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April 23, 2019

Andrew Smith, P.E., LHG
UST/Technical Services Unit Supervisor
Ecology's Toxics Cleanup Program
Southwest Regional Office
Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: Fifth Annual Compliance Groundwater Monitoring Report
Agreed Order No. DE 97TCS121
Frederickson Industrial Park Site, Pierce County, WA
Geosyntec Project: GR4631H

Dear Mr. Smith:

This letter has been prepared by Geosyntec Consultants on behalf of Olin Corporation and Mallinckrodt US Holdings LLC (the Companies) to present the results from compliance monitoring completed in 2018 at the Frederickson Industrial Park Site (Site) in Pierce County, Washington (Figure 1). This compliance monitoring is being performed in accordance with the Washington Department of Ecology's (Ecology's) Agreed Order (AO) No. DE 9514 (Order).

Background

The Site encompasses 527 acres of land south of 176th Street East and east of Canyon Road East in the Fredrickson area of Pierce County, Washington. The Site is situated approximately 10 miles south of Tacoma and 8 miles southwest of Puyallup, and is located in unincorporated County area surrounded by a mixture of industrial, residential and commercial properties. Boeing is the current owner of the Frederickson Industrial Center; Olin and Mallinckrodt are the successors of former owners of the Site.

In 1997, the Companies entered into AO No. DE 97TC-S121 requiring the Companies to undertake the following remedial actions at the Site:

- devise and implement a permanent solution regarding the impact of carbon tetrachloride (CTC) in affected domestic drinking water wells; and

- design and implement a Remedial Investigation/Feasibility Study (RI/FS).

The RI/FS Report [Geosyntec, 2012][1] was submitted to Ecology by the Companies on 28 March 2012 and recommended monitored natural attenuation (MNA) to address CTC in groundwater.

The Cleanup Action Plan (CAP), which was approved by Ecology after a public comment period, was based upon Ecology's approval of MNA as the groundwater remedy. A Compliance Monitoring Work Plan (CMWP) was provided as part of the CAP and outlines the requirements for MNA compliance monitoring. The current compliance monitoring network encompasses eight monitoring wells at the Site (listed in Table 1) and includes hydrogeologic monitoring and groundwater sampling for CTC analysis. As described in the CMWP, compliance monitoring for the Site consists of performance monitoring to track MNA, followed by confirmational monitoring to confirm compliance with applicable cleanup standards. The performance monitoring sampling frequency was reduced from two monitoring events to a single annual event in 2016 as outlined in the CMWP and approved by Ecology. The May 2018 sampling event is the fifth year of the CMWP-required performance monitoring. In accordance with procedures outlined in the CMWP, and as defined in WAC 173-340-720(9)(iv), the performance monitoring well network was reduced from the original eleven wells identified in the CMWP to the current eight wells prior to the 2018 sampling event based on groundwater data from 2014-2017 and approved by Ecology on March 27, 2018. The sampling comparison evaluation results were presented to Ecology in the Fourth Annual Compliance Groundwater Monitoring Report dated February 12, 2018 and in an email dated April 3, 2018. Ecology approved the use of PDBs based on the sampling comparison evaluation results in an email dated April 6, 2018. The 2018 sampling event is the first compliance monitoring event to use PDBs exclusively for sample collection.

Performance Monitoring Groundwater Results

Hydrogeologic Monitoring

Water level data collected during the 2018 groundwater monitoring event are presented in Table 1. Water level contours for Aquifer A are shown in Figure 2 for the 2018 monitoring event. The groundwater gradient in Aquifer A is to the north-northwest towards Clover Creek, which is consistent with past monitoring events.

[1] Geosyntec, 2012. Remedial Investigation/Feasibility Study (RI/FS) Report, Frederickson Industrial Park, Frederickson, Washington. March 2012.

Groundwater elevation data collected semi-annually during 2014-2015 confirmed that water level changes conform to expectations with higher groundwater elevations at the end of the wet season (Spring) and lower groundwater elevations in the dry season (Fall). The groundwater elevation data collected during the 2018 groundwater monitoring event are consistent with the observations seen during previous monitoring events conducted during wet season conditions.

Carbon Tetrachloride

Eight monitoring wells were sampled using passive diffusion bags during the May 2018 monitoring event. The samples were analyzed for CTC by ALS laboratory. Figure 3 presents the performance monitoring well locations and updated CTC contour based on the 2018 CTC results. The CTC data are summarized in Table 2, and the analytical reports are provided in Attachment A. Concentration trends for CTC are plotted for the performance monitoring wells in Figures 4a-4c.

Consistent with previous monitoring results, monitoring wells BMW-18, HLA-1, and 11-CL continue to have the highest CTC concentrations ranging between 3.4 µg/L and 4.5 µg/L (Figure 4a). The intermediate concentration wells (e.g., MW-1 and MW-13) remain in the range between 1.8 µg/L and 2.1 µg/L (Figure 4b). The peripheral monitoring wells, MW-4 on the east, P2-S on the north, and 11-BL on the west, ranged from below method reporting limits of 0.36 (J) µg/L to 0.67 µg/L (Figure 4c). During the reporting period, P2-S and 11-BL had concentrations below the CTC cleanup level of 0.63 µg/L. The trends plotted in Figures 4a-4c illustrate continued declining or slightly variable low CTC concentrations (Table 3). Fluctuations between sampling events are expected given the low CTC concentrations and the seasonal variability of groundwater recharge and discharge.

P2-S continues to meet the CMWP requirements, however Ecology will not approve removal of this well from the performance monitoring network because it serves as a downgradient compliance well for the CTC plume. Therefore, P2-S will continue to be monitored in 2019.

2019 Monitoring Schedule

The monitoring schedule for 2019 will continue to be on an annual basis in accordance with Section 2.1 of the CMWP. This annual monitoring event will occur in the spring (2nd quarter), to coincide with seasonally high groundwater elevations.

Conclusions and Recommendations

The fifth year of MNA compliance monitoring confirmed that CTC concentrations continue to be low and generally declining. The results of the 2018 sampling event demonstrate that MNA is effectively reducing CTC concentrations at the Site.

Please contact Julie Peoples (423-336-4084) if you have questions regarding the information presented herein.

Sincerely,

James J. Deitsch, PhD.
Principal

David L. Parkinson, PhD., P.G. (WA, TX)
Principal Scientist

Cc: Julie Peoples, Olin Corporation
Karen Burke, Mallinckrodt
Deborah Taege, The Boeing Company
Anne Smith, Tacoma Water

Attachments:
Tables
Figures
Attachment A: Analytical Laboratory Report

Tables

Table 1.
Performance Monitoring for 2018 Groundwater Sampling Event Water Level Data
Brazier Site, Frederickson, Washington

Well	Ground Elevation (ft MSL)	Top of Casing Elevation (MSL)	Top of Screen (MSL)	Bottom of Screen (MSL)	Aquifer	Sample Date	Depth to Water (ft)	Water Level (MSL)
11-BL	395.5	396.08	331.5	321.5	Lower - Aquifer A	05/09/18	34.93	361.15
11-CL	403.69	404.55	329.7	319.7	Lower - Aquifer A	05/09/18	39.71	364.84
BMW-18	409.74	412.09	375.7	345.7	Upper - Aquifer A	05/09/18	36.27	375.82
HLA-1	403.86	405.81	320.9	310.9	Lower - Aquifer A	05/09/18	41.02	364.79
MW-1	413.27	415.79	324.8	314.8	Lower - Aquifer A	05/09/18	36.26	379.53
MW-4	465.5	467.72	317.9	307.9	Aquifer A	05/09/18	113.51	354.21
P2-S	340.55	343.6	320.6	310.6	Upper - Aquifer A	05/09/18	14.94	328.66
MW-13	394.5	394.1	284.5	274.5	Aquifer A	05/09/18	51.49	342.61

Note: The Performance Monitoring Network was revised following the 2017 Annual Sampling Event in accordance with the criteria established in the Compliance Monitoring Work Plan and per Ecology approval dated 27 March 2018; BMW-3, MW-7, and P2-I were removed from the network and are no longer sampled as part of compliance monitoring.

