are stored by the analyst in the laboratory where the analyses are performed.

When necessary, a hand written case narrative accompanies each project of field samples. The case narrative explains any anomalies in the analysis or the QA/QC results of the instrument run associated with those field samples.

6.0 Secondary Data Review

All analytical data must undergo a two-tier review. The data must be reviewed for completeness and accuracy by the analyst and must be checked by the Laboratory Director or his designee before the data can be released as final data. Due to laboratory size and personnel limitations, a peer review may not be conducted for this method.

The analyst is responsible for insuring that all calibrations, calibration checks, matrix spikes, duplicates, laboratory control samples, and blanks are within the specifications outlined in this SOP.

6.1 Analyst and Peer Review

As a data package is generated, the analyst is responsible for the following:

- Verify that all data generated matches the raw data report. This includes the result of each parameter along with any manipulations for dilution or non-standard aliquot used.
- Verify that all QA/QC data matches the raw data reports and that it meets the acceptance criteria.
- Initial the report forms to indicate the analyst review is complete.

All data derived from this method undergoes a peer data review (when available) prior to being turned in to the Assistant Laboratory Director. This review serves to catch potential errors prior to the data's entry into the Laboratory Information Management System (LIMS). This review may only be done by another analyst who is certified in this method.

6.2 Laboratory Director Review

The Laboratory Director reviews 10% of all laboratory data and calculations. This review includes sample results, quality control acceptance limits, and review of the level of quality control required for the project.

6.3 Performance Evaluation Studies

Performance evaluation samples are analyzed a minimum of annually on this method. Successful analysis of these samples is a requirement for certifications and accreditations.

7.0 Reporting Limits

The reporting limits for this analysis are those of the lowest concentration standard, as specified in Table 2.

Method detection limit studies are run annually in accordance with Microseeps Standard Operating Procedure for the Determination of Method Detection Limits and PQLs (SOP-ADM 18).

8.0 Safety

Gloves and a laboratory coat should be worn when handling samples and standards. Safety glasses are required in all laboratory areas. For other safety concerns, consult Microseeps' Chemical Hygiene Plan. Material Safety Data Sheets for all compounds used in this procedure are available in the Microseeps' conference room.

9.0 Waste

All sample and laboratory generated waste are disposed of in accordance with Microseeps Standard Operating Procedure for Waste Disposal.

9.1 Waste Minimization

For Microseeps' policy on waste minimization, refer to the Standard Operating Procedure for Waste Disposal.

10.0 References

U.S. Environmental Protection Agency, 1996, Test Methods for Evaluating Solid Waste, SW-846, Office of Solid Waste and Emergency Response, Washington D.C. Method 9056 and Method 9056A.

Environmental Protection Agency. Test Method for the Determination of Inorganic Anions in Water by Ion Chromatography. EPA Method 300.0. EPA 600/4-84-017, 1984.

Annual Book of ASTM Standards, Volume 11.01 Water D4327, Standard Test Method for Anions in Water by Ion Chromatography, pp. 696-703, 1988.

Standard Methods for the Examination of Water and Wastewater, Method 429, "Determination of Anions by Ion Chromatography with Conductivity Measurement," 16th Edition of Standard Methods.

Dionex IC 16 Operation and Maintenance Manual, PN 30579, Dionex Corp., Sunnyvale, CA 94086.

Gaskill, A; Estes, E.D.; Hardison, D.L.; and Myers, L.E. Validation of Methods for Determining Chlorine in Used Oils and Oil Fuels. Prepared for U.S. Environmental Protection Agency Office of Solid Waste EPA Contract No. 68-01-7075, WA 80. July 1988.

Microseeps, Incorporated

Standard Operating Procedure for the Determination of Organic Carbon in Water Samples

(Ref. Method SW846-9060)

Controlled Copy _____

Controlled Copy

Dominic Nestasie
Laboratory Director

Signature of Final Approval:

Patrick McLoughlin, Ph.D.
Technical Director

Date: 8-27-03

1.0 Purpose and Application

This Standard Operating Procedure is used as guidance to determine the concentration of non-purgeable organic carbon in water samples. SW846-9060 refers to total organic carbon as will this SOP for the sake of continuity. This method is most applicable to the measurement of organic carbon in homogeneous samples above 5 mg/L.

1.1 Analyte List

This method is applicable to the following:

- Total Organic Carbon (TOC)
- Dissolved Organic Carbon (DOC)

1.2 Matrices

SW 846 9060 is applicable for groundwater, surface and saline waters, and domestic and industrial wastes.

2.0 Method Summary

The Phoenix 8000 uses wet chemical methods for oxidation. The sample is simultaneously exposed to persulfate ions and to ultraviolet radiation, which act together to oxidize any organic carbon in the sample to carbon dioxide. The carbon dioxide produced is swept by a stream of nitrogen to the detector. During analysis, carbon dioxide levels are measured by a non-dispersive infrared (NDIR) detector. The detector is sensitive to the absorption frequency of carbon dioxide and provides a signal proportional to the instantaneous concentration of carbon dioxide in the carrier gas, nitrogen (N_2), flowing through it. The detector output signal is linear and provides a reading of total organic carbon (TOC). The linear signal is integrated and compared to stored calibration data to compute the sample carbon concentrations in parts per million carbon (ppm C).

2.1 Definitions

Purge: to sparge, to allow gas to flow through a sample to remove volatile elements in a sample.

NDIR: non-dispersive infrared detector; a measuring instrument that provides an electrical signal that is proportional to the concentration of carbon dioxide in the detector.

Oxidation: a reaction in which an element's capability to unite with other substances increased due to the element's loss of electrons.

Persulfate: (S_2O_8) an oxidizing agent used to convert inorganic carbon into carbon dioxide.

Duplicates: two sub-samples of the same sample analyzed within a short time interval.

Laboratory Control Sample: sample matrix free from analytes of interest, spiked with verified known amounts of analytes. Used to assess the performance of the measurement system.

Matrix Spike: sample prepared by adding a known concentration of target analyte to a specific amount of sample. Matrix spikes are used to determine the effect of sample matrix on a method's recovery efficiency.

Method Blank: a sample of similar matrix that is free from the analytes of interest that is processed through all the steps of the analysis with other samples. No target analytes should be present at concentrations that impact the analytical results.

2.2 Method Limitations

2.2.1 This procedure is applicable only to homogeneous samples that can be injected into the Phoenix 8000 TOC. The syringe openings limit the size of particles that can be injected with the sample.

