

CASE NARRATIVE

Monthly Data Pall Life Sciences

Project: 1,4-Dioxane Remediation

Date: February 2016

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Gelman Sciences, Inc. d/b/a Pall Life Sciences (PLS) attests to the validity of the laboratory data generated by PLS's Ann Arbor, Michigan Environmental Laboratory facilities reported herein. All analyses performed by PLS's Environmental Laboratory facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. PLS's Environmental group has 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.

Samples were sent to Brighton Analytical LLC for analysis to insure that they could be analyzed during hold time. This was due to an autosampler failure which has now been rectified. These samples are noted in the comment section of the attached report. Brighton Analytical, L.L.C., is a NELAP, TNI, and MDEQ Drinking Water Accredited Laboratory. The balance of the samples were analyzed by PLS's Environmental Laboratory. The test results in this report meet all NELAP requirements for parameters for which accreditation are required or available. Any exceptions to NELAP requirements are noted in this report. All exceptions are noted per laboratory standard operating procedure based on EPA Method 1624c. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results. The odd even rule is used for rounding. Holding times were met for all samples analyzed. Proper preservation was observed on all samples unless otherwise detailed in the individual sections below.

RECEIPT/ STORAGE

The samples were received on the days noted in the report for the Month; the samples arrived in good condition, properly preserved and on ice when necessary. Samples that require 1,4-dioxane analysis are collected in hydrochloric HCl acid-preserved vials to a pH of ≤ 2 , with the exception of the Pall ozone treatment samples. These samples have chemicals that, when mixed with the HCl acid, cause interferences and trap damage. Every attempt is made to analyze these samples within 24 hours of receipt.

Samples that require Bromate analysis are collected and preserved in the laboratory with ethylene di-amine and refrigerated.

Samples that are delivered to the laboratory the same day as they are collected are likely not to have reached a fully chilled temperature. This is acceptable as long as there is evidence that chilling has begun. All samples are iced or refrigerated at 4°C ($\pm 2^{\circ}\text{C}$) from the time of collection until sample preparation or analysis.

1,4-Dioxane (GC-MS)

All ground water and treated water samples were analyzed for 1,4-Dioxane (GC-MS) in accordance with EPA 1624C, which has been modified to enhance detection limits. Samples that were diluted to bring them within the calibrated range of the instrument are noted with a "D" under the Qualifier Code section of the data report. Reporting limits were adjusted based on each dilution.

No other difficulties were encountered during the 1,4-dioxane analyses. Reporting limit for undiluted samples is 1ppb (part per billion, micrograms per liter, $\mu\text{g/L}$). All quality control parameters were within the acceptance limits.

Some difficulties were seen with an autosampler inability to transport samples; the concentrator data was not affected. No other difficulties were encountered during the 1,4-dioxane analyses. Reporting limit for undiluted samples is 1ppb (part per billion, micrograms per liter, µg/L). All quality control parameters were within the acceptance limits.

A new Field Sampling Technique is being investigated for 1,4-dioxane samples. Samples taken with the prospective technique are labeled "BAG" in the comment section. Until validation of the sampling technique is completed these data will be considered experimental values only.

Bromate (Ion Chromatography)

All surface water and treated samples were analyzed for Bromate (Ion Chromatography) in accordance with EPA 300.1. Surrogates are added to all samples. All quality control parameters were within the acceptance limits with the balance of sample analyzed.

The reporting limit for treated samples is 5.0ppb and for surface samples is 2.0ppb.

Qualifiers

1,4-Dioxane Qualifier Codes:

<u>Qualifier Code</u>	<u>Description</u>
nd:	The compound was analyzed for, but was not detected at or above the detection limit indicated.
D:	Analyte value quantified from a dilution, reporting limit is raised to reflect dilution.
E:	The compound result is greater than the upper quantitation limit in the associated calibration curve, reported as estimate.
B:	The sample vials contained air bubbles larger than 5mm, which may affect compound results.
J:	The compound was positively identified; the associated numerical value is the approximate concentration.
M:	Matrix effects, sample required dilution.
R:	The reported value is unusable and rejected due to variance from quality control criteria.
V:	The reported value is considered estimated due to variance from quality control criteria.
H:	Sample was analyzed past 14 day hold time, but within 28 days.
O:	Samples analyzed in outside laboratory.
S:	Samples split with DEQ.