Table 2.
Carbon Tetrachloride Results for 2018
Brazier Site, Frederickson, Washington

Well	PDB Deployment Date	Sample Date	Result (µg/L)	Lab MRL	Lab MDL	Qualifiers	Depth to Water (ft)	Water Level (MSL)
11-BL	4/24/2018	05/09/18	0.51	0.5	0.096		34.93	361.15
11-CL	4/24/2018	05/09/18	**4.1**	0.5	0.096		39.71	364.84
BMW-18	4/24/2018	05/09/18	**3.4**	0.5	0.096		36.27	375.82
HLA-1	4/24/2018	05/09/18	**4.5**	0.5	0.096		41.02	364.79
MW-1	4/24/2018	05/09/18	**2.1**	0.5	0.096		36.26	379.53
MW-4	4/24/2018	05/09/18	**0.67**	0.5	0.096		113.51	354.21
P2-S	4/24/2018	05/09/18	0.36	0.5	0.096	J	14.94	328.66
MW-13	4/24/2018	05/09/18	**1.8**	0.5	0.096		51.49	342.61

Notes:

BOLD = CTC value above groundwater cleanup level of 0.63 µg/L

µg/L = micrograms per liter; equivalent to parts per billion

MRL = Method Reporting Limit

MDL = Method Detection Limit

Laboratory Qualifier:

J = Carbon Tetrachloride detected between the MDL and method reporting limit (MRL: 0.5 µg/L). The reported value is estimated.

Table 3.
2014-2018 Carbon Tetrachloride Groundwater Performance Monitoring Data
Brazier Site, Frederickson, Washington

Wells	11-BL	11-CL	HLA-1	BMW-3	BMW-18	MW-1	MW-4	MW-7	P2-S	P2-I	MW-13
May-14	**0.97**	**5.4**	**5.0**	*0.28*	**5.5**	**1.8**	**0.82**	**2.3**	**0.76**	**0.72**	**2.3**
Oct-14	**0.95**	**4.4**	**4.6**	*0.39*	**4.8**	**1.4**	**0.66**	ND	ND	ND	**1.9**
Mar-15	**0.64**	**4.3**	**4.4**	*0.19*	**4.2**	**1.5**	0.62	*0.22*	*0.29*	ND	**1.9**
Oct-15	**0.72**	**3.8**	**3.9**	0.51	**3.8**	**1.2**	0.53	*0.24*	*0.45*	ND	**1.7**
May-16	0.50	**2.9**	**3.6**	*0.27*	**3.7**	**1.5**	0.51	ND	*0.28*	ND	**1.3**
Jun-17	**0.74**	**3.7**	**4.4**	*0.43*	**4.7**	**1.8**	**0.67**	ND	*0.27*	ND	**1.6**
May-18[1]	0.51	**4.1**	**4.5**	--	**3.4**	**2.1**	**0.67**	--	*0.36*	--	**1.8**
95% UCL[2]	**0.74**	**4.1**	**4.5**	--	**4.7**	**2.1**	**0.67**	--	*0.45*	--	**1.8**

Notes:

1 - Groundwater sampling prior to 2018 was performed by low-flow method; use of passive diffusion bags for sampling began in 2018.

2 - 95% Upper Confidence Limit on true mean, using Ecology's Statistical Guidance for sample sets less than 20 (Example #15, page 97-98)
https://fortress.wa.gov/ecy/publications/documents/9254.pdf

WAC 173-340-720 (9)(e)(iv) **If more than fifty percent of the measurements are below the practical quantitation limit, the largest value in the data set shall be used in place of an upper confidence limit on the true mean groundwater calculation.

1.5	Bold values are above the CTC cleanup level of 0.63 µg/L
0.5	Estimated Value (i.e., concentration greater than method detection limit but less than method reporting limit)
ND	Non-Detected (Method Detection = 0.096)
--	Monitoring well no longer requires Performance Monitoring

The Performance Monitoring Network was revised following the 2017 Annual Sampling Event in accordance with the criteria established in the Compliance Monitoring Work Plan and per Ecology approval dated 27 March 2018; BMW-3, MW-7, and P2-I were removed from the network and are no longer sampled as part of performance monitoring.

Figures

1,000 500 0 1,000 Feet

Legend

Property Boundary

Source:
ESRI Basemap Imagery, accessed June 2018.

Property Location

Frederickson Industrial Park
Frederickson, WA

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Figure 1

N:\Frederickson\GIS\Figure 1-1 Property Location.mxd; RMurray; 6/18/2018

N

MW-7

P-1S
P-1I
P-2I
P-2S (328.66)

Clover Creek

330
335
340
345
350
355
360
365
370
375
380
385

MW-13 (342.61)

MW-4 (354.21)
12-A

MW-3

11-BL (361.15)

63rd Ave

BMW-21
Y-4B
Y-4A
BMW-19

180th Street

11-CU
11-CL (364.84)
HLA-1 (364.79*)

BMW-18 (375.82)

BMW-20
BMW-4
BMW-22
Y-3B
Y-5
14-AL
BMW-2
MW-1 (379.53)
BMW-12
BMW-13R
BMW-5
BMW-3
Y-2
BMW-16
Y-6
BMW-1
20-AU
Y-1
9-A
BMW-14
BMW-15
Y-7A
Y-7B
9-B
BMW-9
BMW-8
21-A
9-C
BMW-6
BMW-17
BMW-7
PW1
7-A
Y-8
BMW-11
BMW-10

750 375 0 750 Feet

Note:

* - Not used in water level contouring; well is screened in lower level of Aquifer A compared to wells used to develop contours.

Legend

- May 2018 Water Level Contours (ft masl)
- Aquifer A Compliance Monitoring Network Well (May 2018 Water Level (ft masl))
- Monitoring Wells
- Property Boundary

Aquifer A Groundwater Levels
May 2018

Frederickson Industrial Park
Frederickson, WA

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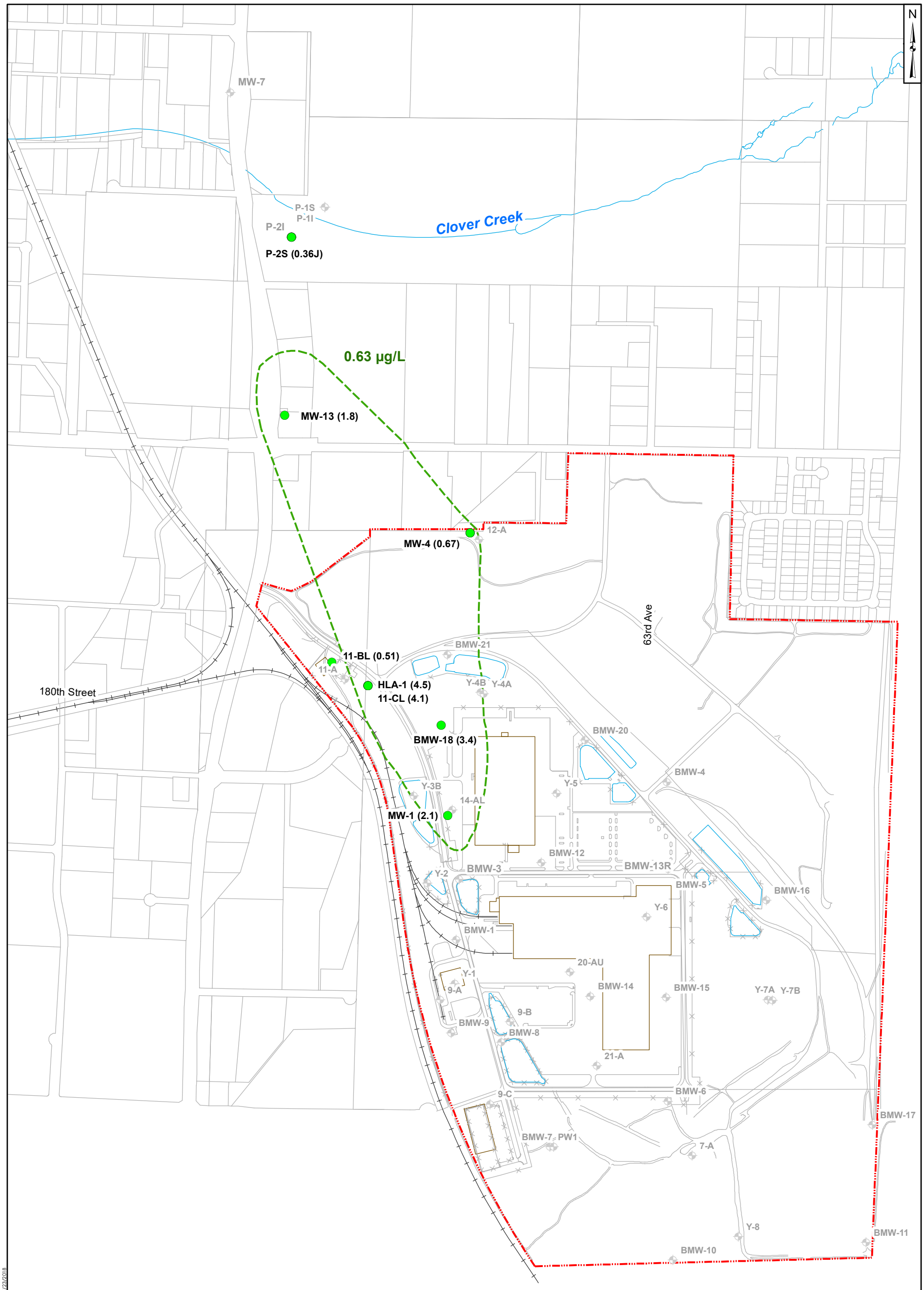
Kennesaw, GA | June 2018

