



NATURAL ATTENUATION EVALUATION REPORT

Part 2

**Inactive Exxon Facility #28077
14258 Jarrettsville Pike
Phoenix, Maryland
Case Number 2006-0303-BA2
Facility I.D. No. 12342**

Prepared By:
Kleinfelder
1745 Dorsey Road, Suite J
Hanover, MD 21076

Prepared For:
ExxonMobil Environmental &
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1400 Park Avenue, Building 7
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ONLY THE CLIENT OR ITS DESIGNATED REPRESENTATIVES MAY USE THIS
DOCUMENT AND ONLY FOR THE SPECIFIC PROJECT FOR WHICH THIS REPORT WAS PREPA



ATTACHMENTS



APPENDIX A

Laboratory Analytical Reports - Chemical



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: April 09, 2019 18:18

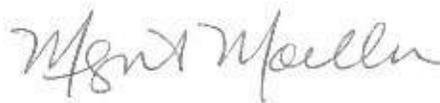
Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2037263
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

(717) 556-7261

To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-45 Groundwater	04/04/2019 08:50	1026387
MW-27B Groundwater	04/04/2019 11:30	1026388
MW-188D Groundwater	04/04/2019 13:45	1026389
TB19064 Water	03/07/2019	1026390

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-45 Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1026387
ELLE Group #: 2037263
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/04/2019 17:27
Collection Date/Time: 04/04/2019 08:50

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	10	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	20 J	25	10	1
10945	Ethyl t-butyl ether	637-92-3	7	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	2	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	350	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z190982AA	04/08/2019 17:27	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z190982AA	04/08/2019 17:26	Alexander D Sechrist	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-27B Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1026388
ELLE Group #: 2037263
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submission Date/Time: 04/04/2019 17:27
Collection Date/Time: 04/04/2019 11:30

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	7	1	0.3	1
10945	Benzene	71-43-2	9	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	0.8 J	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	0.5 J	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	80	1	0.2	1
10945	Toluene	108-88-3	2	1	0.2	1
10945	Xylene (Total)	1330-20-7	6	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	13,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	98.7	50.0	15.0	50

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z190982AA	04/08/2019 15:49	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z190982AA	04/08/2019 15:48	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	190980005A	04/08/2019 09:42	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190950001A	04/05/2019 13:38	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19095520117A	04/05/2019 11:24	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19095520117A	04/05/2019 11:41	Ashlynn M Cornelius	50

*=This limit was used in the evaluation of the final result

Sample Description: MW-188D Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1026389
ELLE Group #: 2037263
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submission Date/Time: 04/04/2019 17:27
Collection Date/Time: 04/04/2019 13:45

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified		ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	24,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
A preserved vial was submitted for analysis. However, the pH at the time of analysis was 4.						
Wet Chemistry		EPA 300.0		mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	0.80	0.50	0.25	5
00228	Sulfate	14808-79-8	9.6	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	190980005A	04/08/2019 09:51	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190950001A	04/05/2019 14:01	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19095520117A	04/05/2019 10:33	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19095520117A	04/05/2019 10:33	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19064 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1026390
ELLE Group #: 2037263
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/04/2019 17:27
Collection Date/Time: 03/07/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z190982AA	04/08/2019 17:03	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z190982AA	04/08/2019 17:02	Alexander D Sechrist	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/09/2019 18:18

Group Number: 2037263

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result ug/l	LOQ** ug/l	MDL ug/l
Batch number: Z190982AA	Sample number(s): 1026387-1026388,1026390		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 190950001A	Sample number(s): 1026388-1026389		
Methane	N.D.	5.0	3.0
Batch number: 190980005A	Sample number(s): 1026388-1026389		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19095520117A	Sample number(s): 1026388-1026389		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: Z190982AA	Sample number(s): 1026387-1026388,1026390								
t-Amyl methyl ether	20	16.49			82		66-120		
Benzene	20	18.58			93		80-120		
t-Butyl alcohol	200	178.67			89		60-130		
Ethyl t-butyl ether	20	17.96			90		68-121		
Ethylbenzene	20	16.76			84		80-120		
di-Isopropyl ether	20	17.65			88		70-124		
Methyl Tertiary Butyl Ether	20	18.5			93		69-122		
Toluene	20	17.61			88		80-120		
Xylene (Total)	60	52.09			87		80-120		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/09/2019 18:18

Group Number: 2037263

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 190950001A Methane	Sample number(s): 1026388-1026389				108	105	85-115	3	20
	59.83	64.49	59.83	62.71					
Batch number: 190980005A CO2 by Headspace	Sample number(s): 1026388-1026389				94	107	85-120	12	20
	35820	33792.33	35820	38263.14					
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19095520117A Nitrate Nitrogen	Sample number(s): 1026388-1026389				103		90-110		
	0.750	0.770			103		90-110		
Sulfate	7.50	7.76			103		90-110		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/l	MS Spike Added ug/l	MS Conc ug/l	MSD Spike Added ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: Z190982AA	Sample number(s): 1026387-1026388,1026390 UNSPK: 1026388									
t-Amyl methyl ether	6.75	20	24.2	20	24.7	87	90	66-120	2	30
Benzene	9.25	20	30.02	20	30.31	104	105	80-120	1	30
t-Butyl alcohol	N.D.	200	171.17	200	175.42	86	88	60-130	2	30
Ethyl t-butyl ether	0.803	20	19.77	20	20.22	95	97	68-121	2	30
Ethylbenzene	N.D.	20	18.27	20	18.49	91	92	80-120	1	30
di-Isopropyl ether	0.476	20	19.51	20	19.86	95	97	70-124	2	30
Methyl Tertiary Butyl Ether	80.19	20	98.9	20	99.5	94 (2)	97 (2)	69-122	1	30
Toluene	1.83	20	21.07	20	21.34	96	98	80-120	1	30
Xylene (Total)	5.77	60	61.77	60	62.3	93	94	80-120	1	30
	mg/l	mg/l	mg/l	mg/l	mg/l					
Batch number: 19095520117A	Sample number(s): 1026388-1026389 UNSPK: 1026389									
Nitrate Nitrogen	0.796	2.50	3.14			94		90-110		
Sulfate	9.59	25	33.66			96		90-110		