2.2.2 Method limitations include interferences from carbonate and bicarbonate that may be present in the samples. Those substances must either be removed from the sample, or accounted for in the final calculation. This method calls for removal of carbonate and bicarbonate by acidification and purging the acidified sample with nitrogen however, the data user should be aware that this purging may result in the loss of some volatile carbon compounds.

3.0 Apparatus, Materials, and Operating Conditions

3.1 Apparatus

- Tekmar Dohrmann Phoenix 8000 TOC
- Autosampler: 72 count rack
- Software: Dionex TOC Talk 4.0

3.2 Materials

- 40 ml amber VOA vials
- Compressed nitrogen gas UHP/zero grade
- Class A volumetric flasks
- Class A volumetric pipettes
- 125 mm Whatman glass microfibre filter

3.3 Operating Conditions

- Nitrogen operating pressure: 30 - 35 psi

4.0 Reagents

All chemicals and reagents used in this procedure are laboratory reagent grade. Stock standards are standardized in the laboratory using ASTM Type II ultra pure deionized water, or purchased as certified standards or stock solution. Reagent and standards logbooks are maintained in the laboratory.

4.1 Standard Preparation Procedures

- **21% Phosphoric Acid Reagent:** Measure 37 ml of 85% phosphoric acid (H_3PO_4) into rinsed bottle. Add 188 ml ultra pure deionized water. This reagent remains stable for one month.

- **10% Persulfate/5% Phosphoric Acid Mixture:** Add 9 ml of 85% H_3PO_4 to 213 ml of ultra pure deionized water in a rinsed bottle. Measure 25g of 98+% sodium persulfate ($Na_2S_2O_8$) and add this to the phosphoric acid solution. This reagent remains stable for one week.

- **1000 ppmc Potassium Hydrogen Phthalate Stock Solution:** Dissolve 2.128 g of potassium hydrogen phthalate (KHP) in ultra pure water and dilute to 1000 ml.

- **Calibration Standards:** Calibration standards can be purchased from a reliable vendor. If prepared in-house, the are prepared by diluting a volume of the 1000 ppmc potassium hydrogen phthalate solution with 100 ml of deionized water in accordance with the following table:

Table 4.1
Calibration Standards

ml of 1000 ppmc Stock	Calibration Standard Concentration	Standard Concentration in µg C
Blank	0 ppm C	0 µg C
0.5	5 ppm C	2.5 µg C
1.0	10 ppm C	5 µg C
4.0	40 ppm C	20 µg C
10.0	100 ppm C	50 µg C
20.0	200 ppm C	100 µg C

- **Laboratory Control Sample:** The LCS is purchased from ERA as a certified second source solution. Deionized water is added to 5 ml of the purchased solution to 1000 ml.

- **CCV:** Prepared at 40 ppm using the same source and procedure as the calibration standard preparation above, but prepared in an independent batch.

4.2 Glassware and Storage Requirements for Reagents and Standards

Stock standards are to be stored in 1000 ml amber glass jars and refrigerated.

4.3 Surrogate Standards

Not applicable.

5.0 Procedure

Samples are to be collected in 250 ml polypropylene bottles and cooled to 4°C. Samples are preserved with sulfuric acid to a pH of less than 2. The holding time is 28 days, and samples should be protected from sunlight. Samples are to be stored refrigerated at 4° C ± 2°.

Analysts who use this method have been certified for the method by running Initial Demonstration of Proficiency (IDOP) Samples in accordance with Microseeps Standard Operating Procedure for Administering and Documenting Training in Laboratory Procedures and Instrumentation (SOP ADM 02). IDOPs are run any time there is significant change to an instrument, method, or in the Training procedure for training a new analyst.

5.1 Sample Preparation

If dissolved or soluble organic carbon are requested, the samples are to be filtered through a 125 mm Whatman glass microfibre filter. It is preferable that all filtering occur in the field prior to sample preservation. A sample should not be filtered once it has been preserved.

5.2 Calibration

Prepare calibration standards in accordance with Table 4.1. 2-ml injections of each standard are analyzed as a samples and the instrument software is used to combine the calibration and method file. The calibration is linear, with the calibration points (concentration vs. instrument response) fit via a linear regression routine. The coefficient of correlation must be 0.9950 or higher for the initial calibration to be acceptable. If this criterion is not met, the system should be inspected, the calibration repeated, and all samples since the last acceptable CCV are rerun.

An ICV is run immediately following the initial calibration. The % drift should not exceed ± 10%.

5.3 Sample Analysis

An instrument run or sample batch is a single set of twenty or fewer samples that is analyzed on a given day. All client samples are homogenized and representative aliquots are transferred into 40 ml VOA vials that can be loaded into the auto sampler.

5.3.1 Open TOC Talk on computer console and follow the instructions bulleted below:

- Go to "sample set up"
- Click on "Instrument"
- Under System, click on "Ready" to turn on UV lamp
- Click "OK."
- Let the lamp warm up for approximately one hour.

5.3.2 Check reagent and gas supplies and replenish, if necessary, during warm-up phase. Put all quality control samples into 40 ml vials to be loaded into auto sampler.

5.3.3 After warm-up is complete:

- Click on "Run" on the main menu
- Click on "sample setup"
- Select "sample" as the sample type in the first row.
- Select a method ID (concentration for calibration)
- Select "Ready"

5.3.4 After the cleaning procedure, the continuing calibration verification is run followed by the continuing calibration blank, the performance blank, and then the laboratory control sample. After these samples come a series of ten client samples (in the 40 ml vials) and then the series is repeated except for the LCS. The LCS is run every twenty samples. Continue loading rack until full or all samples are loaded.

5.3.5 Confirm that the rack style selected on the screen matches the auto sampler rack. Click "OK" and then "Yes" to save changes and choose a name for the rack. Click "Start" to begin analysis.

When analyzed samples are at a concentration >200 ppm, the samples are diluted and re-analyzed.

***Note:** All samples originating from South Carolina will be analyzed in quadruplicate. From all other states, the laboratory will analyze samples in quadruplicate at the request of the client.

5.4 Quality Control Requirements

The following are analyzed once per batch unless otherwise specified:

5.4.1 One method blank using 18 Mohm water. Any TOC detected in the method blank must be present at less than the concentration of TOC in the lowest standard.

Corrective Action: If this criterion is not met, inspect all glassware and equipment, and prepare and analyze another method blank. Method blanks should continue to be run until this criterion is met. If three blanks are analyzed in succession and this criterion is still not met, the laboratory director should be notified.

5.4.2 A Laboratory Control Sample. The acceptance criterion for the LCS is a percent recovery between 70% and 130%.

Corrective Action: If the LCS fails a new calibration curve shall be run and all samples since the last acceptable LCS shall be re-analyzed.