Figure
2

N:\Frederickson\GIS\2018_Mxd\Figure_02_Oilin_GW_Elev_May2018.mxd; RMurray; 6/18/2018



Legend

- Aquifer A Monitoring Well (CTC Concentration (µg/L))
- Monitoring Wells
- CTC Contour for May 2018 data set
- Property Boundary

Notes:

1. (0.27 J) The results were above the Method Detection Limit (MDL), but below the Method Reporting Limit (MRL) and thus the values are estimated (i.e., J - flagged).

750 375 0 750 Feet

Aquifer A Carbon Tetrachloride Groundwater Results May 2018

Frederickson Industrial Park
Frederickson, WA

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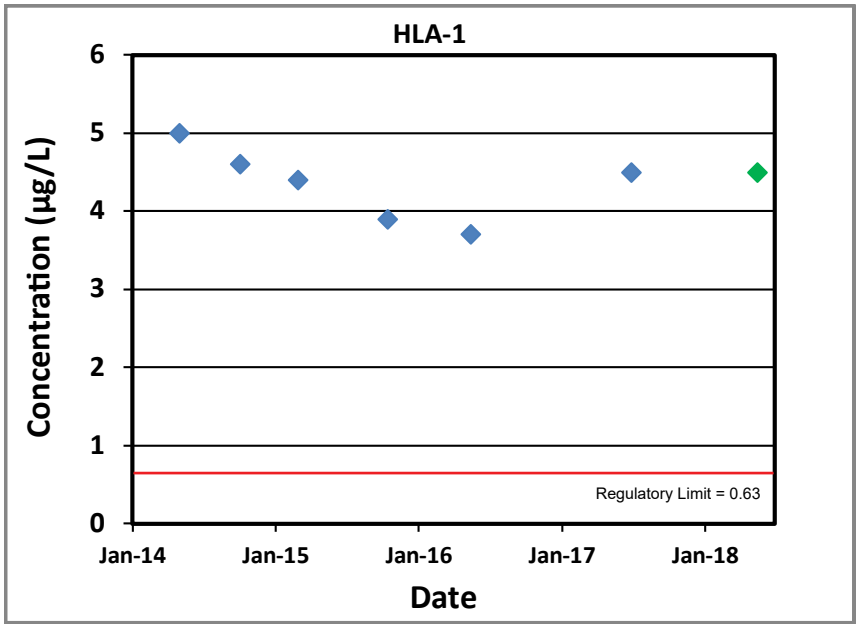
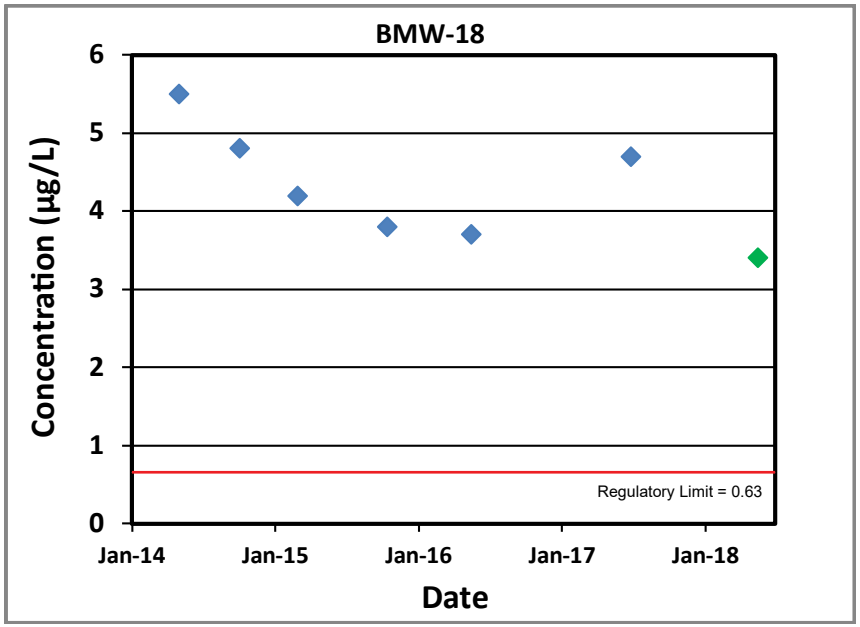
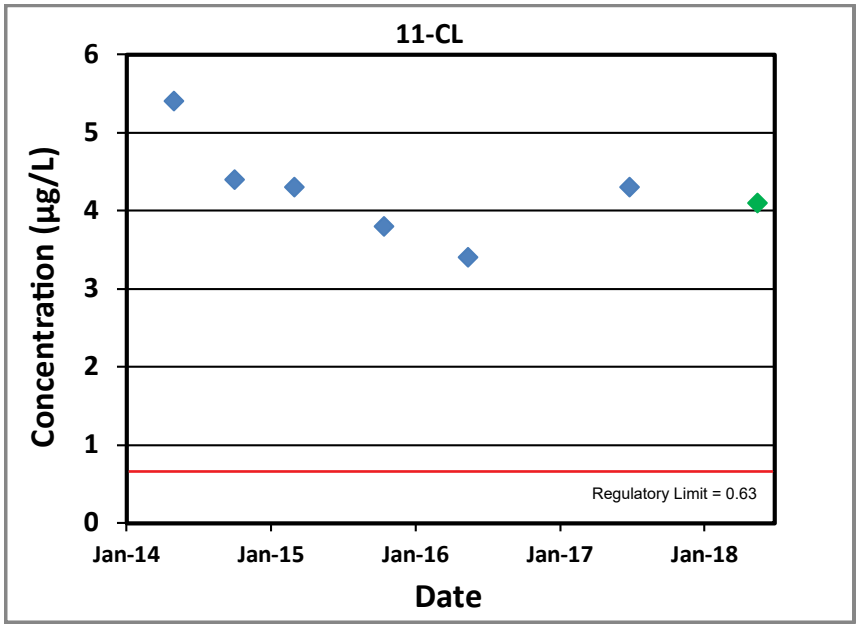
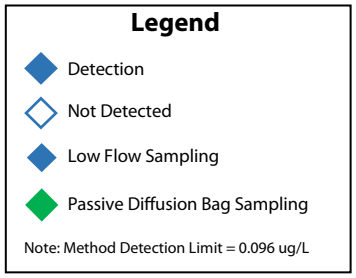
Figure 3

N:\Frederickson\GIS\2018 May\Figure 03 Oln CTC Conc May2018.mxd: SColsky: 7/23/2018









Carbon Tetrachloride
Groundwater Monitoring Well Data
Frederickson Industrial Park, Frederickson, WA