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc	DUP Conc	DUP RPD	DUP RPD Max
---------------	----------	----------	---------	-------------

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/09/2019 18:18

Group Number: 2037263

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 19095520117A	Sample number(s): 1026388-1026389 BKG: 1026389			
Nitrate Nitrogen	0.796	0.783	2 (1)	15
Sulfate	9.59	9.51	1 (1)	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys

Batch number: Z190982AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1026387	104	100	100	97
1026388	104	102	98	97
1026390	104	102	99	95
Blank	103	101	98	96
LCS	103	103	99	97
MS	103	101	99	98
MSD	104	103	99	97
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon

Batch number: 190950001A

	Propene
1026388	67
1026389	64
Blank	104
LCS	106
LCSD	103
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

Delivery and Receipt Information

Delivery Method: ELLE Courier Arrival Timestamp: 04/04/2019 17:27
 Number of Packages: 1 Number of Projects: 1
 State/Province of Origin: MD

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	No
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace ≥ 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCI
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Melvin Sanchez (8943) at 17:55 on 04/04/2019

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp)* All Temperatures in °C.

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Corrected Temp</u>	<u>Therm. Type</u>	<u>Ice Type</u>	<u>Ice Present?</u>	<u>Ice Container</u>	<u>Elevated Temp?</u>	<u>Samples Collected Same Day as Receipt?</u>
1	DT131	6.6	DT	Wet	Y	Bagged	Y	Y

Sample ID Discrepancy Details

<u>Sample ID on COC</u>	<u>Sample ID on Label</u>	<u>Comments</u>
MW188D	MW-189D	

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: April 10, 2019 12:51

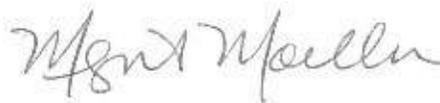
Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2037531
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

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Attn: Jennifer Kozak
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Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

(717) 556-7261

To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-45R Groundwater	04/05/2019 08:15	1027609
MW-188D Groundwater	04/05/2019 10:40	1027610
MW-54C Groundwater	04/05/2019 13:15	1027611
MW-82D Groundwater	04/05/2019 14:30	1027612
TB19091 Water	04/03/2019	1027613

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-45R Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1027609
ELLE Group #: 2037531
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/05/2019 17:02
Collection Date/Time: 04/05/2019 08:15

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	9	1	0.3	1
10945	Benzene	71-43-2	0.5 J	1	0.2	1
10945	t-Butyl alcohol	75-65-0	18 J	25	10	1
10945	Ethyl t-butyl ether	637-92-3	7	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	2	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	330	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z190991AA	04/09/2019 12:25	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z190991AA	04/09/2019 12:24	Anita M Dale	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-188D Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1027610
ELLE Group #: 2037531
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/05/2019 17:02
Collection Date/Time: 04/05/2019 10:40

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified		ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	6,700 J	12,000	2,600	1
07105	Methane	74-82-8	4.4 J	5.0	3.0	1
Wet Chemistry		EPA 300.0		mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	14.7	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	190980005A	04/08/2019 10:32	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190980002A	04/08/2019 15:39	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	1	19096987115A	04/06/2019 17:56	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19096987115A	04/06/2019 17:56	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-54C Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1027611
ELLE Group #: 2037531
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/05/2019 17:02
Collection Date/Time: 04/05/2019 13:15

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	N.D.	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	2.0 J	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	190980005A	04/08/2019 11:28	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190980004A	04/08/2019 14:39	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	1	19096987115B	04/06/2019 18:52	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19096987115B	04/06/2019 18:52	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-82D Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1027612
ELLE Group #: 2037531
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/05/2019 17:02
Collection Date/Time: 04/05/2019 14:30

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	N.D.	12,000	2,600	1
07105	Methane	74-82-8	910	25	15	5
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	N.D.	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	190980005A	04/08/2019 11:37	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190980004A	04/09/2019 17:28	Connor Lent	5
00368	Nitrate Nitrogen	EPA 300.0	1	19096987115B	04/06/2019 18:10	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19096987115B	04/06/2019 18:10	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19091 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1027613
ELLE Group #: 2037531
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/05/2019 17:02
Collection Date/Time: 04/03/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z190991AA	04/09/2019 07:56	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z190991AA	04/09/2019 07:55	Anita M Dale	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/10/2019 12:51

Group Number: 2037531

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result ug/l	LOQ** ug/l	MDL ug/l
Batch number: Z190991AA	Sample number(s): 1027609,1027613		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 190980002A	Sample number(s): 1027610		
Methane	N.D.	5.0	3.0
Batch number: 190980004A	Sample number(s): 1027611-1027612		
Methane	N.D.	5.0	3.0
Batch number: 190980005A	Sample number(s): 1027610-1027612		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19096987115A	Sample number(s): 1027610		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30
Batch number: 19096987115B	Sample number(s): 1027611-1027612		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: Z190991AA	Sample number(s): 1027609,1027613								
t-Amyl methyl ether	20	16.39			82		66-120		
Benzene	20	19.15			96		80-120		
t-Butyl alcohol	200	169.13			85		60-130		
Ethyl t-butyl ether	20	18.4			92		68-121		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/10/2019 12:51