5.4.3 CCV (prepared independently) should be run every fifteen samples to verify calibration. The CCV shall be followed by a continuing calibration blank. The criterion for acceptance for the CCV is a % recovery of ± 10%.

Corrective Action: If the CCV fails, the instrument shall be recalibrated, and all samples since the last acceptable CCV shall be re-analyzed.

5.4.4 A Matrix Spike Sample every 10 samples. The acceptance criterion for the matrix spike is a percent recovery of between 70% and 130%.

Corrective Action: If the matrix spike fails and the rest of the QC is within the acceptance criteria, matrix interference should be noted in a case narrative.

5.4.5 A Sample Duplicate every 10 samples. The acceptance criterion for the duplicate sample is a relative percent difference of less than or equal to 20% between the duplicate and the sample.

Corrective Action: If the duplicate fails that criterion, another duplicate shall be run. If the RPD is acceptable the analyses may continue. If the duplicate fails again and the rest of the quality control is acceptable, it is noted in a case narrative as a problem with the sample matrix.

5.4.6 Contingency for Handling Out of Control or Unacceptable Data: All samples associated with out of control quality control samples (with the exception of matrix interference) must be reanalyzed. If quality control acceptance criteria cannot be met using the corrective action above, a detailed check of the deionized water and chemical purity is made. Reagents, standards, and other quality control samples are re-prepared and analyzed. If problems persist, sample analysis will be halted and the Technical Director shall be contacted immediately to determine the cause and implement corrective action.

Any data submitted with unacceptable quality control sample results shall be qualified in a case narrative. The narrative should indicate the out of control event that occurred, the corrective

action that was taken, and any other pertinent information to inform the client of exactly what occurred.

5.5 Capturing and Submitting Data

The software used for the Phoenix 8000 is specific to the instrument and is called TOC Talk 4.0. Analytical results are generated and printed using the TOC Talk software and reported in parts per million.

The formula used for calculating concentration or instrument response is:

$y = mx + b$

Where:
- y = signal
- m = slope
- x = concentration (area count)
- b = y intercept

The software calculates TOC concentration using two different y-intercepts. The y-intercept used for calculating concentration for calibration verifications is the y-intercept calculated from the initial calibration. The y-intercept used for calculating sample and other quality control concentrations is blank corrected, and is the mean of the last three replicates of the Blank TC Ranges 3, 4, & 5 run immediately following the cleaning procedure.

The instrument run log is generated by the TOC Talk software. These logs are printed and place into a three-ringed binder and kept in the laboratory. The current and previous years' raw data are maintained in the laboratory; older records are archived in the Records Storage Area and are maintained for five full years. All instrument maintenance is recorded in the Instrument Maintenance Logbook, which is kept in the laboratory.

6.0 Secondary Data Review

It is the analyst's responsibility to insure that all calibrations, calibration verifications, matrix spikes, laboratory control samples, duplicates, and blanks are within the acceptance criteria outlined in this Standard Operating Procedure.

Precision is monitored by calculating the relative percent difference (RPD) between a sample and a sample duplicate.

Accuracy is monitored by calculating the percent recovery of a spiked sample.

6.1 Peer Review

A peer review is not currently conducted on the data derived from this analysis.

6.2 Laboratory Director Review

The Laboratory Director reviews 10% of all laboratory data. This review includes sample results, quality control acceptance limits, and a review of the level of quality control required for the project.

6.3 Performance Evaluations

Performance evaluation studies are conducted on this method annually, or more often, in order to maintain laboratory certifications or accreditations.

7.0 Reporting Limits

The reporting limit for TOC is 5.0 ppm. Reporting limits are typically 3 to 5 times the MDL.

Method detection limit studies are run annually in accordance with Microseeps Standard Operating Procedure for the Determination of Method Detection Limits and PQLs (SOP-ADM 18).

8.0 Safety

Safety glasses are required in all laboratory areas. For further information regarding safety issues, please refer to the Microseeps Chemical Hygiene Plan.

9.0 Waste

All sample waste and laboratory-generated waste shall be handled in accordance with Microseeps' Standard Operating Procedure for Waste Disposal.

9.1 Waste Minimization

Waste minimization is to be implemented where applicable. For more specific information concerning waste minimization, please consult Microseeps' Standard Operating Procedure for Waste Disposal.

10. References

U.S. Environmental Protection Agency, 1986, Test Methods for Evaluating Solid Waste, Volume C. Third Ed., SW 846-9060. Washington D.C.

Tekmar Dohrmann Phoenix 8000 User Manual. Copyright 1997 - 1998.

Microseeps Incorporated

Standard Operating Procedure for the Analysis of Biochemical Oxygen Demand (BOD) and Carbonaceous Biochemical Oxygen Demand (CBOD)

(Ref. Methods EPA 405.1 and SM5210B)

Controlled Copy No. _____

Signatures of Final Approval:

Dominic Nestasie
Laboratory Director

Patrick McLoughlin, Ph.D.
Technical Director

8-29-03
Date

1.0 Purpose and Application

The purpose of this method is to determine the relative oxygen requirements of wastewater. Biochemical oxygen demand is a calculation of the effect of waste discharges on the oxygen requirements of the water receiving the waste discharge. The oxygen requirements are measured by the amount of dissolved oxygen used by microbes in their consumption of organic matter in the waste. Method references can be found in Section 10.0 of this standard operating procedure.

Carbonaceous biological oxygen demand is the relative oxygen requirement of wastewaters when the nitrogenous demand is inhibited.

1.1 Analyte List

This method is applicable for determining biological oxygen demand and carbonaceous biological oxygen demand.

1.2 Matrix

This method is applicable to wastewater, effluents, and polluted waters.

2.0 Summary of Method

A non-preserved sample aliquot is added to a 300 ml bottle along with oxygenated buffered lab grade deionized water and a microbial seed. Bottles are topped of with the oxygenated water and dissolved oxygen is measured with a meter. Bottles are capped and incubated in dark at 21°C for five days. After fives days, bottles are removed and dissolved oxygen is measured. The most recent oxygen measurement is subtracted from the original oxygen measurement and the total oxygen used is recorded.

2.1 Definitions

Glucose-Glutamic Acid (GGA): a standard check solution on which a BOD CBOD measurement is made in order to evaluate dilution water quality, seed effectiveness, and analytical technique. The GGAs should be used to evaluate precision and bias.

Laboratory Control Sample: sample matrix free from analytes of interest, spiked with verified known amounts of analytes. Used to assess the performance of the measurement system.

Method Blank: a sample of similar matrix that is free from the analytes of interest that is processed through all the steps of the analysis with other samples. No target analytes should be present at concentrations that impact the analytical results.