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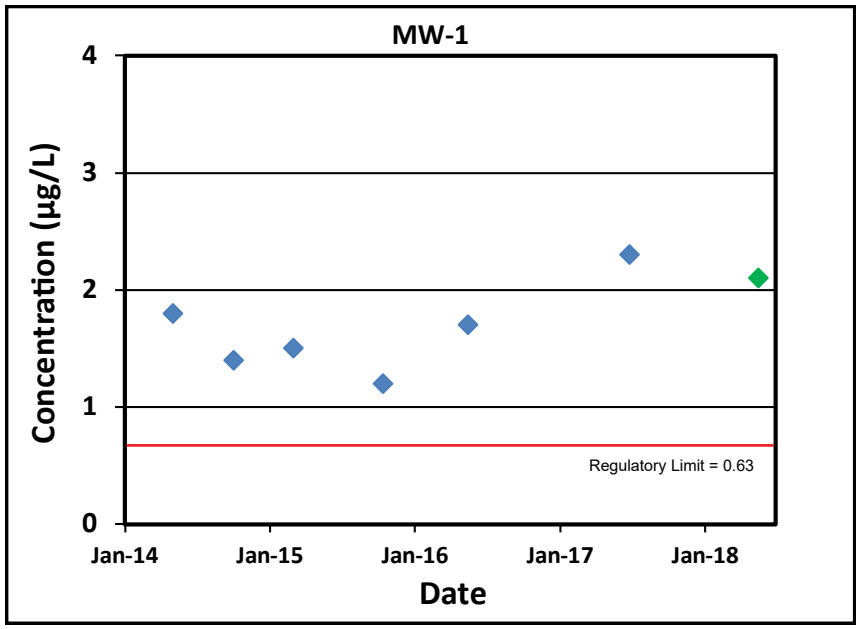
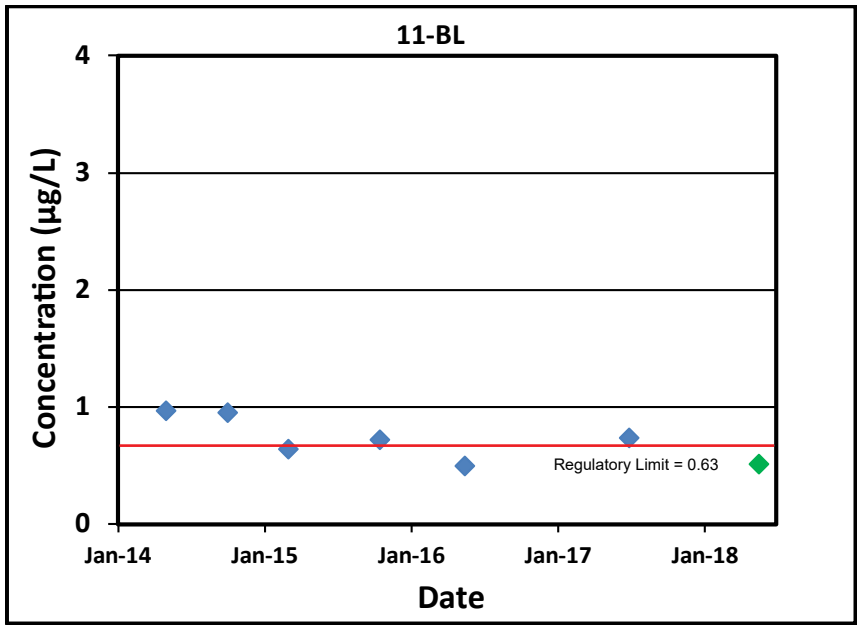
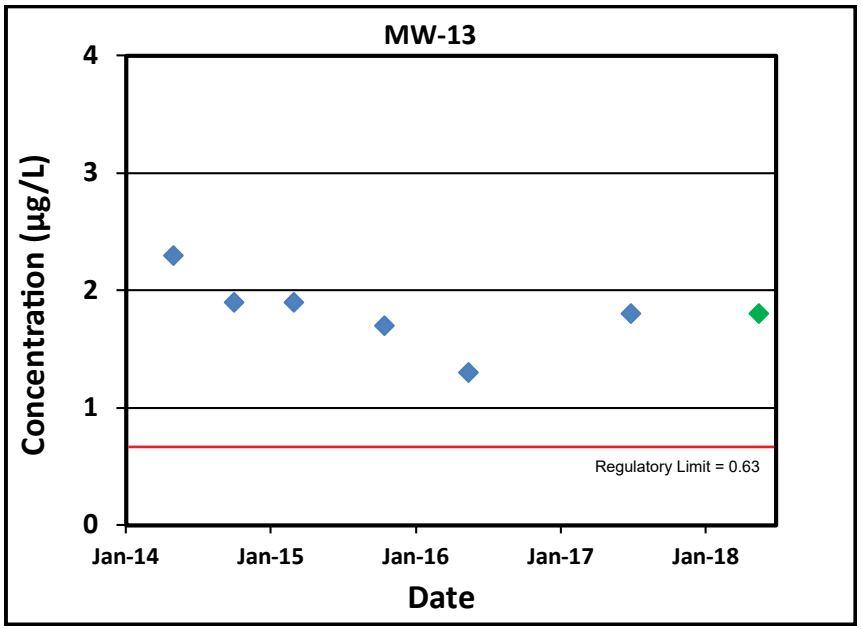
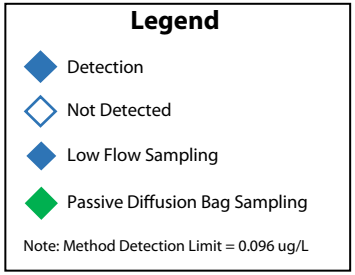
Seattle, WA | February 2019

Figure **4a**









Carbon Tetrachloride
Groundwater Monitoring Well Data
Frederickson Industrial Park, Frederickson, WA

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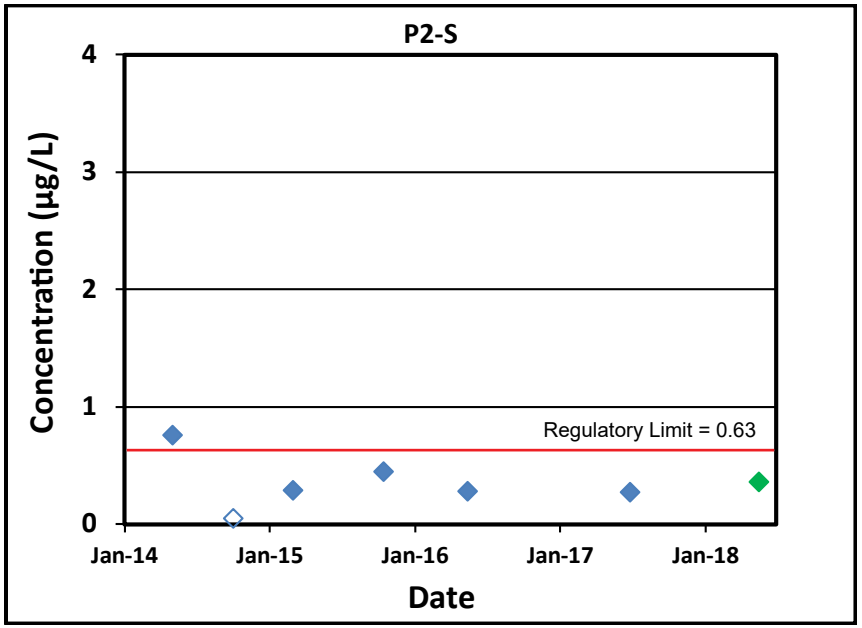
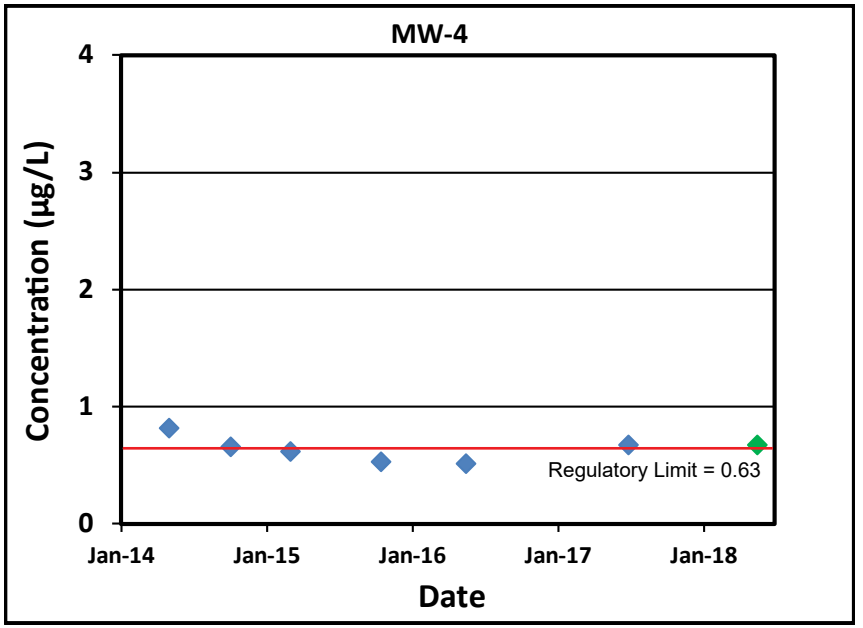
Figure **4b**