Group Number: 2037531

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Ethylbenzene	20	16.86			84		80-120		
di-Isopropyl ether	20	17.9			90		70-124		
Methyl Tertiary Butyl Ether	20	19.27			96		69-122		
Toluene	20	18.06			90		80-120		
Xylene (Total)	60	52.91			88		80-120		
	ug/l	ug/l	ug/l	ug/l					
Batch number: 190980002A	Sample number(s): 1027610								
Methane	59.83	63.37	59.83	63.44	106	106	85-115	0	20
Batch number: 190980004A	Sample number(s): 1027611-1027612								
Methane	59.83	62.63	59.83	64.72	105	108	85-115	3	20
Batch number: 190980005A	Sample number(s): 1027610-1027612								
CO2 by Headspace	35820	33792.33	35820	38263.14	94	107	85-120	12	20
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19096987115A	Sample number(s): 1027610								
Nitrate Nitrogen	0.750	0.709	0.750	0.706	95	94	90-110	0	20
Sulfate	7.50	7.38	7.50	7.28	98	97	90-110	1	20
Batch number: 19096987115B	Sample number(s): 1027611-1027612								
Nitrate Nitrogen	0.750	0.709	0.750	0.706	95	94	90-110	0	20
Sulfate	7.50	7.38	7.50	7.28	98	97	90-110	1	20

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 19096987115B	Sample number(s): 1027611-1027612 UNSPK: 1027612									
Nitrate Nitrogen	N.D.	2.50	1.99			80*		90-110		
Sulfate	N.D.	25	20.8			83*		90-110		

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/10/2019 12:51

Group Number: 2037531

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 19096987115B	Sample number(s): 1027611-1027612 BKG: 1027612			
Nitrate Nitrogen	N.D.	N.D.	0 (1)	15
Sulfate	N.D.	N.D.	0 (1)	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys

Batch number: Z190991AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1027609	100	100	99	95
1027613	105	102	98	94
Blank	105	100	100	95
LCS	104	101	100	97
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon

Batch number: 190980002A

	Propene
1027610	86
Blank	106
LCS	100
LCSD	103
Limits:	46-135

Analysis Name: Volatile Headspace Hydrocarbon

Batch number: 190980004A

	Propene
1027611	62
1027612	90
Blank	102
LCS	106
LCSD	106
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

Delivery and Receipt Information

Delivery Method: ELLE Courier Arrival Timestamp: 04/05/2019 17:02
 Number of Packages: 1 Number of Projects: 1
 State/Province of Origin: MD

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace \geq 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCI
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Melvin Sanchez (8943) at 18:32 on 04/05/2019

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp)* All Temperatures in °C.

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Corrected Temp</u>	<u>Therm. Type</u>	<u>Ice Type</u>	<u>Ice Present?</u>	<u>Ice Container</u>	<u>Elevated Temp?</u>
1	DT42-01	1.0	DT	Wet	Y	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: June 10, 2019 13:20

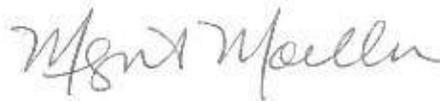
Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2037822
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

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To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-40 Groundwater	04/08/2019 09:50	1028913
MW-71 Groundwater	04/08/2019 11:15	1028914
MW-27R [R] Groundwater	04/08/2019 13:45	1028915
MW-1 Groundwater	04/08/2019 13:50	1028916
MW-7 [R] Groundwater	04/08/2019 11:50	1028917
TB19091 Water	04/04/2019	1028918

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-40 Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1028913
ELLE Group #: 2037822
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/08/2019 17:15
Collection Date/Time: 04/08/2019 09:50

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	0.4 J	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	100,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	1.7	0.50	0.25	5
00228	Sulfate	14808-79-8	38.1	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191023AA	04/12/2019 23:06	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191023AA	04/12/2019 23:05	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	190990006A	04/09/2019 11:48	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190990005A	04/09/2019 11:26	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	1	19099520117A	04/10/2019 00:24	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19099520117A	04/10/2019 00:24	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-71 Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1028914
ELLE Group #: 2037822
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submission Date/Time: 04/08/2019 17:15
Collection Date/Time: 04/08/2019 11:15

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified		ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	64,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0		mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	2.5	0.50	0.25	5
00228	Sulfate	14808-79-8	21.5	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	190990006A	04/09/2019 11:58	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190990005A	04/09/2019 11:45	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	1	19099520117A	04/10/2019 00:41	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19099520117A	04/10/2019 00:41	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-27R [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1028915
ELLE Group #: 2037822
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/08/2019 17:15
Collection Date/Time: 04/08/2019 13:45

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	5	1	0.3	1
10945	Benzene	71-43-2	4	1	0.2	1
10945	t-Butyl alcohol	75-65-0	17 J	25	10	1
10945	Ethyl t-butyl ether	637-92-3	0.7 J	1	0.2	1
10945	Ethylbenzene	100-41-4	8	1	0.2	1
10945	di-Isopropyl ether	108-20-3	0.3 J	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	76	1	0.2	1
10945	Toluene	108-88-3	5	1	0.2	1
10945	Xylene (Total)	1330-20-7	7	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	3,200 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	2.9	0.50	0.25	5
00228	Sulfate	14808-79-8	64.9	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191024AA	04/12/2019 23:18	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191024AA	04/12/2019 23:17	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	190990006A	04/09/2019 12:08	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190990005A	04/09/2019 12:05	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	1	19099520117A	04/10/2019 00:58	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19099520117A	04/10/2019 00:58	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1028916
ELLE Group #: 2037822
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/08/2019 17:15
Collection Date/Time: 04/08/2019 13:50