Duplicates: two sub-samples of the same sample analyzed within a short time interval.

2.2 Method Limitations

An adjustment of pH may be necessary to reach a pH in the range of 6.5 to 7.5. The presence of oil or grease in samples may coat the probe and cause dissolved oxygen detection to be inhibited. Residual chlorine can cause interference by killing microbes that are present in the seed.

3.0 Apparatus, Materials, and Operating Conditions

3.1 Apparatus

- YSI Model 54A dissolved oxygen meter and probe
- Incubator thermostatically controlled at 20° ±1° C

3.2 Materials

- 300 ml BOD bottles with stoppers and snap on cover caps
- 1000 ml volumetric flask
- Magnetic stir plate
- Magnetic stirrers
- Pipettes
- pH strips
- Bench sheet for BOD or CBOD (originals are kept in the Master Bench Sheet File in the Wet Chemistry Laboratory)

3.3 Operating Conditions

- YSI Model 54A Oxygen Meter - Calibrate oxygen meter using oxygen saturated lab grade deionized water according to manufacturer's instructions on back of meter.

4.0 Reagents

All reagents are laboratory grade and purchased from a reliable manufacturer. All dry chemicals and other reagents are purchased from Fisher Scientific unless noted otherwise. All reagents, prepared solutions, and standards are stored according to manufacturer and method specific instructions. Standards are labeled and documented in accordance with Microseeps Standard Operating Procedure for Standards and Reference Materials SOP-ADM 15.

4.1 Standard Preparation Procedures

All standards are prepared using Type II 18 mega ohm ultra pure deionized water from a purchased system that is maintained by the manufacturer. All purchased reagents come with certificates of analysis and expire according to the specifications of the manufacturer. All other reagents listed below include a holding time or frequency of preparation.

4.1.1 Buffer Solutions

All buffer solutions are stored in plastic bottles in a cool, dry place. They are made up fresh every six months.

- **Magnesium sulfate solution:** Prepared by adding 22.5 grams of $MgSO_4 .7H_2O$ to 1 liter volumetric flask and bringing volume to 1liter with deionized water.

- **Ferric chloride solution:** Prepared by adding 0.25 grams $FeCl_3 . 6 H_2O$ to 1 liter volumetric flask and bringing volume to 1 liter with deionized water.

- **Calcium chloride solution:** Prepared by adding 27.5 grams $CaCl_2$ to 1 liter volumetric flask and bringing volume to 1 liter with deionized water.

- **Phosphate buffer:** Prepared by adding 8.5 grams $KH_2 PO_4$, 21.75 gram K_2HPO_4, 17.7 grams Na_2HPO_4, and 1.7 grams NH_4Cl to a 1liter volumetric and bringing volume to 1 liter with deionized water.

4.1.2 Buffered Oxygen Saturated Lab Grade Deionized Water: Lab grade oxygen saturated deionized water is prepare by aerating deionized water for three to four hours and then adding each buffer at a ratio of 1 ml of buffer per liter of water. This solution is made fresh prior to use.

4.1.3 BOD Seed: Microbial seed (Polyseed) is prepared by adding capsule contents to 500 ml of buffered oxygen saturated lab grade deionized water and stirring for 1 hour. This solution is made fresh prior to use.

4.1.4 CBOD Seed: Microbial seed contains nitrification inhibitor as purchased (Polyseed), and is prepared the same as the BOD Seed above.

4.1.5 DPD Total Residual Chlorine Powder: One powder aliquot is released from the dispenser and added to 10 ml of sample for the determination of the presence of residual chlorine. The DPD expires 1 year from purchase.

4.1.6 Sodium Sulfite (0.025N): Sodium sulfite solution is prepared by adding 1.574 grams Na_2SO_3 to a 1 liter volumetric flask and bringing volume to 1 liter using deionized water. This solution is used for removal of residual chlorine from sample aliquots. This solution is made fresh prior to use.

4.1.7 1N Sodium Hydroxide: The sodium hydroxide (NaOH) is used in pH adjustment.

4.1.8 1N Sulfuric Acid: The sulfuric acid (H_2SO_4) is purchased from LabChem for use in pH adjustment.

4.1.9 Starch Solution: Add 5g of soluble starch to 25 ml of cold reagent water, mix thoroughly. Add the cold water suspension to 800 ml of boiling reagent water. Dilute to 1 L and allow to

boil a few minutes. Let cool and store in refrigerator. This solution may be preserved by adding 5 ml chloroform per liter.

4.2 Quality Control Sample Preparation

4.2.1 Laboratory control sample (LCS) purchased from ERA as a standard solution with a certified concentration prepared by adding 5 ml of standard solution to 1 liter volumetric flask and bringing volume to 1 liter using deionized water. The LCSW (37.4 mg/L) is made immediately prior to use. The purchased standard expires one year from date of purchase.

4.2.2 GGA solution (200 mg/L): Glucose/glutamic acid solution prepared by adding 0.15 g. dextrose and 0.15 g. glutamic acid to 1 liter volumetric and bringing volume to 1 liter using deionized water. The GGA reagents expire one year from the date of purchase. This solution is made up fresh prior to use.

4.2.3 Seed Control: The seed control solution is prepared by adding 1 packet of the seed to 500 ml of dilution water and stirring for one hour. This solution is made up fresh prior to each use and expires after 6 hours.

4.2.4 Blanks: Blanks are made using the unseeded buffered oxygenated deionized water.

4.3 Glassware and Storage Requirements for Reagents and Standards

All seed solutions and standards are made fresh prior to use and kept in plastic bottles at room temperature.

5.0 Procedure

Samples for BOD and CBOD are collected in 1 Liter unpreserved polypropylene bottles. Samples should be cooled to 4°C as soon as possible upon collection and shipped overnight to the laboratory. Samples must be analyzed within the holding time of 48 hours and samples should be stored at 4°C.

Analysts who use this method have been certified for the method by running Initial Demonstration of Proficiency (IDOP) Samples in accordance with Microseeps Standard Operating Procedure for Administering and Documenting Training in Laboratory Procedures and Instrumentation (SOP ADM 02). IDOPs are run any time there is significant change to an instrument, method, or in the training procedure for training a new analyst.

The %RSD must be less than 20%. If this criterion is not met, the system is checked and the IDOP samples are re-analyzed.