Legend

- Detection
- Not Detected
- Low Flow Sampling
- Passive Diffusion Bag Sampling

Note: Method Detection Limit = 0.096 ug/L

Carbon Tetrachloride
Groundwater Monitoring Well Data
Frederickson Industrial Park, Frederickson, WA

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Figure **4c**

Attachment A

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

May 31, 2018

Analytical Report for Service Request No: K1804348

Dave Parkinson
GeoSyntec Consultants
520 Pike Street, Suite #1375
Seattle, WA 98101

RE: OLIN - Frederickson

Dear Dave,

Enclosed are the results of the sample(s) submitted to our laboratory May 10, 2018
For your reference, these analyses have been assigned our service request number **K1804348.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3350. You may also contact me via email at Kelley.Lovejoy@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Kelley Lovejoy

Kelley Lovejoy
Project Manager

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Table of Contents

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Case Narrative

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Client: GeoSyntec Consultants
Project: OLIN - Frederickson
Sample Matrix: Water

Service Request: K1804348
Date Received: 05/10/2018

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier III deliverables including summary forms for each of the analyses. When appropriate to the method, method blank results have been reported with each analytical test.

Sample Receipt:

Eleven water samples were received for analysis at ALS Environmental on 05/10/2018. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4ºC upon receipt at the laboratory.

Volatiles by GC/MS:

No significant anomalies were noted with this analysis.

Approved by Kelley Bovejoy Date 05/31/2018

Chain of Custody

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS Environmental

CHAIN OF CUSTODY
89320

004

SR# K1804348

COC Set____of____

COC#_____

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

Project Name: OLIN - FREDERICKSON | Project Number:

Project Manager: DAVE PARKINSON

Company: GEOSYNTEC CONSULTANTS

Address: 520 PIKE ST, SUITE #1375, SEATTLE, WA

Phone #: (206) 496-1446 | email: DPARKINSON@GEOSYNTEC.COM

Sampler Signature: | Sampler Printed Name: LEE BURES

CLIENT SAMPLE ID	LABID	SAMPLING Date	SAMPLING Time	Matrix	NUMBER OF CONTAINERS	7D Screen VOA GCMS /	14D 8260C / VOC FP	1 (GTC)	2	3	4	5	Remarks
1. GW-050918-11-BL		5/9/18	0920	W	3			X					
2. GW-050918-11-CL		5/9/18	0940	W	3			X					
3. GW-050918-BMW-18		5/9/18	1125	W	9			X					MS/MSD
4. GW-050918-HLA-1		5/9/18	0955	W	3			X					
5. GW-050918-MW-1		5/9/18	0758	W	3			X					
6. GW-050918-MW-4		5/9/18	0845	W	3			X					
7. GW-050918-P2-S		5/9/18	1055	W	3			X					
8. GW-050918-MW-13		5/9/18	1025	W	3			X					
9. GW-050918-DUP		5/9/18	—	W	3			X					
10. PDB BLANK-050918		5/9/18	1130	W	3			X					

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

Invoice Information

P.O.# REBR00004

Bill To:

Turnaround Requirements

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____(Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature SHIPPED VIA FEDEX	Signature	Signature DANIEL PEARSON	Signature	Signature
Printed Name LEE BURES	Printed Name	Printed Name	Printed Name ALS-K	Printed Name	Printed Name
Firm BTS	Firm	Firm	Firm 5-10-18 0805	Firm	Firm
Date/Time 5/9/18 6/10/18 0805	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

PC KL

Cooler Receipt and Preservation Form

Client GEOSYNTEC Service Request K18 04348

Received: 5-10-18 Opened: 5-10-18 By: DSP Unloaded: 5-10-18 By: DSP

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* *Courier* (*Hand Delivered*)
2. Samples were received in: (circle) (*Cooler*) *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y (N) If yes, how many and where? _____
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA	Tracking Number (NA)	Filed
-0.6	-0.7	0.6	0.5	-0.1	378	39320		

4. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* (*Wet Ice*) *Dry Ice* *Sleeves* _____
5. Were custody papers properly filled out (ink, signed, etc.)? NA (Y) N
6. Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA (Y) N
   If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA (Y) N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA (Y) N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA (Y) N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* (NA) Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* NA (Y) N
12. Was C12/Res negative? (NA) Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: 2 TRIP BLANKS NOT ON COC

Volatile Organic Compounds

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Client: GeoSyntec Consultants **Service Request:** K1804348
Project: OLIN - Frederickson

Cover Page - Organic Analysis Data Package
Volatile Organic Compounds

Sample Name	Lab Code	Date Collected	Date Received
GW-050918-11-BL	K1804348-001	05/09/2018	05/10/2018
GW-050918-11-CL	K1804348-002	05/09/2018	05/10/2018
GW-050918-BMW-18	K1804348-003	05/09/2018	05/10/2018
GW-050918-HLA-1	K1804348-004	05/09/2018	05/10/2018
GW-050918-MW-1	K1804348-005	05/09/2018	05/10/2018
GW-050918-MW-4	K1804348-006	05/09/2018	05/10/2018
GW-050918-P2-S	K1804348-007	05/09/2018	05/10/2018
GW-050918-MW-13	K1804348-008	05/09/2018	05/10/2018
GW-050918-DUP	K1804348-009	05/09/2018	05/10/2018
PDB-BLANK-050918	K1804348-010	05/09/2018	05/10/2018
Trip Blank	K1804348-011	05/09/2018	05/10/2018
GW-050918-BMW-18MS	KWG1802491-1	05/09/2018	05/10/2018
GW-050918-BMW-18DMS	KWG1802491-2	05/09/2018	05/10/2018

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	GW-050918-11-BL	**Units:**	ug/L
Lab Code:	K1804348-001	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	**0.51**		0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	106	73-122	05/16/18	Acceptable
Toluene-d8	96	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	99	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	GW-050918-11-CL	**Units:**	ug/L
Lab Code:	K1804348-002	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	**4.1**		0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	111	73-122	05/16/18	Acceptable
Toluene-d8	98	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	102	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	GW-050918-BMW-18	**Units:**	ug/L
Lab Code:	K1804348-003	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	**3.4**		0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	106	73-122	05/16/18	Acceptable
Toluene-d8	95	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	96	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	GW-050918-HLA-1	**Units:**	ug/L
Lab Code:	K1804348-004	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	**4.5**		0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	110	73-122	05/16/18	Acceptable
Toluene-d8	96	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	99	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	GW-050918-MW-1	**Units:**	ug/L
Lab Code:	K1804348-005	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	**2.1**		0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	108	73-122	05/16/18	Acceptable
Toluene-d8	95	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	97	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	GW-050918-MW-4	**Units:**	ug/L
Lab Code:	K1804348-006	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	**0.67**		0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	108	73-122	05/16/18	Acceptable
Toluene-d8	95	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	97	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	GW-050918-P2-S	**Units:**	ug/L
Lab Code:	K1804348-007	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	**0.36**	J	0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	110	73-122	05/16/18	Acceptable
Toluene-d8	98	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	96	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	GW-050918-MW-13	**Units:**	ug/L
Lab Code:	K1804348-008	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	**1.8**		0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	108	73-122	05/16/18	Acceptable
Toluene-d8	96	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	96	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	GW-050918-DUP	**Units:**	ug/L
Lab Code:	K1804348-009	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	**1.8**		0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	111	73-122	05/16/18	Acceptable
Toluene-d8	99	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	97	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	PDB-BLANK-050918	**Units:**	ug/L
Lab Code:	K1804348-010	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	ND	U	0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	109	73-122	05/16/18	Acceptable
Toluene-d8	96	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	98	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	05/09/2018
Sample Matrix:	Water	**Date Received:**	05/10/2018