Bromate Qualifier Codes:

<u>Qualifier Code</u>	<u>Description</u>
nd:	The compound was analyzed for, but was not detected at or above the detection limit indicated.
E:	The compound result is greater than the upper quantitation limit in the associated calibration curve.
J:	The compound was positively identified; the associated numerical value is the approximate concentration.
R:	The reported value is unusable and rejected due to variance from quality control criteria.
V:	The reported value is considered estimated due to variance from quality control criteria.
H:	Sample was analyzed past 28 day hold time

Analyst: Susan E.O. Peters SusanEO Peters Date: 03-11-16

Report Checked by: Laurel Beyer Laurel Beyer Date: 3-11-16



Sample Analysis Report

February, 2016

642 South Wagner Road
Ann Arbor, MI 48103-9019 US
734.436.4025 phone

Analyst Initials: SEW
Date: 02-11-16

Sample Name - Date/Time Sampled	1,4-Dioxane Results (ppb)	R.L. (ppb)	Bromate Results (ppb)	R.L. (ppb)	Bromide Results (ppb)	R.L. (ppb)	Comments	Qualifier(s)
Residential Wells								
D0								
4601 Park 4 inch-02-08-16-14:13-1	2	1.0						
4601 Park 6 inch-02-08-16-13:41-1	2	1.0						
Extraction Wells								
C3								
DOLPH-02-01-16-08:43-1	76	10.0						D
TW-20-02-01-16-08:35-1	720	50.0						D
D2								
LB-4-02-01-16-09:15-1	400	25.0						D
TW-21-02-01-16-09:27-1	130	5.0						D
E								
TW-16-02-01-16-10:26-1	760	50.0						D
TW-18-02-01-16-08:48-1	250	10.0						D
TW-19-02-01-16-10:28-1	834	25.0						D
Marshy								
PW-1-02-01-16-08:45-1	720	25.0						D
SW								
TW-22-02-01-16-09:58-1	660	50.0						D
TW-8-02-01-16-10:00-1	780	50.0						D

Sample Name - Date/Time Sampled	1,4-Dioxane Results (ppb)	R.L. (ppb)	Bromate Results (ppb)	R.L. (ppb)	Bromide Results (ppb)	R.L. (ppb)	Comments	Qualifier(s)
Monitoring Wells								
C2								
MW-25s-02-11-16-11:48-1	170	10						D
C3								
MW-105s-02-16-16-15:13-1	540	10.0						D
MW-18d-02-29-16-11:21-1	130	10.0						D
MW-2d-02-10-16-11:42-1	28	1.0						
MW-2s-02-10-16-11:29-1	4	1.0						
MW-32-02-24-16-12:42-1	13	1.0						
MW-35-02-24-16-11:59-1	4	1.0						
MW-37-02-29-16-10:56-1	270	10.0						D
MW-39s-02-19-16-10:38-1	2	1.0						
D0								
A2 Cleaning Supply-02-02-16-11:43-1	48	1.0					Brighton Analytical	O
MW-51-02-05-16-12:10-1	nd	1.0						
MW-53d-02-01-16-15:46-1	nd	1.0					Brighton Analytical	O
MW-53i-02-01-16-16:12-1	56	1.0					Brighton Analytical	O
MW-53s-02-01-16-15:08-1	nd	1.0					Brighton Analytical	O
MW-61d-02-04-16-15:07-1	2	1.0						
MW-61s-02-04-16-14:35-1	12	1.0						
MW-93-02-02-16-11:05-1	5	1.0					Brighton Analytical	O
D2								
2819 Dexter Rd-02-08-16-15:17-1	320	10.0						D
MW-107-02-22-16-15:18-1	700	10.0						D
MW-113-02-09-16-14:02-1	59	1.0						
MW-118-02-12-16-11:29-1	58	1.0						