5.1 Sample Pretreatment

5.1.1 Samples Containing Residual Chlorine

Samples need to be tested for the presence of residual chlorine by adding a pre-measured portion of DPD to 10 ml of sample. If sample aliquot turns pink upon addition of powder pillow, the sample contains residual chlorine, which needs to be removed by the one of the following procedures:

- Allow samples to stand in the light for 1 to 2 hours to dissipate the residual chlorine. Retest for residual chlorine before proceeding (use procedure below if residual chlorine remains)

OR

Determine required volume of sodium sulfite on a 100 ml aliquot of neutralized sample by removing a 100 ml sample aliquot and treating as follows:

- Add 10 ml of H2SO4 to the sample aliquot.
- Add 10 ml of 10% potassium iodide (KI) solution.
- Add 2 ml starch solution.
- Titrate with 0.025N sodium sulfite solution to the starch-iodine (blue) end point.

Based upon the amount of sodium sulfite used in the procedure above to dechlorinate 100ml of sample, determine the amount of sodium sulfite necessary to dechlorinate the remaining volume of sample, add the sodium sulfite to the neutralized sample, mix, and check the sample for residual chlorine after 10 – 20 minutes.

Sample pH must range from 6.5 to 7.5 and is tested using Colorphast pH strips. If pH is found to be outside of this range it is brought into range using 1N NaOH or 1N H_2SO_4.

5.1.2 Samples Supersaturated With Dissolved Oxygen

In order to prevent abiotic loss of oxygen during incubation in samples that contain more than 9 mg DO/L, reduce the DO to saturation at 20° C by bringing the sample to 20° C in a partially filled bottle while agitating by vigorous shaking.

5.1.3 Nitrification Inhibition

For CBOD analysis, nitrification inhibition is achieved by using a purchased seed containing a nitrification inhibitor.

5.2 Calibration

The Dissolved Oxygen meter is calibrated by placing the probe in a bottle filled with oxygen saturated deionized water for 20 minutes while the meter is set to the temperature mode. After 20 minutes the probe is at temperature and the dissolved oxygen meter is calibrated by turning the meter setting to10 and adjusting the dissolved oxygen reading according to the temperature chart on the back of the meter using the calibration knob.

The probe is rinsed with deionized water following the final reading and stored in water saturated air.

5.3 Sample Analysis

Several dilutions of prepared samples are made in order to obtain DO uptake of at least 2 mg/L. The number of dilutions is dependent upon the availability of historical information on the samples. The number of dilutions for samples of known origin range from two to six. For new samples with no historical data, a minimum of six dilutions shall be performed (1x, 5x, 10x, 25x, 50x, 100x). Analyst experience factors greatly in making the determination of number and types of dilutions. The analyst's goal is to analyze dilutions that result in a residual DO of at least 1 mg/L and a DO uptake of at least 2 mg/L after a 5 day incubation period in order to have data acceptable for reporting.

An analytical batch is a single set of twenty or fewer samples that is analyzed on a given day. The analysis is conducted according to the following procedure:

- Obtain and fill out a worksheet for each batch of samples to be analyzed.
- Be sure to note the date and time of analysis for this short hold.
- Line up a set of BOD bottles and record bottle I. D. on data sheet with corresponding sample I. D.
- Add 2 ml of BOD or CBOD seed to each BOD bottle.
- Measure and pour the sample aliquot for the desired dilution directly in the BOD bottle and record the time of addition on data sheet.
- Fill remainder of bottle with buffered oxygenated DI water.
- Read dissolved oxygen in each bottle by placing calibrated probe into bottle and allowing needle to stabilize. Record dissolved oxygen value on data sheet.
- Place stopper in each bottle and cap.
- Place capped bottles in a 20° C ± 1°C dark incubator for 5 days.
- After five days calibrate meter according to previous procedure. Remove bottles from incubator, uncap, and remove stoppers.
- Read final dissolved oxygen value and record on data sheet in appropriate column.

5.4 Quality Control Requirements

The acceptance criteria for the quality control samples listed below were derived from actual laboratory data. A minimum of twenty data sets was used to calculate the average and standard

deviation for each quality control sample type. Control limits were set using three times the standard deviation.

5.4.1 Meter Calibration

Oxygen meter must be calibrated prior to initial and final dissolved oxygen readings according to the manufacturer's instructions.

5.4.2 Blanks

Two buffered water blanks (seedless) must be run with every BOD batch. The blanks must consistently deplete less than 0.2 mg/L. Depletion cannot exceed 0.5 mg/L for reporting compliance samples.

Corrective Action: If the blank is outside of the acceptance criterion, the reason is determined and noted is a case narrative and it is noted that samples cannot be rerun due to expiration of hold time.

5.4.3 GGA

Two GGA standards are run at the beginning of the batch following the water blanks and two are run at the end of each batch. GGAs for the BOD and CBOD have a true value of 200 mg/L and the acceptance criteria is a percent recovery of 85% - 115%.

Corrective Action: If the GGA is outside of the acceptance criterion, the reason is determined and noted the case narrative and it is noted that samples cannot be rerun due to expiration of hold time.

5.4.4 Laboratory Control Sample

An LCSW is run once every batch. The LCSW is a certified solution from an outside source. The acceptance criterion for the LCSW is a percent recovery between 56% and 129%.

Corrective Action: If the LSCW is outside of the acceptance criterion, the reason is determined in the case narrative and it is noted that samples cannot be rerun due to expiration of hold time.

5.4.5 Duplicate Sample

A duplicate sample is analyzed once per analytical batch. Acceptance criterion for the duplicate and associated sample is a relative percent difference (RPD) must be less than 30%.

Corrective Action: If the RPD for the sample and its duplicate is outside of the acceptance criterion, the reason is determined in the case narrative and it is noted that samples cannot be rerun due to expiration of hold time.

5.4.6 Seed Control

A seed control is analyzed once per analytical batch. Acceptance criterion for the seed control is a seed correction factor of between 0.6 mg/L and 1 mg/L, and a residual DO of at least 1 mg/L and a DO depletion of at least 2 mg/L.

Corrective Action: If the acceptance criterion above is not met, the reason is determined and noted in the case narrative along with a note that samples cannot be reanalyzed due to hold time expiration.

5.5 Capturing and Submitting Data

The CBOD and BOD are calculated according to the following equation:

$$\text{Mg/L} = \frac{(\text{Initial D.O.-Final D.O.}) - \text{Blank Average D.O.}}{\text{Sample volume}} \times 300$$

If more than one sample dilution meets the criteria of a residual DO of at least 1 mg/L and a DO depletion of at least 2 mg/L and there is no evidence of toxicity at higher sample concentrations or the existence of an obvious anomaly, average results in the acceptable range and enter that result on the raw data sheet.