Volatile Organic Compounds

Sample Name:	Trip Blank	**Units:**	ug/L
Lab Code:	K1804348-011	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	ND	U	0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	107	73-122	05/16/18	Acceptable
Toluene-d8	97	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	101	68-117	05/16/18	Acceptable

Comments:

Analytical Results

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

Volatile Organic Compounds

Sample Name:	Method Blank	**Units:**	ug/L
Lab Code:	KWG1802491-4	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Carbon Tetrachloride	ND	U	0.50	0.096	1	05/16/18	05/16/18	KWG1802491	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Dibromofluoromethane	104	73-122	05/16/18	Acceptable
Toluene-d8	94	65-144	05/16/18	Acceptable
4-Bromofluorobenzene	100	68-117	05/16/18	Acceptable

Comments:

Client: GeoSyntec Consultants **Service Request:** K1804348
Project: OLIN - Frederickson
Sample Matrix: Water

Surrogate Recovery Summary
Volatile Organic Compounds

Extraction Method: EPA 5030B **Units:** Percent
Analysis Method: 8260C **Level:** Low

Sample Name	Lab Code	Sur1	Sur2	Sur3
GW-050918-11-BL	K1804348-001	106	96	99
GW-050918-11-CL	K1804348-002	111	98	102
GW-050918-BMW-18	K1804348-003	106	95	96
GW-050918-HLA-1	K1804348-004	110	96	99
GW-050918-MW-1	K1804348-005	108	95	97
GW-050918-MW-4	K1804348-006	108	95	97
GW-050918-P2-S	K1804348-007	110	98	96
GW-050918-MW-13	K1804348-008	108	96	96
GW-050918-DUP	K1804348-009	111	99	97
PDB-BLANK-050918	K1804348-010	109	96	98
Trip Blank	K1804348-011	107	97	101
Method Blank	KWG1802491-4	104	94	100
GW-050918-BMW-18MS	KWG1802491-1	101	99	105
GW-050918-BMW-18DMS	KWG1802491-2	98	97	107
Lab Control Sample	KWG1802491-3	99	97	106

Surrogate Recovery Control Limits (%)

Sur1	=	Dibromofluoromethane	73-122
Sur2	=	Toluene-d8	65-144
Sur3	=	4-Bromofluorobenzene	68-117

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Client: GeoSyntec Consultants
Project: OLIN - Frederickson

Service Request: K1804348
Date Analyzed: 05/16/2018
Time Analyzed: 10:53

Internal Standard Area and RT Summary
Volatile Organic Compounds

File ID: J:\MS46\DATA\051618\0516F004.D
Instrument ID: MS46
Analysis Method: 8260C

Lab Code: KWG1802490-2
Analysis Lot: KWG1802490

		Fluorobenzene		Chlorobenzene-d5		1,4-Dichlorobenzene-d4	
		Area	**RT**	**Area**	**RT**	**Area**	**RT**
	Results ==>	198,452	6.59	79,948	10.04	66,232	12.61
	Upper Limit ==>	396,904	7.09	159,896	10.54	132,464	13.11
	Lower Limit ==>	99,226	6.09	39,974	9.54	33,116	12.11
	ICAL Result ==>	154,265	6.58	70,113	10.04	56,459	12.62
Associated Analyses							
GW-050918-BMW-18MS	KWG1802491-1	201,649	6.59	81,686	10.04	69,234	12.61
GW-050918-BMW-18DMS	KWG1802491-2	203,605	6.59	81,849	10.04	69,913	12.61
Lab Control Sample	KWG1802491-3	202,368	6.59	82,374	10.04	71,114	12.61
Method Blank	KWG1802491-4	188,609	6.59	76,573	10.04	61,614	12.61
Trip Blank	K1804348-011	182,021	6.59	75,066	10.04	59,523	12.61
GW-050918-BMW-18	K1804348-003	179,736	6.59	73,320	10.04	59,386	12.61
GW-050918-11-BL	K1804348-001	177,479	6.59	74,609	10.04	58,703	12.61
GW-050918-11-CL	K1804348-002	176,031	6.59	72,118	10.04	58,629	12.61
GW-050918-HLA-1	K1804348-004	176,280	6.59	72,611	10.04	58,092	12.62
GW-050918-MW-1	K1804348-005	176,609	6.59	73,186	10.04	56,495	12.61
GW-050918-MW-4	K1804348-006	177,122	6.59	72,522	10.04	56,980	12.61
GW-050918-P2-S	K1804348-007	176,373	6.59	74,196	10.04	59,815	12.61
GW-050918-MW-13	K1804348-008	170,293	6.59	71,440	10.04	56,742	12.61
GW-050918-DUP	K1804348-009	173,614	6.59	73,560	10.04	57,791	12.62
PDB-BLANK-050918	K1804348-010	172,765	6.59	72,697	10.04	57,903	12.62

Results flagged with an asterisk (*) indicate values outside control criteria.

QA/QC Report

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Extracted:**	05/16/2018
Sample Matrix:	Water	**Date Analyzed:**	05/16/2018

Matrix Spike/Duplicate Matrix Spike Summary
Volatile Organic Compounds

Sample Name:	GW-050918-BMW-18	**Units:**	ug/L
Lab Code:	K1804348-003	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C	**Extraction Lot:**	KWG1802491

		GW-050918-BMW-18MS KWG1802491-1 Matrix Spike			GW-050918-BMW-18DMS KWG1802491-2 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Carbon Tetrachloride	3.4	14.2	10.0	108	13.1	10.0	97	53-161	8	30

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Extracted:**	05/16/2018
Sample Matrix:	Water	**Date Analyzed:**	05/16/2018

Lab Control Spike Summary
Volatile Organic Compounds

Extraction Method:	EPA 5030B	**Units:**	ug/L
Analysis Method:	8260C	**Basis:**	NA
		Level:	Low
		Extraction Lot:	KWG1802491

	Lab Control Sample KWG1802491-3 Lab Control Spike			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
Carbon Tetrachloride	9.25	10.0	93	55-140

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Extracted:**	05/16/2018
Sample Matrix:	Water	**Date Analyzed:**	05/16/2018
		Time Analyzed:	13:41

Method Blank Summary
Volatile Organic Compounds

Sample Name:	Method Blank	**Instrument ID:**	MS46
Lab Code:	KWG1802491-4	**File ID:**	J:\MS46\DATA\051618\0516F010.D
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C	**Extraction Lot:**	KWG1802491

This Method Blank applies to the following analyses:

Sample Name	Lab Code	File ID	Date Analyzed	Time Analyzed
GW-050918-BMW-18MS	KWG1802491-1	J:\MS46\DATA\051618\0516F006.D	05/16/18	11:55
GW-050918-BMW-18DMS	KWG1802491-2	J:\MS46\DATA\051618\0516F007.D	05/16/18	12:21
Lab Control Sample	KWG1802491-3	J:\MS46\DATA\051618\0516F008.D	05/16/18	12:48
Trip Blank	K1804348-011	J:\MS46\DATA\051618\0516F011.D	05/16/18	14:07
GW-050918-BMW-18	K1804348-003	J:\MS46\DATA\051618\0516F012.D	05/16/18	14:33
GW-050918-11-BL	K1804348-001	J:\MS46\DATA\051618\0516F013.D	05/16/18	15:00
GW-050918-11-CL	K1804348-002	J:\MS46\DATA\051618\0516F014.D	05/16/18	15:26
GW-050918-HLA-1	K1804348-004	J:\MS46\DATA\051618\0516F015.D	05/16/18	15:52
GW-050918-MW-1	K1804348-005	J:\MS46\DATA\051618\0516F016.D	05/16/18	16:19
GW-050918-MW-4	K1804348-006	J:\MS46\DATA\051618\0516F017.D	05/16/18	16:45
GW-050918-P2-S	K1804348-007	J:\MS46\DATA\051618\0516F018.D	05/16/18	17:12
GW-050918-MW-13	K1804348-008	J:\MS46\DATA\051618\0516F019.D	05/16/18	17:38
GW-050918-DUP	K1804348-009	J:\MS46\DATA\051618\0516F020.D	05/16/18	18:05
PDB-BLANK-050918	K1804348-010	J:\MS46\DATA\051618\0516F021.D	05/16/18	18:31