Sample Name - Date/Time Sampled	1,4-Dioxane Results (ppb)	R.L. (ppb)	Bromate Results (ppb)	R.L. (ppb)	Bromide Results (ppb)	R.L. (ppb)	Comments	Qualifier(s)
MW-11d-02-24-16-14:07-1	220	5.0						D
MW-17-02-19-16-11:40-1	340	10.0						D
MW-39d-02-19-16-11:00-1	55	1.0						
MW-4d-02-23-16-15:27-1	910	100.0						D
MW-77-02-23-16-13:57-1	1800	100.0						D
MW-92-02-10-16-13:50-1	27	1.0						
MW-94s-02-29-16-13:56-1	300	5.0						D
MW-BE-1d-02-26-16-13:05-1	710	10.0						D
MW-BE-1s-02-26-16-13:30-1	980	25.0						D
MW-KD-1d-02-25-16-14:26-1	210	5.0						D
MW-KD-1s-02-25-16-13:50-1	58	1.0						
E								
MW-100-02-23-16-14:47-1	2400	100.0						D
MW-101-02-09-16-15:18-1	150	1.0						
MW-103d-02-03-16-15:57-1	10	1.0					Brighton Analytical	O
MW-103s-02-03-16-14:51-1	78	1.0					Brighton Analytical	O
MW-104-02-18-16-14:14-1	8	1.0						
MW-104-02-18-16-13:45-1	6	1.0					BAG	
MW-105d-02-16-16-14:55-1	220	10.0						D
MW-106s-02-16-16-14:01-1	220	10.0						D
MW-108d-02-19-16-14:40-1	1500	100.0						D
MW-108s-02-19-16-13:50-1	410	10.0						D
MW-110-02-09-16-14:39-1	63	1.0						
MW-112i-02-04-16-13:57-1	8	1.0						
MW-112s-02-04-16-13:24-1	nd	1.0						
MW-115-02-22-16-14:43-1	370	10.0						D
MW-116-02-22-16-14:07-1	380	10.0						D

Sample Name - Date/Time Sampled	1,4-Dioxane Results (ppb)	R.L. (ppb)	Bromate Results (ppb)	R.L. (ppb)	Bromide Results (ppb)	R.L. (ppb)	Comments	Qualifier(s)
MW-119-02-10-16-15:24-1	84	1.0						
MW-30d-02-23-16-10:41-1	350	10.0						D
MW-64-02-24-16-13:30-1	42	1.0						
MW-66-02-24-16-11:40-1	2	1.0						
MW-72d-02-23-16-11:31-1	1400	100.0						D
MW-76i-02-02-16-14:02-1	100	10.0					Brighton Analytical	D, O
MW-76s-02-02-16-14:29-1	290	10.0					Brighton Analytical	D, O
MW-79d-02-17-16-13:57-1	3	1.0						
MW-79s-02-17-16-14:30-1	250	5.0						D
MW-81-02-29-16-14:52-1	290	10.0						D
MW-84s-02-02-16-15:15-1	100	1.0					Brighton Analytical	O
MW-85-02-26-16-14:25-1	910	50.0						D
MW-87d-02-18-16-15:00-1	350	25.0						D
MW-87d-02-18-16-14:40-1	340	10.0					BAG	D
MW-87s-02-18-16-15:18-1	760	25.0					BAG	D
MW-87s-02-18-16-15:28-1	950	25.0						D
MW-88-02-19-16-15:24-1	150	10.0						D
MW-90-02-10-16-14:35-1	28	1.0						
Marshy								
NMW-1s-02-03-16-13:45-1	2400	200.0					Brighton Analytical	D, O
NMW-2s-02-03-16-14:02-1	2600	200.0					Brighton Analytical	D, O
SW								
MW-10d-02-29-16-12:04-1	970	50.0						D
Surface Water								
Not Applicable								
HC/HR-02-01-16-08:55-1				nd	2.0			