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	5	2	5
10945	Benzene	71-43-2	3 J	5	1	5
10945	t-Butyl alcohol	75-65-0	N.D.	130	50	5
10945	Ethyl t-butyl ether	637-92-3	N.D.	5	1	5
10945	Ethylbenzene	100-41-4	520	5	1	5
10945	di-Isopropyl ether	108-20-3	N.D.	5	1	5
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	5	1	5
10945	Toluene	108-88-3	1,100	50	10	50
10945	Xylene (Total)	1330-20-7	2,200	25	3	5
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	28,000	12,000	2,600	1
07105	Methane	74-82-8	28	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	4.4	0.50	0.25	5
00228	Sulfate	14808-79-8	79.6	20.0	6.0	20

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191023AA	04/13/2019 02:45	Hu Yang	5
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191023AA	04/13/2019 03:09	Hu Yang	50
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191023AA	04/13/2019 02:44	Hu Yang	5
01163	GC/MS VOA Water Prep	SW-846 5030B	2	Z191023AA	04/13/2019 03:08	Hu Yang	50
08097	CO2 by Headspace	RSKSOP-175 modified	1	190990006A	04/09/2019 12:18	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190990005A	04/09/2019 12:23	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	1	19099520117A	04/10/2019 01:15	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19099520117A	04/12/2019 02:53	Hallie A Burnett	20

*=This limit was used in the evaluation of the final result

Sample Description: MW-7 [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1028917
ELLE Group #: 2037822
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/08/2019 17:15
Collection Date/Time: 04/08/2019 11:50

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	0.4 J	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	0.5 J	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	3	1	0.2	1
10945	Toluene	108-88-3	0.5 J	1	0.2	1
10945	Xylene (Total)	1330-20-7	5 J	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	7,500 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	5.1	0.50	0.25	5
00228	Sulfate	14808-79-8	8.2	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191023AA	04/13/2019 00:19	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191023AA	04/13/2019 00:18	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	190990006A	04/09/2019 12:28	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190990005A	04/09/2019 12:41	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	1	19099520117A	04/10/2019 01:32	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19099520117A	04/10/2019 01:32	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19091 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1028918
ELLE Group #: 2037822
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/08/2019 17:15
Collection Date/Time: 04/04/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
07105	Methane	74-82-8	N.D.	5.0	3.0	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	190990005A	04/09/2019 13:01	Connor Lent	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 06/10/2019 13:20

Group Number: 2037822

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result ug/l	LOQ** ug/l	MDL ug/l
Batch number: Z191023AA	Sample number(s): 1028913,1028916-1028917		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: Z191024AA	Sample number(s): 1028915		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 190990005A	Sample number(s): 1028913-1028918		
Methane	N.D.	5.0	3.0
Batch number: 190990006A	Sample number(s): 1028913-1028917		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19099520117A	Sample number(s): 1028913-1028917		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
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*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 06/10/2019 13:20

Group Number: 2037822

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: Z191023AA	Sample number(s): 1028913,1028916-1028917								
t-Amyl methyl ether	20	15.65			78		66-120		
Benzene	20	18.74			94		80-120		
t-Butyl alcohol	200	170.28			85		60-130		
Ethyl t-butyl ether	20	17.17			86		68-121		
Ethylbenzene	20	16.61			83		80-120		
di-Isopropyl ether	20	16.93			85		70-124		
Methyl Tertiary Butyl Ether	20	18.09			90		69-122		
Toluene	20	17.98			90		80-120		
Xylene (Total)	60	52.81			88		80-120		
Batch number: Z191024AA	Sample number(s): 1028915								
t-Amyl methyl ether	20	16.26			81		66-120		
Benzene	20	19.74			99		80-120		
t-Butyl alcohol	200	178.03			89		60-130		
Ethyl t-butyl ether	20	18.07			90		68-121		
Ethylbenzene	20	17.45			87		80-120		
di-Isopropyl ether	20	17.83			89		70-124		
Methyl Tertiary Butyl Ether	20	19.09			95		69-122		
Toluene	20	18.75			94		80-120		
Xylene (Total)	60	55.16			92		80-120		
	ug/l	ug/l	ug/l	ug/l					
Batch number: 190990005A	Sample number(s): 1028913-1028918								
Methane	59.83	62.85	59.83	61.62	105	103	85-115	2	20
Batch number: 190990006A	Sample number(s): 1028913-1028917								
CO2 by Headspace	35820	32926.87	35820	33145.95	92	93	85-120	1	20
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19099520117A	Sample number(s): 1028913-1028917								
Nitrate Nitrogen	0.750	0.782			104		90-110		
Sulfate	7.50	7.54			101		90-110		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/l	MS Spike Added ug/l	MS Conc ug/l	MSD Spike Added ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: Z191023AA	Sample number(s): 1028913,1028916-1028917 UNSPK: 1028913									