QA/QC Report

Client:	GeoSyntec Consultants	**Service Request:**	K1804348
Project:	OLIN - Frederickson	**Date Extracted:**	05/16/2018
Sample Matrix:	Water	**Date Analyzed:**	05/16/2018
		Time Analyzed:	12:48

Lab Control Sample Summary
Volatile Organic Compounds

Sample Name:	Lab Control Sample	**Instrument ID:**	MS46
Lab Code:	KWG1802491-3	**File ID:**	J:\MS46\DATA\051618\0516F008.D
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260C	**Extraction Lot:**	KWG1802491

This Lab Control Sample applies to the following analyses:

Sample Name	Lab Code	File ID	Date Analyzed	Time Analyzed
GW-050918-BMW-18MS	KWG1802491-1	J:\MS46\DATA\051618\0516F006.D	05/16/18	11:55
GW-050918-BMW-18DMS	KWG1802491-2	J:\MS46\DATA\051618\0516F007.D	05/16/18	12:21
Method Blank	KWG1802491-4	J:\MS46\DATA\051618\0516F010.D	05/16/18	13:41
Trip Blank	K1804348-011	J:\MS46\DATA\051618\0516F011.D	05/16/18	14:07
GW-050918-BMW-18	K1804348-003	J:\MS46\DATA\051618\0516F012.D	05/16/18	14:33
GW-050918-11-BL	K1804348-001	J:\MS46\DATA\051618\0516F013.D	05/16/18	15:00
GW-050918-11-CL	K1804348-002	J:\MS46\DATA\051618\0516F014.D	05/16/18	15:26
GW-050918-HLA-1	K1804348-004	J:\MS46\DATA\051618\0516F015.D	05/16/18	15:52
GW-050918-MW-1	K1804348-005	J:\MS46\DATA\051618\0516F016.D	05/16/18	16:19
GW-050918-MW-4	K1804348-006	J:\MS46\DATA\051618\0516F017.D	05/16/18	16:45
GW-050918-P2-S	K1804348-007	J:\MS46\DATA\051618\0516F018.D	05/16/18	17:12
GW-050918-MW-13	K1804348-008	J:\MS46\DATA\051618\0516F019.D	05/16/18	17:38
GW-050918-DUP	K1804348-009	J:\MS46\DATA\051618\0516F020.D	05/16/18	18:05
PDB-BLANK-050918	K1804348-010	J:\MS46\DATA\051618\0516F021.D	05/16/18	18:31

QA/QC Results

Client: GeoSyntec Consultants
Project: OLIN - Frederickson

Service Request: K1804348
Date Analyzed: 05/16/2018
Time Analyzed: 10:19

Tune Summary
Volatile Organic Compounds

File ID: J:\MS46\DATA\051618\0516F003.D
Instrument ID: GCMS46
Column:

Analysis Method: 8260C
Analysis Lot: KWG1802490

Target Mass	Relative to Mass	Lower Limit%	Upper Limit%	Relative Abundance %	Raw Abundance	Result Pass/Fail
50	95	15	40	17.1	2729	PASS
75	95	30	60	52.2	8351	PASS
95	95	100	100	100.0	16003	PASS
96	95	5	9	6.1	984	PASS
173	174	0	2	0.7	103	PASS
174	95	50	120	90.5	14490	PASS
175	174	5	9	7.3	1062	PASS
176	174	95	101	97.3	14106	PASS
177	176	5	9	5.9	835	PASS

Sample Name	Lab Code	File ID	Date Analyzed	Time Analyzed	Q
Continuing Calibration Verification	KWG1802490-2	J:\MS46\DATA\051618\0516F004.D	05/16/2018	10:53	
GW-050918-BMW-18MS	KWG1802491-1	J:\MS46\DATA\051618\0516F006.D	05/16/2018	11:55	
GW-050918-BMW-18DMS	KWG1802491-2	J:\MS46\DATA\051618\0516F007.D	05/16/2018	12:21	
Lab Control Sample	KWG1802491-3	J:\MS46\DATA\051618\0516F008.D	05/16/2018	12:48	
Method Blank	KWG1802491-4	J:\MS46\DATA\051618\0516F010.D	05/16/2018	13:41	
Trip Blank	K1804348-011	J:\MS46\DATA\051618\0516F011.D	05/16/2018	14:07	
GW-050918-BMW-18	K1804348-003	J:\MS46\DATA\051618\0516F012.D	05/16/2018	14:33	
GW-050918-11-BL	K1804348-001	J:\MS46\DATA\051618\0516F013.D	05/16/2018	15:00	
GW-050918-11-CL	K1804348-002	J:\MS46\DATA\051618\0516F014.D	05/16/2018	15:26	
GW-050918-HLA-1	K1804348-004	J:\MS46\DATA\051618\0516F015.D	05/16/2018	15:52	
GW-050918-MW-1	K1804348-005	J:\MS46\DATA\051618\0516F016.D	05/16/2018	16:19	
GW-050918-MW-4	K1804348-006	J:\MS46\DATA\051618\0516F017.D	05/16/2018	16:45	
GW-050918-P2-S	K1804348-007	J:\MS46\DATA\051618\0516F018.D	05/16/2018	17:12	
GW-050918-MW-13	K1804348-008	J:\MS46\DATA\051618\0516F019.D	05/16/2018	17:38	
GW-050918-DUP	K1804348-009	J:\MS46\DATA\051618\0516F020.D	05/16/2018	18:05	
PDB-BLANK-050918	K1804348-010	J:\MS46\DATA\051618\0516F021.D	05/16/2018	18:31	

Results flagged with an asterisk (*) indicate the analysis performed outside specified tune window

Client: GeoSyntec Consultants **Service Request:** K1804348
Project: OLIN - Frederickson **Calibration Date:** 09/15/2017

Initial Calibration Summary
Volatile Organic Compounds

Calibration ID: CAL15549 **Column:** MS
Instrument ID: MS46

Level ID	File ID	Level ID	File ID
A	J:\MS46\DATA\091517\0915F008.D	G	J:\MS46\DATA\091517\0915F014.D
B	J:\MS46\DATA\091517\0915F009.D	H	J:\MS46\DATA\091517\0915F015.D
C	J:\MS46\DATA\091517\0915F010.D	I	J:\MS46\DATA\091517\0915F016.D
D	J:\MS46\DATA\091517\0915F011.D	J	J:\MS46\DATA\091517\0915F017.D
E	J:\MS46\DATA\091517\0915F012.D	K	J:\MS46\DATA\091517\0915F018.D
F	J:\MS46\DATA\091517\0915F013.D		

Analyte Name	Level ID	Amt	RRF	Level ID	Amt	RRF	Level ID	Amt	RRF	Level ID	Amt	RRF	Level ID	Amt	RRF
Carbon Tetrachloride	A	0.10	0.360	B	0.20	0.509	C	0.50	0.421	D	1.0	0.442	E	2.0	0.397
	F	5.0	0.443	G	10	0.429	H	20	0.436	I	40	0.429	J	60	0.453
	K	80	0.468												
Dibromofluoromethane										D	4.0	0.234	E	6.0	0.282
	F	8.0	0.260	G	10	0.271	H	12	0.251	I	14	0.261	J	16	0.266
	K	20	0.281												
Toluene-d8										D	4.0	0.764	E	6.0	1.00
	F	8.0	0.867	G	10	1.01	H	12	1.01	I	14	0.959	J	16	1.01
	K	20	1.20												
4-Bromofluorobenzene										D	4.0	0.622	E	6.0	0.869
	F	8.0	0.745	G	10	0.833	H	12	0.777	I	14	0.769	J	16	0.824
	K	20	0.732												

Results flagged with an asterisk (*) indicate values outside control criteria.