Contingency for Handling Out of Control or Unacceptable Data: Since samples cannot be reanalyzed due to holding time requirements, any out of control data must be investigated by the analyst to determine why the quality control sample(s) was/were not within acceptance criteria and those reasons should be noted in a case narrative. A detailed check of all reagents, including the seed must be made in addition to checking the analytical procedure. If the problem cannot be determined, the Lead Analyst should be asked to consult and if the problem still cannot be determined, the Technical Director shall be contacted immediately to determine the cause and implement corrective action.

Any data submitted with unacceptable quality control sample results shall be qualified in a case narrative. The narrative should indicate the out of control event that occurred, the corrective action that was taken, and any other pertinent information to inform the client of exactly what occurred.

6.0 Secondary Data Review

It is the analyst's responsibility to insure that all calibrations and quality control samples are within the specifications outlined in this SOP. All data are validated by the analyst and the Lead Analyst. Both signatures are required on all raw data sheets that attest to the following: "Your signature indicates all data is within acceptance criteria or justified in narrative form."

6.1 Peer Review

All data derived from this method undergoes peer data review prior to being turned into the assistant laboratory director. This review served to catch potential errors prior to the data's entry into the Laboratory Information Management System. This review may only be done by another analyst who is certified in this method or the Group Lead Analyst.

6.2 Laboratory Director Review

The Laboratory Director reviews 10% of all laboratory data and calculations. This review includes sample results, quality control acceptance limits, and a review of the level of quality control required for the project.

6.3 Performance Evaluation Studies

Performance evaluation samples are analyzed a minimum of annually on this method. Successful analysis of these samples is a requirement for certifications and accreditations.

7.0 Reporting Limits

The reporting limit for CBOD and BOD is 2 mg/L.

Method detection limit studies are run annually and must be equal to or lower than the reporting limit. MDLs are determined by analyzing seven aliquots of a known standard (estimated to be 3 to 5 times the lowest concentration that can be seen above noise level) through the procedure, and calculating the mean and standard deviation. Once the seven aliquots are run the results are given to the Quality Systems Coordinator. The Quality Systems Coordinator puts the MDL data into a spreadsheet and makes recommendations for adjustments to reporting limits, if necessary. MDL studies are kept on file in the Quality Systems Office.

8.0 Safety

Safety glasses are required in all laboratory areas. Samples and reagents should always be handled with caution. For other safety concerns, consult Microseeps' Chemical Hygiene Plan. Material Safety Data Sheets (MSDS) for all compounds used in this procedure are available in the Microseeps' conference room.

9.0 Waste

Unused portions of samples are kept for thirty days following analysis. The samples are then removed from the laboratory and stored until disposal according to Microseeps Standard Operation Procedure for Waste Disposal (SOP-ADM 14).

9.1 Waste Minimization

Where possible, Microseeps takes steps to minimize the amount of waste generated by substitution and good chemical handling procedures. For specific information on waste minimization consult SOP-ADM 14.

10.0 References

American Public Health Assoc., American Water Works Assoc, & Water Pollution Control Federation. Standard Methods for the Examination of Water and Wastewater, 19th Edition, Method 5210B, 1995.

Environmental Protection Agency. Methods for Chemical Analysis of Water and Wastes. EPA-600/4/79-020, Method 405.1, Cincinnati, OH 1974.

Microseeps, Incorporated

Standard Operating Procedure For the Analysis of Chemical Oxygen Demand

(Reference Method: Hach 8000)

Controlled Copy No. _____

Controlled Document

Signatures of Final Approval:

Dominic Nestasie
Laboratory Director

Patrick McLoughlin, Ph.D.
Technical Director

2-28-03
Date

1.0 Purpose and Application

Oxygen demand is an important parameter for determining the effect of organic pollutants on receiving waters. The three main methods used for determining oxygen demand are Biochemical Oxygen Demand (BOD), (indirectly) Total Organic Carbon (TOC), and Chemical Oxygen Demand (COD).

COD is a measurement of the oxygen required to oxidize material in a sample that will oxidize when subject to a strong oxidizing agent. This method details COD determination for samples with concentrations from 5 mg/L to 150 mg/L.

1.1 Analyte List

Chemical oxygen demand measured as mg/l COD.

1.2 Matrix

This method is applicable to analysis of wastewater, effluents, drinking water, groundwater, and surface waters.

2.0 Method Summary

Chemical Oxygen Demand (COD) is the oxygen equivalent of the amount of organic matter ozidizable by potassium dichromate ($K_2Cr_2O_7$) in a 50% sulfuric acid solution. During this oxidation process, which involves heating samples combined with acid and reagents in pre-prepared vials, each dichromate molecule loses 3 atoms of oxygen; therefore, most carbon converts to carbon dioxide, and any hydrogen converts to water. Additionally, the valence of chromium atoms in the dichromate changes from 6^+ to 3^+. This change, which is directly related to the oxygen demand, is measured colorimetrically at 420 nm. A standard curve is then used to convert the measured absorption to a concentration.

2.1 Definitions

Analytical Batch: Twenty or fewer client samples analyzed at one time.

Duplicates: two sub-samples of the same sample analyzed within a short time interval.

Laboratory Control Sample: sample matrix free from analytes of interest, spiked with verified known amounts of analytes. Used to assess the performance of the measurement system.

Matrix Spike: sample prepared by adding a known concentration of target analyte to a specific amount of sample. Matrix spikes are used to determine the effect of sample matrix on a method's recovery efficiency.

Preparation Blank: a sample of similar matrix that is free from the analytes of interest that is processed through all the steps of the analysis with other samples. No target analytes should be present at concentrations above the reporting limit.

2.2 Method Limitations

Incomplete oxidation of aliphatic hydrocarbons, organic acids, and alcohols is improved through the use of silver ions e.g. ($AgSO_4$), though heterocyclic compounds containing nitrogen still present difficulties. Interference from the oxidation of chloride is reduced by the addition of mercuric sulfate ($HgSO_4$). This eliminates interference from up to 2000 mg/l chloride. Interference may also arise from organic contamination from plastic sample containers.

The escape of volatile pollutants is prevented by the use of sealed digestion vials, which also eliminate the need for condensers.

3.0 Apparatus, Materials, and Operating Conditions

3.1 Apparatus

- HACH COD micro digestion reactor
- Spectronic 20G Spectrophotometer capable of reading 420 nm

3.2 Materials

- COD digestion reagent vials
- Volumetric flasks
- Pipets, Eppendorf and volumetric
- Specimen cups
- Test tube rack
- COD Bench sheet

3.2 Operating Conditions

- The spectrophotometer is allowed to warm up for at least 1 hour prior to use.
- Samples are brought to ambient room temperature before analysis.