Sample Name - Date/Time Sampled	1,4-Dioxane Results (ppb)	R.L. (ppb)	Bromate Results (ppb)	R.L. (ppb)	Bromide Results (ppb)	R.L. (ppb)	Comments	Qualifier(s)
HC/HR-02-02-16-09:15-1			nd	2.0				
HC/HR-02-03-16-08:30-1			nd	2.0				
HC/HR-02-04-16-09:15-1			nd	2.0				
HC/HR-02-05-16-09:45-1			nd	2.0				
HC/HR-02-08-16-08:15-1			nd	2.0				
HC/HR-02-09-16-08:30-1			nd	2.0				
HC/HR-02-10-16-09:15-1			nd	2.0				
HC/HR-02-11-16-08:37-1			nd	2.0				
HC/HR-02-12-16-08:50-1			nd	2.0				
HC/HR-02-16-16-08:15-1			nd	2.0				
HC/HR-02-17-16-08:55-1			nd	2.0				
HC/HR-02-18-16-08:45-1			nd	2.0				
HC/HR-02-19-16-08:45-1			nd	2.0				
HC/HR-02-22-16-08:45-1			nd	2.0				
HC/HR-02-23-16-08:20-1			nd	2.0				
HC/HR-02-24-16-08:25-1			nd	2.0				
HC/HR-02-25-16-09:00-1			nd	2.0				
HC/HR-02-26-16-09:00-1			nd	2.0				
HC/HR-02-29-16-09:00-1			nd	2.0				

Treatment System

OUTFALL-02-01-16-1	4	1.0						
OUTFALL-02-01-16-2			7	5.0				
OUTFALL-02-02-16-1	4	1.0						
OUTFALL-02-02-16-2			7	5.0				
OUTFALL-02-03-16-1	4	1.0						
OUTFALL-02-03-16-2			6	5.0				
OUTFALL-02-04-16-1	4	1.0						

Sample Name - Date/Time Sampled	1,4-Dioxane Results (ppb)	R.L. (ppb)	Bromate Results (ppb)	R.L. (ppb)	Bromide Results (ppb)	R.L. (ppb)	Comments	Qualifier(s)
OUTFALL-02-04-16-2			7	5.0				
OUTFALL-02-07-16-1	4	1.0						
OUTFALL-02-07-16-2			7	5.0				
OUTFALL-02-08-16-1	3	1.0						
OUTFALL-02-08-16-2			7	5.0				
OUTFALL-02-09-16-1	3	1.0						
OUTFALL-02-09-16-2			7	5.0				
OUTFALL-02-10-16-1	4	1.0						
OUTFALL-02-10-16-2			7	5.0				
OUTFALL-02-11-16-1	3	1.0						
OUTFALL-02-11-16-2			8	5.0				
OUTFALL-02-14-16-1	3	1.0						
OUTFALL-02-14-16-2			9	5.0				
OUTFALL-02-15-16-1	3	1.0						
OUTFALL-02-15-16-2			9	5.0				
OUTFALL-02-16-16-1	3	1.0						
OUTFALL-02-16-16-2			9	5.0				
OUTFALL-02-17-16-1	3	1.0						
OUTFALL-02-17-16-2			9	5.0				
OUTFALL-02-18-16-1	3	1.0						
OUTFALL-02-18-16-2			9	5.0				
OUTFALL-02-21-16-1	3	1.0						
OUTFALL-02-21-16-2			9	5.0				
OUTFALL-02-22-16-1	3	1.0						
OUTFALL-02-22-16-2			7	5.0				
OUTFALL-02-23-16-1	3	1.0						
OUTFALL-02-23-16-2			8	5.0				

Sample Name - Date/Time Sampled	1,4-Dioxane Results (ppb)	R.L. (ppb)	Bromate Results (ppb)	R.L. (ppb)	Bromide Results (ppb)	R.L. (ppb)	Comments	Qualifier(s)
OUTFALL-02-24-16-1	3	1.0						
OUTFALL-02-24-16-2			7	5.0				
OUTFALL-02-25-16-1	3	1.0						
OUTFALL-02-25-16-2			7	5.0				
OUTFALL-02-28-16-1	3	1.0						
OUTFALL-02-28-16-2			7	5.0				
OUTFALL-02-29-16-1	4	1.0						
OUTFALL-02-29-16-2			7	5.0				
Red Pond-02-01-16-06:20-1	490	10.0					Brighton Analytical	D, O
Red Pond-02-08-16-06:35-1	490	10.0					Brighton Analytical	D, O
Red Pond-02-16-16-08:04-1	420	10.0						D
Red Pond-02-22-16-06:45-1	460	10.0						D
Red Pond-02-29-16-08:10-1	460	10.0						D

Qualifier Codes:

- nd: The compound was analyzed for, but was not detected at or above the detection limit indicated.
- D: Analyte value quantified from a dilution, reporting limit is raised to reflect dilution
- O: Sample analyzed by and outside laboratory specified in the comment section