† SPCC Compound **‡ CCC Compound**

Client: GeoSyntec Consultants **Service Request:** K1804348
Project: OLIN - Frederickson **Calibration Date:** 09/15/2017

Initial Calibration Summary
Volatile Organic Compounds

Calibration ID: CAL15549 **Column:** MS
Instrument ID: MS46

		Calibration Evaluation					RRF Evaluation		
Analyte Name	**Compound Type**	**Fit Type**	**Eval.**	**Eval. Result**	**Q**	**Control Criteria**	**Average RRF**	**Q**	**Minimum RRF**
Carbon Tetrachloride	MS	AverageRF	% RSD	8.7		≤ 20	0.435		0.100
Dibromofluoromethane	SURR	AverageRF	% RSD	5.9		≤ 20	0.263		0.01
Toluene-d8	SURR	AverageRF	% RSD	12.9		≤ 20	0.977		0.01
4-Bromofluorobenzene	SURR	AverageRF	% RSD	9.9		≤ 20	0.771		0.01

Results flagged with an asterisk (*) indicate values outside control criteria.

† SPCC Compound **‡ CCC Compound**

QA/QC Results

Client: GeoSyntec Consultants
Project: OLIN - Frederickson

Service Request: K1804348
Calibration Date: 09/15/2017
Date Analyzed: 09/15/2017

Second Source Calibration Verification
Volatile Organic Compounds

Calibration Type: Internal Standard
Analysis Method: 8260C

Calibration ID: CAL15549
Units: PPB

File ID: J:\MS46\DATA\091517\0915F021.D
J:\MS46\DATA\091717\0917F004.D

Analyte Name	Expected	Result	Average RF	SSV RF	%D	%Drift	Criteria	Curve Fit
Carbon Tetrachloride	10	9.9	0.435	0.430	-1	NA	± 30 %	AverageRF

Results flagged with an asterisk (*) indicate values outside control criteria.

† SPCC Compound **‡ CCC Compound**

Client: GeoSyntec Consultants
Project: OLIN - Frederickson

Service Request: K1804348
Date Analyzed: 05/16/2018

Continuing Calibration Verification Summary
Volatile Organic Compounds

Calibration Type: Internal Standard
Analysis Method: 8260C

Calibration Date: 09/15/2017
Calibration ID: CAL15549
Analysis Lot: KWG1802490
Units: PPB

File ID: J:\MS46\DATA\051618\0516F004.D

Analyte Name	Expected	Result	Min RF	Average RF	CCV RF	%D	%Drift	Criteria	Curve Fit
Carbon Tetrachloride	10	8.6	0.100	0.435	0.372	-14	NA	± 20	AverageRF
Dibromofluoromethane	10	10	0.01	0.263	0.264	0	NA	± 20	AverageRF
Toluene-d8	10	9.7	0.01	0.977	0.950	-3	NA	± 20	AverageRF
4-Bromofluorobenzene	10	11	0.01	0.771	0.828	7	NA	± 20	AverageRF

Results flagged with an asterisk (*) indicate values outside control criteria.

† SPCC Compound **‡ CCC Compound**

Client: GeoSyntec Consultants **Service Request:** K1804348
Project: OLIN - Frederickson

Analysis Run Log
Volatile Organic Compounds

Analysis Method: 8260C **Analysis Lot:** KWG1802490
Instrument ID: MS46

File ID	Sample Name	Lab Code	Date Analysis Started	Start Time	Q	Date Analysis Finished	Finish Time
0516F003.D	GC/MS Tuning - Bromofluorobenzene	KWG1802490-1	5/16/2018	10:19		5/16/2018	10:36
0516F004.D	Continuing Calibration Verification	KWG1802490-2	5/16/2018	10:53		5/16/2018	11:10
0516F006.D	GW-050918-BMW-18MS	KWG1802491-1	5/16/2018	11:55		5/16/2018	12:12
0516F007.D	GW-050918-BMW-18DMS	KWG1802491-2	5/16/2018	12:21		5/16/2018	12:38
0516F008.D	Lab Control Sample	KWG1802491-3	5/16/2018	12:48		5/16/2018	13:05
0516F010.D	Method Blank	KWG1802491-4	5/16/2018	13:41		5/16/2018	13:58
0516F011.D	Trip Blank	K1804348-011	5/16/2018	14:07		5/16/2018	14:24
0516F012.D	GW-050918-BMW-18	K1804348-003	5/16/2018	14:33		5/16/2018	14:50
0516F013.D	GW-050918-11-BL	K1804348-001	5/16/2018	15:00		5/16/2018	15:17
0516F014.D	GW-050918-11-CL	K1804348-002	5/16/2018	15:26		5/16/2018	15:43
0516F015.D	GW-050918-HLA-1	K1804348-004	5/16/2018	15:52		5/16/2018	16:09
0516F016.D	GW-050918-MW-1	K1804348-005	5/16/2018	16:19		5/16/2018	16:36
0516F017.D	GW-050918-MW-4	K1804348-006	5/16/2018	16:45		5/16/2018	17:02
0516F018.D	GW-050918-P2-S	K1804348-007	5/16/2018	17:12		5/16/2018	17:29
0516F019.D	GW-050918-MW-13	K1804348-008	5/16/2018	17:38		5/16/2018	17:55
0516F020.D	GW-050918-DUP	K1804348-009	5/16/2018	18:05		5/16/2018	18:22
0516F021.D	PDB-BLANK-050918	K1804348-010	5/16/2018	18:31		5/16/2018	18:48
0516F022.D	ZZZZZZ	ZZZZZZ	5/16/2018	18:58		5/16/2018	19:15
0516F023.D	ZZZZZZ	ZZZZZZ	5/16/2018	19:24		5/16/2018	19:41
0516F024.D	ZZZZZZ	ZZZZZZ	5/16/2018	19:50		5/16/2018	20:07
0516F025.D	ZZZZZZ	ZZZZZZ	5/16/2018	20:17		5/16/2018	20:34
0516F026.D	ZZZZZZ	ZZZZZZ	5/16/2018	20:43		5/16/2018	21:00
0516F027.D	ZZZZZZ	ZZZZZZ	5/16/2018	21:09		5/16/2018	21:26
0516F028.D	ZZZZZZ	ZZZZZZ	5/16/2018	21:36		5/16/2018	21:53
0516F029.D	ZZZZZZ	ZZZZZZ	5/16/2018	22:02		5/16/2018	22:19

Results flagged with an asterisk (*) indicate the holding time was exceeded for the analysis

QA/QC Results

Client: GeoSyntec Consultants
Project: OLIN - Frederickson
Sample Matrix: Water

Service Request: K1804348
Date Extracted: 05/16/2018

Extraction Prep Log
Volatile Organic Compounds

Extraction Method: EPA 5030B
Analysis Method: 8260C

Extraction Lot: KWG1802491
Level: Low

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Volume	% Solids	Note
GW-050918-11-BL	K1804348-001	05/09/18	05/10/18	10ml	10ml	NA	
GW-050918-11-CL	K1804348-002	05/09/18	05/10/18	10ml	10ml	NA	
GW-050918-BMW-18	K1804348-003	05/09/18	05/10/18	10ml	10ml	NA	
GW-050918-HLA-1	K1804348-004	05/09/18	05/10/18	10ml	10ml	NA	
GW-050918-MW-1	K1804348-005	05/09/18	05/10/18	10ml	10ml	NA	
GW-050918-MW-4	K1804348-006	05/09/18	05/10/18	10ml	10ml	NA	
GW-050918-P2-S	K1804348-007	05/09/18	05/10/18	10ml	10ml	NA	
GW-050918-MW-13	K1804348-008	05/09/18	05/10/18	10ml	10ml	NA	
GW-050918-DUP	K1804348-009	05/09/18	05/10/18	10ml	10ml	NA	
PDB-BLANK-050918	K1804348-010	05/09/18	05/10/18	10ml	10ml	NA	
Trip Blank	K1804348-011	05/09/18	05/10/18	10ml	10ml	NA	
Method Blank	KWG1802491-4	NA	NA	10ml	10ml	NA	
GW-050918-BMW-18MS	KWG1802491-1	05/09/18	05/10/18	10ml	10ml	NA	
GW-050918-BMW-18DMS	KWG1802491-2	05/09/18	05/10/18	10ml	10ml	NA	
Lab Control Sample	KWG1802491-3	NA	NA	10ml	10ml	NA	

Results flagged with an asterisk (*) indicate the holding time was exceeded for the analysis