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 06/10/2019 13:20

Group Number: 2037822

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/l	MS Spike Added ug/l	MS Conc ug/l	MSD Spike Added ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
t-Amyl methyl ether	N.D.	20	15.52	20	15.79	78	79	66-120	2	30
Benzene	N.D.	20	19.39	20	19.51	97	98	80-120	1	30
t-Butyl alcohol	N.D.	200	157.33	200	160.46	79	80	60-130	2	30
Ethyl t-butyl ether	N.D.	20	17.62	20	17.52	88	88	68-121	1	30
Ethylbenzene	N.D.	20	17.29	20	17.35	86	87	80-120	0	30
di-Isopropyl ether	N.D.	20	17.12	20	17.14	86	86	70-124	0	30
Methyl Tertiary Butyl Ether	0.445	20	18.65	20	18.87	91	92	69-122	1	30
Toluene	N.D.	20	18.38	20	18.6	92	93	80-120	1	30
Xylene (Total)	N.D.	60	54.1	60	53.94	90	90	80-120	0	30
Batch number: Z191024AA	Sample number(s): 1028915 UNSPK: 1028915									
t-Amyl methyl ether	5.13	20	21.84	20	22.01	84	84	66-120	1	30
Benzene	3.69	20	23.14	20	23.5	97	99	80-120	2	30
t-Butyl alcohol	16.8	200	178.22	200	179.7	81	81	60-130	1	30
Ethyl t-butyl ether	0.681	20	17.99	20	18.42	87	89	68-121	2	30
Ethylbenzene	8.50	20	26.25	20	26.62	89	91	80-120	1	30
di-Isopropyl ether	0.350	20	17.71	20	18.02	87	88	70-124	2	30
Methyl Tertiary Butyl Ether	75.98	20	93.91	20	95.46	90	97	69-122	2	30
Toluene	4.54	20	23.15	20	23.51	93	95	80-120	2	30
Xylene (Total)	6.86	60	61.91	60	62.59	92	93	80-120	1	30

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: Z191023AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1028913	108	103	98	93
1028916	104	99	100	95
1028917	105	102	98	95
Blank	106	100	98	93
LCS	105	103	99	97
MS	105	102	99	96
MSD	105	103	98	96
Limits:	80-120	80-120	80-120	80-120

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: Z191024AA

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 06/10/2019 13:20

Group Number: 2037822

Surrogate Quality Control (continued)

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: Z191024AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1028915	106	102	99	96
Blank	106	101	98	93
LCS	103	102	98	97
MS	104	100	100	97
MSD	105	102	99	97
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 190990005A

	Propene
1028913	61
1028914	81
1028915	61
1028916	60
1028917	99
1028918	67
Blank	105
LCS	106
LCSD	103
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

Delivery and Receipt Information

Delivery Method: ELLE Courier Arrival Timestamp: 04/08/2019 17:15
 Number of Packages: 1 Number of Projects: 2
 State/Province of Origin: MD

Arrival Condition Summary

Shipping Container Sealed:	No	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace \geq 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCl
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Cory Jeremiah (10469) at 19:41 on 04/08/2019

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* *All Temperatures in °C.*

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
2	DT42-01	1.1	DT	Wet	N	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: April 14, 2019 14:36

Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2038023
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
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Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

(717) 556-7261

To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-38 [R] Groundwater	04/09/2019 08:50	1029675
MW-38B Groundwater	04/09/2019 10:00	1029676
MW-38C [R] Groundwater	04/09/2019 09:50	1029677
MW-54 Groundwater	04/09/2019 11:45	1029678
MW-74 [R] Groundwater	04/09/2019 13:10	1029679
MW-75 [R] Groundwater	04/09/2019 14:15	1029680
TB19091 Water	04/04/2019	1029681

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-38 [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1029675
ELLE Group #: 2038023
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/09/2019 17:15
Collection Date/Time: 04/09/2019 08:50

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	0.9 J	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	0.2 J	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	8	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	23,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	8.0	0.50	0.25	5
00228	Sulfate	14808-79-8	10.1	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191021AA	04/12/2019 14:16	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191021AA	04/12/2019 14:15	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	3	191000002A	04/10/2019 10:27	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191000001A	04/10/2019 12:35	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	2	19100987106A	04/10/2019 16:28	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	2	19100987106A	04/10/2019 16:28	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-38B Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1029676
ELLE Group #: 2038023
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/09/2019 17:15
Collection Date/Time: 04/09/2019 10:00

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	15,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	2.3	0.50	0.25	5
00228	Sulfate	14808-79-8	9.3	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191021AA	04/12/2019 14:38	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191021AA	04/12/2019 14:37	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	3	191000002A	04/10/2019 10:37	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191000001A	04/10/2019 12:52	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	2	19100987106A	04/10/2019 17:24	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	2	19100987106A	04/10/2019 17:24	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-38C [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1029677
ELLE Group #: 2038023
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/09/2019 17:15
Collection Date/Time: 04/09/2019 09:50

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	3	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	3	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	0.8 J	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	69	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	20,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	22.6	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191021AA	04/12/2019 15:00	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191021AA	04/12/2019 14:59	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	3	191000002A	04/10/2019 10:47	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191000001A	04/10/2019 13:10	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	2	19100987106A	04/10/2019 17:43	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	2	19100987106A	04/10/2019 17:43	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-54 Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1029678
ELLE Group #: 2038023
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/09/2019 17:15
Collection Date/Time: 04/09/2019 11:45

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	0.4 J	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	5,600 J	12,000	2,600	1
07105	Methane	74-82-8	65	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	1.6	0.50	0.25	5
00228	Sulfate	14808-79-8	3.6 J	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191021AA	04/12/2019 15:22	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191021AA	04/12/2019 15:21	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	3	191000002A	04/10/2019 10:57	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191000001A	04/10/2019 13:29	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	2	19100987106A	04/10/2019 18:01	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	2	19100987106A	04/10/2019 18:01	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-74 [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1029679
ELLE Group #: 2038023
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/09/2019 17:15
Collection Date/Time: 04/09/2019 13:10

