

CASE NARRATIVE**Monthly Data Pall Life Sciences
Project: 1,4-Dioxane Remediation
Date: January 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.

Two drinking water samples from residential wells were sent to Brighton Analytical LLC for analysis: 697 South Wagner Road, and 5005 Jackson Road. 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 with the exception of a Red Pond sample from the end of the month: Red Pond 02/25/16. This sample was analyzed three times with two autosampler failures causing unreportable data, the third analysis was on day 16 of the sample hold time. This sample was reported with the appropriate qualifier codes. Proper preservation noted for the methods performed on these 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.

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.

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, µg/L). All quality control parameters were within the acceptance limits.

Some difficulties were seen with an autosampler stopping in the middle of a run, the concentrator data was not affected. Where possible these samples were reanalyzed. One sample could not be resampled: Red Pond 02/25/2016, this sample was reanalyzed and reported with a Qualifier (H) and an explanation of the issue in the comment section. 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.

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 and standards and analyzed by Ion Chromatography utilizing background ion suppression and a conductivity detector. A surface water sample HC/HR 01/04/2016 had no bromate peak, however the surrogate was low. This sample was reported as an estimate per the Quality parameters of the method. No additional difficulties were encountered during the Bromate analyses. 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 Susan E.O. Peters Date: 02-12-16

Report Checked by: Laurel Beyer La Beyer Date: 2/12/16

Sample Analysis Report

January, 2016

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

Analyst Initials: SEOP
Date: 02-10-16

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-01-05-16-14:23-1	2	1.0						
4601 Park 6 inch-01-05-16-13:37-1	2	1.0						
5005 Jackson Rd-01-20-16-13:40-1	17	1.0					Brighton Analytical	O
Not Determined								
697 South Wagner Rd-01-20-16-13:55-1	nd	1.0					Brighton Analytical	O
Extraction Wells								
C3								
DOLPH-01-04-16-07:53-1	100	10.0						D
TW-20-01-04-16-08:10-1	890	10.0						D
D2								
LB-4-01-04-16-11:39-1	480	10.0						D
TW-21-01-04-16-11:50-1	140	1.0						
E								
TW-16-01-04-16-11:30-1	900	10.0						D
TW-18-01-04-16-07:56-1	280	10.0						D
TW-19-01-04-16-11:31-1	710	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)
Marshy								
PW-1-01-04-16-07:57-1	900	10.0						D
SW								
TW-22-01-04-16-11:46-1	550	10.0						D
TW-8-01-04-16-11:45-1	680	10.0						D
Monitoring Wells								
C3								
MW-20-01-27-16-16:08-1	nd	1.0						
D0								
A2 Cleaning Supply-01-05-16-15:33-1	56	1.0						
MW-51-01-06-16-11:56-1	nd	1.0						
MW-53d-01-04-16-14:56-1	nd	1.0						
MW-53i-01-04-16-15:21-1	40	1.0						
MW-53s-01-04-16-14:05-1	nd	1.0						
MW-61d-01-07-16-11:11-1	3	1.0						
MW-61s-01-07-16-11:31-1	15	1.0						
MW-93-01-06-16-14:30-1	4	1.0						
D2								
MW-120s-01-22-16-14:06-1	nd	1.0						
MW-121s-01-22-16-11:36-1	nd	1.0						
MW-122s-01-27-16-12:18-1	110	1.0						
MW-123s-01-26-16-15:07-1	nd	1.0						
MW-124s-01-28-16-10:52-1	nd	1.0						
MW-126s-01-21-16-14:00-1	nd	1.0						
MW-129i-01-08-16-13:00-1	nd	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-129s-01-08-16-13:33-1	nd	1.0						
MW-130i-01-08-16-16:06-1	2	1.0						
MW-130s-01-08-16-15:30-1	nd	1.0						
MW-131s-01-21-16-15:27-1	nd	1.0						
MW-133i-01-29-16-11:58-1	2	1.0						
MW-133s-01-29-16-11:19-1	2	1.0						
MW-134i-01-28-16-14:24-1	10	1.0						
MW-134s-01-28-16-13:52-1	9	1.0						
MW-54d-01-26-16-11:47-1	94	1.0						
MW-54s-01-26-16-11:02-1	nd	1.0						
E								
MW-103s-01-07-16-13:12-1	73	1.0						
MW-104-01-29-16-14:55-1	7	1.0						
MW-112d-01-07-16-16:30-1	nd	1.0						
MW-112i-01-07-16-15:40-1	10	1.0						
MW-112s-01-07-16-14:52-1	nd	1.0						
MW-120d-01-22-16-15:08-1	nd	1.0						
MW-121d-01-22-16-12:17-1	1	1.0						
MW-122d-01-27-16-11:29-1	nd	1.0						
MW-123d-01-26-16-15:55-1	nd	1.0						
MW-124d-01-28-16-11:41-1	nd	1.0						
MW-126d-01-21-16-14:45-1	nd	1.0						
MW-129d-01-08-16-14:22-1	1	1.0						
MW-130d-01-22-16-16:07-1	nd	1.0						
MW-131d-01-21-16-16:11-1	nd	1.0						
MW-133d-01-29-16-12:40-1	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)
MW-134d-01-28-16-15:03-1	5	1.0						
MW-135-01-25-16-15:32-1	nd	1.0						
MW-76i-01-06-16-15:43-1	110	1.0						
MW-76s-01-06-16-16:15-1	300	5.0						D
MW-84s-01-07-16-14:00-1	100	10.0						D
SH								
MW-5d-01-27-16-17:02-1	6500	200.0						D
Surface Water								
Not Applicable								
HC/HR-01-04-16-09:00-2			nd	2.0			no bromate peak found, surrogate recovery low, reported as estimate per method QC	V
HC/HR-01-05-16-08:45-1			nd	2.0				
HC/HR-01-06-16-08:45-1			nd	2.0				
HC/HR-01-07-16-08:45-1			nd	2.0				
HC/HR-01-08-16-08:45-1			nd	2.0				
HC/HR-01-11-16-08:30-1			nd	2.0				
HC/HR-01-12-16-08:30-1			nd	2.0				
HC/HR-01-13-16-08:30-1			nd	2.0				
HC/HR-01-14-16-08:25-1			nd	2.0				
HC/HR-01-15-16-08:30-1			nd	2.0				
HC/HR-01-19-16-09:00-1			nd	2.0				
HC/HR-01-20-16-08:30-1			nd	2.0				
HC/HR-01-21-16-08:55-1			nd	2.0				
HC/HR-01-22-16-08:52-1			nd	2.0				
HC/HR-01-25-16-08:55-1			nd	2.0				
HC/HR-01-26-16-08:55-1			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-01-27-16-09:15-1			nd	2.0				
HC/HR-01-28-16-08:56-1			nd	2.0				
HC/HR-01-29-16-09:15-1			nd	2.0				