4.0 Reagents

All reagents are laboratory grade and purchased from a reliable manufacturer. COD Reagent vials are purchased from a reliable manufacturer and contain specified amounts of sulfuric acid, mercuric sulfate, potassium dichromate, silver sulfate, and deionized water.

4.1 Standard Preparation Procedures

All standards are prepared using Type II 18 mega ohm ultra pure deionized water.

4.1.1 Stock KHP Solution (1000mg/l O2): In a 1-liter volumetric flask, dissolve 0.8502 g of KHP crystals. Dilute to volume with deionized water and mix thoroughly.

4.1.2 Calibration Standards: Prepare a blank and five calibration standards by diluting 0.0, 0.25, 1.25, 2.50, 5.0, and 7.50 ml of the stock KHP solution to 50 ml (using a 50 ml volumetric flask) with deionized water.

4.2 Quality Control Sample Preparation

4.2.1 Laboratory Control Standard: Purchased commercially and prepared according to manufacturer's instructions. In most cases, add 5 ml of the purchased solution with a known demand value to 995 ml of deionized water to produce a standard with a known value.

4.2.2 Duplicate: Thoroughly homogenize the sample and remove an appropriate aliquot.

4.2.3 Matrix Spike: Add 0.25 ml of 1000-ppm stock KHP solution to 6 ml of sample for a final concentration of 40 mg/l.

4.2.4 Preparation Blank: Prepared from ultra pure water deionized water.

4.3 Glassware and Storage Requirements for Reagents and Standards

The COD reagent vials and stock standard solution are stored at 4°C ± 2°C. The COD reagent vials are stored in a closed box to minimize exposure to light. Calibration standards are prepared shortly before analysis. All standards and reagents are stored in amber jars.

5.0 Procedure

Samples are collected in sulfuric acid (H_2SO_4) preserved polypropylene bottles to ensure a pH of less than 2 with a minimum sample volume of 125 ml. Samples may be stored for up to 28 days from the date of collection at 4°C ± 2°C.

Analysts who use this method have been certified for the method by running Initial Demonstration of Proficiency Samples. The IDOPs are an identical set of 4 LCSWs run consecutively. IDOPs are run any time there is significant change to an instrument, method, or in the Training procedure for training a new analyst.

The percent relative standard deviation (%RSD) is calculated for the IDOPs by:

$$\%RSD = \frac{\sigma_{n-1}}{S} \times 100\%$$

Where:

% RSD = the percent relative standard deviation.
σ_{n-1} = the standard deviation about the mean.
S = the mean response $(X_1 + X_2 + X_3 + X_4)/4$

The %RSD must be less than 20%. If this criterion is not met, the system is checked and the IDOP samples are re-analyzed.

5.1 Sample Preparation

Samples are allowed to come to ambient room temperature prior to analysis.

5.2 Calibration

5.2.1 Initial Calibration (ICAL): Prior to sample analysis, calibration standards are prepared at the following concentrations: 0.0 mg/l, 5.0 mg/l, 25.0 mg/l, 50.0 mg/l, 100 mg/l, and 150.0 mg/l (See Section 4.1.2). Acceptance criterion for the initial calibration is a correlation coefficient of 0.995 or greater.

Corrective Action: If the correlation coefficient is less than 0.995, sample analysis is placed on hold until the problem is corrected. Another set of calibration standards is prepared and analyzed.

The spectrophotometer is zeroed by placing a vial filled with deionized water in the instrument and pressing the zero absorbance button. The spectrophotometer should then read 0.000 absorbance. The calibration samples used for the curve must be prepared and digested for every lot of COD vials purchased or if the calibration verification no longer falls within the recovery limits specified on the bench sheet. The calibration curve shall be run following the steps in Section 5.3.

5.2.2 Initial Calibration Blank (ICB): Initial calibration or initial calibration verification is immediately followed by an initial calibration blank. The result of the blank must be less than the reporting limit of 5 mg/l COD.

Corrective Action: If the ICB is outside of the acceptance criteria, a new blank is prepared and analyzed. Analysis cannot proceed until an acceptable blank is confirmed.

5.2.3 Initial Calibration Verification (ICV): A mid-point standard made from the stock standard solution is analyzed to verify initial calibration. If the percent drift of the ICV is within ± 10% of the true standard concentration, it is not necessary to analyze a new ICAL.

Corrective Action: If the ICV is outside of the acceptance criteria, a new initial calibration curve must be analyzed.

5.3 Sample Analysis

5.3.1 Obtain and complete the top portion of the bench sheet for COD.

5.3.2 Remove the reaction vials from the refrigerator.

5.3.3 Place the appropriate number of reaction vials in a holding rack.

5.3.4 Allow vials to warm to room temperature (approximately 1.5 hrs.)

5.3.5 Label the vials with the sample identification or standard concentration.

5.3.6 Remove the cap from the vial.

5.3.7 Pipette 2.0 ml of the sample, or 2.0 ml of an appropriate dilution into the vial.

Note: Spilled reagent will affect test accuracy and is hazardous to skin and other materials. DO NOT RUN THE COD TEST WITH VIALS THAT HAVE HAD ANY REAGENTS SPILLED FROM THEM.

Use only the exact volume of sample called for in the procedure. A larger sample volume will dilute the acid concentration and lower the boiling point of the mixture. This will increase the pressure, which may break the vial.

5.3.8 Replace the cap and tighten to avoid vapor loss and accidental spillage.

5.3.9 Hold the vial by the cap and invert several times to mix. CAUTION: The vial will become very hot during mixing. Do not hold tube near face.

5.3.10 Visually examine the vial. If the color of the sample turns green, the COD concentration is too high. Re-prepare the sample at a dilution.

5.3.11 Place the vials in the COD reactor. After all of the vials are in place, turn the reactor on and heat the vials for 2 hours.

5.3.12 Check the vials after approximately 20 minutes to determine if any additional samples have turned green in color.

5.3.13 After 2 hours, turn off the reactor and allow the vials to cool to 120°C or less.

5.3.14 Take the vials out of the reactor and allow them to cool to room temperature.

5.3.15 Place the cooled vial directly into the spectrophotometer after wiping with a Kim wipe to remove fingerprints and record the absorbance at 420 nm.

5.3.16 Record the standard and sample absorbencies on the bench sheet.

5.3.17 Use the standard curve to calculate COD based upon the absorbance measured in the previous step, and record the value in the appropriate column on the data sheet as described in Section 5.5 below.

5.4 Quality Control Requirements

The following quality control samples must be run with each analytical batch. Acceptance criteria for the quality control samples were generated using in-house data that consisted of a minimum of twenty data sets. The average and standard deviation for each quality control sample type were calculated. Control limits were set using the average percent recovery ± three times the standard deviation for the LCSW and matrix spikes, and three times the standard deviation of the RPDs of sample/duplicate sets.