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	N.D.	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	10.2	0.50	0.25	5
00228	Sulfate	14808-79-8	8.5	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191021AA	04/12/2019 15:44	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191021AA	04/12/2019 15:43	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	3	191000002A	04/10/2019 11:07	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191000001A	04/10/2019 13:46	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	2	19100987106A	04/10/2019 18:20	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	2	19100987106A	04/10/2019 18:20	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-75 [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1029680
ELLE Group #: 2038023
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/09/2019 17:15
Collection Date/Time: 04/09/2019 14:15

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	3	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	8,300 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	8.5	0.50	0.25	5
00228	Sulfate	14808-79-8	7.4	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191021AA	04/12/2019 16:06	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191021AA	04/12/2019 16:05	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	3	191000002A	04/10/2019 11:17	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191000001A	04/10/2019 14:04	Connor Lent	1
00368	Nitrate Nitrogen	EPA 300.0	2	19100987106A	04/10/2019 18:39	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	2	19100987106A	04/10/2019 18:39	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19091 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1029681
ELLE Group #: 2038023
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/09/2019 17:15
Collection Date/Time: 04/04/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191021AA	04/12/2019 16:28	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191021AA	04/12/2019 16:27	Alexander D Sechrist	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/14/2019 14:36

Group Number: 2038023

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result ug/l	LOQ** ug/l	MDL ug/l
Batch number: F191021AA	Sample number(s): 1029675-1029681		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 191000001A	Sample number(s): 1029675-1029680		
Methane	N.D.	5.0	3.0
Batch number: 191000002A	Sample number(s): 1029675-1029680		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19100987106A	Sample number(s): 1029675-1029680		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F191021AA	Sample number(s): 1029675-1029681								
t-Amyl methyl ether	20	20.19			101		66-120		
Benzene	20	19.61			98		80-120		
t-Butyl alcohol	200	172.79			86		60-130		
Ethyl t-butyl ether	20	19.96			100		68-121		
Ethylbenzene	20	18.97			95		80-120		
di-Isopropyl ether	20	19.85			99		70-124		
Methyl Tertiary Butyl Ether	20	20.31			102		69-122		
Toluene	20	19.21			96		80-120		
Xylene (Total)	60	58.56			98		80-120		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/14/2019 14:36

Group Number: 2038023

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 191000001A Methane	Sample number(s): 1029675-1029680				99	108	85-115	8	20
	59.83	59.44	59.83	64.39					
Batch number: 191000002A CO2 by Headspace	Sample number(s): 1029675-1029680				86	85	85-120	1	20
	35820	30983.47	35820	30544.16					
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19100987106A Nitrate Nitrogen	Sample number(s): 1029675-1029680				96		90-110		
Sulfate	0.750	0.719			103		90-110		
	7.50	7.69							

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 19100987106A Nitrate Nitrogen	Sample number(s): 1029675-1029680 UNSPK: 1029675					121*		90-110		
Sulfate	7.96	2.50	10.97			114*		90-110		
	10.13	25	38.61							

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 19100987106A Nitrate Nitrogen	Sample number(s): 1029675-1029680 BKG: 1029675			
Sulfate	7.96	7.83	2	15
	10.13	9.53	6 (1)	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/14/2019 14:36

Group Number: 2038023

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: F191021AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1029675	100	97	98	98
1029676	102	96	98	100
1029677	101	97	98	99
1029678	101	97	97	99
1029679	100	97	98	100
1029680	101	97	98	100
1029681	101	98	99	99
Blank	100	97	97	98
LCS	101	100	99	99
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191000001A

	Propene
1029675	75
1029676	70
1029677	61
1029678	79
1029679	71
1029680	65
Blank	107
LCS	100
LCSD	103
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

Delivery and Receipt Information

Delivery Method: ELLE Courier Arrival Timestamp: 04/09/2019 17:15
 Number of Packages: 1 Number of Projects: 1

Arrival Condition Summary

Shipping Container Sealed:	No	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	No
Samples Chilled:	Yes	VOA Vial Headspace ≥ 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCl
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Cory Jeremiah (10469) at 17:38 on 04/09/2019

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp)* All Temperatures in °C.

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Corrected Temp</u>	<u>Therm. Type</u>	<u>Ice Type</u>	<u>Ice Present?</u>	<u>Ice Container</u>	<u>Elevated Temp?</u>
1	32170023	5.2	IR	Wet	Y	Bagged	N

Sample Date/Time Discrepancy Details

<u>Sample ID on COC</u>	<u>Date/Time on Label</u>	<u>Comments</u>
MW-75 [R]	4/09/2019 13:10	4 vials of MW-75 [R] time labeled 1310

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: April 18, 2019 09:46

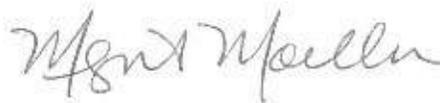
Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2038299
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

(717) 556-7261

To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-13 [R] Groundwater	04/10/2019 09:20	1030737
MW-42C(192) Groundwater	04/10/2019 10:30	1030738
MW-42A Groundwater	04/10/2019 12:15	1030739
MW-42B Groundwater	04/10/2019 13:45	1030740
MW-73C Groundwater	04/10/2019 14:35	1030741
TB-19091 Water	04/08/2019	1030742