Treatment System

OUTFALL-01-03-16-1	4	1.0						
OUTFALL-01-03-16-02			6	5.0				
OUTFALL-01-04-16-1	5	1.0						
OUTFALL-01-04-16-2			8	5.0				
OUTFALL-01-05-16-1	7	1.0						
OUTFALL-01-05-16-2			7	5.0				
OUTFALL-01-06-16-1	5	1.0						
OUTFALL-01-06-16-2			8	5.0				
OUTFALL-01-07-16-1	4	1.0						
OUTFALL-01-07-16-2			6	5.0				
OUTFALL-01-10-16-1	4	1.0						
OUTFALL-01-10-16-2			7	5.0				
OUTFALL-01-11-16-1	4	1.0						
OUTFALL-01-11-16-2			8	5.0				
OUTFALL-01-12-16-1	4	1.0						
OUTFALL-01-12-16-2			7	5.0				
OUTFALL-01-13-16-1	4	1.0						
OUTFALL-01-13-16-2			7	5.0				
OUTFALL-01-14-16-1	4	1.0						
OUTFALL-01-14-16-2			6	5.0				
OUTFALL-01-17-16-1	4	1.0						
OUTFALL-01-17-16-2			7	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-01-18-16-1	4	1.0						
OUTFALL-01-18-16-2			7	5.0				
OUTFALL-01-19-16-1	4	1.0						
OUTFALL-01-19-16-2			8	5.0				
OUTFALL-01-20-16-1	4	1.0						
OUTFALL-01-20-16-2			7	5.0				
OUTFALL-01-21-16-1	4	1.0						
OUTFALL-01-21-16-2			6	5.0				
OUTFALL-01-24-16-1	4	1.0						
OUTFALL-01-24-16-2			6	5.0				
OUTFALL-01-25-16-1	4	1.0						
OUTFALL-01-25-16-2			6	5.0				
OUTFALL-01-26-16-1	4	1.0						
OUTFALL-01-26-16-2			6	5.0				
OUTFALL-01-27-16-1	4	1.0						
OUTFALL-01-27-16-2			7	5.0				
OUTFALL-01-28-16-1	4	1.0						
OUTFALL-01-28-16-2			6	5.0				
OUTFALL-01-31-16-1	4	1.0						
OUTFALL-01-31-16-2			6	5.0				
Red Pond-01-04-16-08:26-1	440	10.0						D
Red Pond-01-11-16-07:40-1	480	10.0						D
Red Pond-01-19-16-08:20-1	490	10.0						D
Red Pond-01-25-16-09:25-1	390	10.0					run three times due to instrument stopping mid-run	D, H

Qualifier Codes:

- nd: The compound was analyzed for, but was not detected at or above the detection limit indicated.
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- H: Sample was analyzed past 14 day hold time, but within 28 days.
- O: Sample analyzed by and outside laboratory specified in the comment section
- V: The reported value is considered estimated due to variance from quality control criteria.