Preparation Blank (PBW): A preparation blank is analyzed with every batch of samples. The preparation blank must be less than the reporting limit of 5 mg/l COD.

Corrective Action: If the preparation blank is outside of acceptance criteria, analysis is halted, the problem corrected, and another preparation blank is analyzed.

Laboratory Control Standard (LCS): A laboratory control standard is analyzed with every batch of samples. Acceptance criteria for the LCS is a percent recovery between 73-121%.

Corrective Action: If the LCS falls outside of acceptance criteria, sample analysis is halted and a detailed check of the deionized water and chemical purity is made. Reagents, standards, and other quality control samples are re-prepared. If problems persist, sample analysis will be placed on hold and the Technical Director shall be contacted immediately to determine the cause and implement corrective action. A new LCS must fall within the acceptance criteria in order for analysis to continue.

Duplicate: A sample duplicate is analyzed with every batch of samples. Relative percent difference is calculated between the sample and its associated duplicate using the following formula. Acceptance criterion for the sample duplicate is an RPD of less than or equal to (≤) 29%.

$$RPD = \frac{2 \times |C1 - C2|}{C1 + C2} \times 100$$

Corrective Action: If the sample duplicate falls outside of the acceptance criteria, the analytical procedure is reviewed and another duplicate is analyzed provided sufficient sample volume is available. See note below for instructions on the procedure to follow when the second duplicate result is out of acceptance criteria.

Matrix Spike: A matrix spike is run with every analytical batch of samples. Acceptance criterion for the matrix spike is a percent recovery between 51-136%. Percent recovery is calculated using the following formula:

$$Percent\,\mathrm{Recovery} = \frac{MeasuredValue}{TrueValue} \times 100\%$$

Corrective Action: If the matrix spike is outside of the acceptance criterion, but all other quality control samples are within their respective control limits, the cause is attributed to matrix interference. If other quality control is outside of control limits, analysis is halted, the analysis procedure is scrutinized to find the cause, the problem corrected, and samples analyzed prior to the matrix spike must be reanalyzed.

Contingency for Handling Out of Control or Unacceptable Data: All samples associated with out of control quality control samples (with the exception of matrix interference) must be reanalyzed. If quality control acceptance criteria cannot be met using the corrective action above, a detailed check of the deionized water and chemical purity is made. Reagents, standards, and other quality control samples are re-prepared and analyzed. If problems persist, sample analysis will be halted and the Technical Director shall be contacted immediately to determine the cause and implement corrective action.

Any data submitted with unacceptable quality control sample results shall be qualified in a case narrative. The narrative should indicate the out of control event that occurred, the corrective action that was taken, and any other pertinent information to inform the client of exactly what occurred.

5.5 Capturing and Submitting Data

Calibration, sample, and quality control absorbencies are recorded on the bench sheet and are used to calculate concentrations from the least-squares-fit line derived from the 5-point calibration. Results are reported in mg/l.

Complete Calibration Section of Bench Sheet:

- Record absorbance from each calibration standard on the Bench Sheet
- Calculate and record slope of the calibration.
- Calculate and record the Y intercept.
- Calculate and record the coefficient of correlation.

Calculate the Sample Concentration:

The concentration of the sample can be calculated using the following formula:

$Y = mx + b$

Where:
y = sample concentration (dependent variable)
m = slope as determined by the calibration.
x = sample absorbance (independent variable)
b = y intercept as determined by the calibration.

6.0 Secondary Data Review

The analyst is responsible for insuring that all calibrations, calibration checks, and quality control samples are within the specifications outlined in this SOP.

The analyst and the Lead Analyst validate all data. Both signatures are required on all raw data sheets that attest to the following: "Your signature indicates all data is within acceptance criteria or justified in narrative form."

The analyst checks all raw data and calculations for reasonableness and accuracy, making sure that sample dilutions are taken into account. Quality control results are rechecked for compliance with acceptance criteria. If any acceptance criteria cannot be met or if any atypical conditions are encountered, a Case Narrative detailing the conditions is written and handed in with the results.

6.1 Peer Review

All data derived from this method undergoes peer data review prior to being turned into the assistant laboratory director. This review serves to catch potential errors prior to the data's entry into the Laboratory Information Management System. This review may only be done by another analyst who is certified in this method or the Group Lead Analyst.

6.2 Laboratory Director Review

The Laboratory Director reviews 10% of all laboratory data and calculations. This review includes sample results, quality control acceptance limits, and a review of the level of quality control required for the project.

6.3 Performance Evaluation Studies

Performance evaluation samples are analyzed a minimum of annually on this method. Successful analysis of these samples is a requirement for certifications and accreditations.

7.0 Reporting Limits

The reporting limit for COD is 5 mg/l. Reporting limits are typically 3 to 5 times the MDL.

Method detection limit studies are run annually and must be equal to or lower than the reporting limit. MDLs are determined by analyzing seven aliquots of a known standard (estimated to be 3 to 5 times the lowest concentration that can be seen above noise level) through the procedure, and calculating the mean and standard deviation. Once the seven aliquots are run the results are given to the Quality Control Coordinator. The Quality Control Coordinator puts the MDL data into a spreadsheet and makes recommendations for adjustments to reporting limits, if necessary.

8.0 Safety

Safety glasses are required in all laboratory areas. Samples and reagents should always be handled with caution. For other safety concerns, consult Microseeps' Chemical Hygiene Plan. Material Safety Data Sheets (MSDS) for all compounds used in this procedure are available in the Microseeps' conference room.

9.0 Waste

Unused portions of samples are kept for thirty days following analysis. The samples are then removed from the laboratory and stored until disposal according to Microseeps Standard Operation Procedure for Waste Disposal (SOP-ADM 14).

9.1 Waste Minimization

Where possible, Microseeps takes steps to minimize the amount of waste generated by substitution and good chemical handling procedures. For specific information on waste minimization consult SOP-ADM 14.

10.0 References

Environmental Protection Agency. Methods for Chemical Analysis of Waters and Wastes. EPA-600/4/79-020, Method 410.4, Cincinnati, OH 1978.

"Hach Handbook if Water Analysis." Hach Chemical Company, 1979. Method 8000.

"Hach Analytical Procedure: Chemical Oxygen Demand, Reactor Digestion Method." Hach Chemical Company, 1983.

Standard Methods for the Examination of Water and Wastewater, 2320 B. 1989, 17th Ed. American Public Health Association, Washington, DC.