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-13 [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1030737
ELLE Group #: 2038299
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/10/2019 17:29
Collection Date/Time: 04/10/2019 09:20

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	0.9 J	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	16,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	2.2	0.50	0.25	5
00228	Sulfate	14808-79-8	33.9	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191024AA	04/13/2019 00:31	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191024AA	04/13/2019 00:30	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191010003A	04/11/2019 10:42	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191010002A	04/11/2019 11:19	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19101520106A	04/11/2019 17:27	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19101520106A	04/11/2019 17:27	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-42C(192) Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1030738
ELLE Group #: 2038299
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/10/2019 17:29
Collection Date/Time: 04/10/2019 10:30

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	13,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	4.1	0.50	0.25	5
00228	Sulfate	14808-79-8	16.0	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191024AA	04/13/2019 00:56	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191024AA	04/13/2019 00:55	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191010003A	04/11/2019 10:50	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191010002A	04/11/2019 11:37	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19101520106A	04/11/2019 18:42	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19101520106A	04/11/2019 18:42	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-42A Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1030739
ELLE Group #: 2038299
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/10/2019 17:29
Collection Date/Time: 04/10/2019 12:15

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	18,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	1.8	0.50	0.25	5
00228	Sulfate	14808-79-8	N.D.	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191024AA	04/13/2019 01:20	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191024AA	04/13/2019 01:19	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191010003A	04/11/2019 10:59	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191010002A	04/11/2019 11:55	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19101520106A	04/11/2019 20:34	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19101520106A	04/11/2019 20:34	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-42B Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1030740
ELLE Group #: 2038299
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submission Date/Time: 04/10/2019 17:29
Collection Date/Time: 04/10/2019 13:45

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	11,000 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	120	50.0	15.0	50

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191024AA	04/13/2019 01:44	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191024AA	04/13/2019 01:43	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191010003A	04/11/2019 11:07	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191010002A	04/11/2019 12:32	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19101520106B	04/12/2019 00:38	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19101520106B	04/12/2019 00:57	Ashlynn M Cornelius	50

*=This limit was used in the evaluation of the final result

Sample Description: MW-73C Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1030741
ELLE Group #: 2038299
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/10/2019 17:29
Collection Date/Time: 04/10/2019 14:35

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	10	1	0.3	1
10945	Benzene	71-43-2	8	1	0.2	1
10945	t-Butyl alcohol	75-65-0	190	25	10	1
10945	Ethyl t-butyl ether	637-92-3	5	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	1	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	190	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	N.D.	12,000	2,600	1
07105	Methane	74-82-8	240	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	5.6	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191024AA	04/13/2019 02:09	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191024AA	04/13/2019 02:08	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191010003A	04/11/2019 11:15	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191010002A	04/11/2019 12:50	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19101520106B	04/12/2019 03:08	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19101520106B	04/12/2019 03:08	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: TB-19091 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1030742
ELLE Group #: 2038299
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/10/2019 17:29
Collection Date/Time: 04/08/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191024AA	04/12/2019 22:54	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191024AA	04/12/2019 22:53	Hu Yang	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/18/2019 09:46

Group Number: 2038299

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	LOQ**	MDL
	ug/l	ug/l	ug/l
Batch number: Z191024AA	Sample number(s): 1030737-1030742		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 191010002A	Sample number(s): 1030737-1030741		
Methane	N.D.	5.0	3.0
Batch number: 191010003A	Sample number(s): 1030737-1030741		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19101520106A	Sample number(s): 1030737-1030739		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30
Batch number: 19101520106B	Sample number(s): 1030740-1030741		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added	LCS Conc	LCSD Spike Added	LCSD Conc	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
	ug/l	ug/l	ug/l	ug/l					
Batch number: Z191024AA	Sample number(s): 1030737-1030742								
t-Amyl methyl ether	20	16.26			81		66-120		
Benzene	20	19.74			99		80-120		
t-Butyl alcohol	200	178.03			89		60-130		
Ethyl t-butyl ether	20	18.07			90		68-121		
Ethylbenzene	20	17.45			87		80-120		
di-Isopropyl ether	20	17.83			89		70-124		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/18/2019 09:46

Group Number: 2038299

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Methyl Tertiary Butyl Ether	20	19.09			95		69-122		
Toluene	20	18.75			94		80-120		
Xylene (Total)	60	55.16			92		80-120		
	ug/l	ug/l	ug/l	ug/l					
Batch number: 191010002A	Sample number(s): 1030737-1030741								
Methane	59.83	58.4	59.83	57.99	98	97	85-115	1	20
Batch number: 191010003A	Sample number(s): 1030737-1030741								
CO2 by Headspace	35820	36827.61	35820	38151.51	103	107	85-120	4	20
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19101520106A	Sample number(s): 1030737-1030739								
Nitrate Nitrogen	0.750	0.701			94		90-110		
Sulfate	7.50	7.37			98		90-110		
Batch number: 19101520106B	Sample number(s): 1030740-1030741								
Nitrate Nitrogen	0.750	0.701			94		90-110		
Sulfate	7.50	7.37			98		90-110		

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: Z191024AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1030737	107	102	98	95
1030738	106	102	99	94
1030739	107	103	98	94
1030740	106	102	98	95
1030741	105	98	98	94
1030742	108	102	98	92
Blank	106	101	98	93
LCS	103	102	98	97
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191010002A

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/18/2019 09:46

Group Number: 2038299

Surrogate Quality Control (continued)

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191010002A

	Propene
1030737	72
1030738	56
1030739	70
1030740	62
1030741	66
Blank	96
LCS	95
LCSD	95
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

Delivery and Receipt Information

Delivery Method:	<u>ELLE Courier</u>	Arrival Timestamp:	<u>04/10/2019 17:24</u>
Number of Packages:	<u>1</u>	Number of Projects:	<u>1</u>
State/Province of Origin:	<u>MD</u>		

Arrival Condition Summary

Shipping Container Sealed:	No	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace \geq 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCI
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Cory Jeremiah (10469) at 19:08 on 04/10/2019

Samples Chilled Details

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Corrected Temp</u>	<u>Therm. Type</u>	<u>Ice Type</u>	<u>Ice Present?</u>	<u>Ice Container</u>	<u>Elevated Temp?</u>
1	DT146	2.3	DT	Wet	Y	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: April 29, 2019 03:17

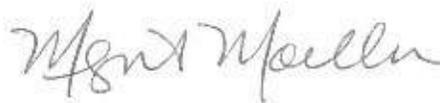
Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2038476
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

(717) 556-7261

To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-54B [R] Groundwater	04/11/2019 10:00	1031640
MW-138D Groundwater	04/11/2019 11:00	1031641
SVE-1 [R] Groundwater	04/11/2019 12:15	1031642
MW-187A [R] Groundwater	04/11/2019 13:00	1031643
MW-187B [R] Groundwater	04/11/2019 13:45	1031644
MW-187C Groundwater	04/11/2019 14:25	1031645
TB19091 Water	04/04/2019	1031646

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-54B [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1031640
ELLE Group #: 2038476
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/11/2019 17:11
Collection Date/Time: 04/11/2019 10:00

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	0.7 J	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	14 J	25	10	1
10945	Ethyl t-butyl ether	637-92-3	4	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	1	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	19	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	5,500 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	2.6	0.50	0.25	5
00228	Sulfate	14808-79-8	7.9	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191023AA	04/13/2019 03:51	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191023AA	04/13/2019 03:50	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191020004A	04/12/2019 10:31	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191020007A	04/12/2019 11:07	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102963117A	04/12/2019 17:07	Anna Campanella	5
00228	Sulfate	EPA 300.0	1	19102963117A	04/12/2019 17:07	Anna Campanella	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-138D Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1031641
ELLE Group #: 2038476
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/11/2019 17:11
Collection Date/Time: 04/11/2019 11:00

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	19	1	0.3	1
10945	Benzene	71-43-2	4	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	3	1	0.2	1
10945	Ethylbenzene	100-41-4	0.2 J	1	0.2	1
10945	di-Isopropyl ether	108-20-3	0.9 J	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	270	1	0.2	1
10945	Toluene	108-88-3	0.5 J	1	0.2	1
10945	Xylene (Total)	1330-20-7	0.7 J	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	5,200 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	1.5	0.50	0.25	5
00228	Sulfate	14808-79-8	16.4	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191023AA	04/13/2019 04:13	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191023AA	04/13/2019 04:12	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191020004A	04/12/2019 10:38	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191020007A	04/12/2019 11:25	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102963117B	04/12/2019 20:15	Anna Campanella	5
00228	Sulfate	EPA 300.0	1	19102963117B	04/12/2019 20:15	Anna Campanella	5

*=This limit was used in the evaluation of the final result

Sample Description: SVE-1 [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1031642
ELLE Group #: 2038476
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/11/2019 17:11
Collection Date/Time: 04/11/2019 12:15

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	1	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	0.7 J	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	10	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	9,600 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	1.7	0.50	0.25	5
00228	Sulfate	14808-79-8	110	20.0	6.0	20

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191023AA	04/13/2019 04:36	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191023AA	04/13/2019 04:35	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191020004A	04/12/2019 10:54	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191020007A	04/12/2019 11:43	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102963117B	04/12/2019 23:22	Anna Campanella	5
00228	Sulfate	EPA 300.0	1	19102963117B	04/12/2019 23:40	Anna Campanella	20

*=This limit was used in the evaluation of the final result

Sample Description: MW-187A [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1031643
ELLE Group #: 2038476
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submission Date/Time: 04/11/2019 17:11
Collection Date/Time: 04/11/2019 13:00

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	28	1	0.3	1
10945	Benzene	71-43-2	38	1	0.2	1
10945	t-Butyl alcohol	75-65-0	11 J	25	10	1
10945	Ethyl t-butyl ether	637-92-3	2	1	0.2	1
10945	Ethylbenzene	100-41-4	10	1	0.2	1
10945	di-Isopropyl ether	108-20-3	1	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	45	1	0.2	1
10945	Toluene	108-88-3	200	10	2	10
10945	Xylene (Total)	1330-20-7	110	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	18,000	12,000	2,600	1
07105	Methane	74-82-8	4.7 J	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	2.9	0.50	0.25	5
00228	Sulfate	14808-79-8	6.4	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191023AA	04/13/2019 04:58	Hu Yang	1
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	D191062AA	04/17/2019 06:08	Hu Yang	10
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191023AA	04/13/2019 04:57	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	2	D191062AA	04/17/2019 06:07	Hu Yang	10
08097	CO2 by Headspace	RSKSOP-175 modified	1	191020004A	04/12/2019 11:02	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191020007A	04/12/2019 13:44	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102963117B	04/12/2019 23:57	Anna Campanella	5
00228	Sulfate	EPA 300.0	1	19102963117B	04/12/2019 23:57	Anna Campanella	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-187B [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1031644
ELLE Group #: 2038476
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submission Date/Time: 04/11/2019 17:11
Collection Date/Time: 04/11/2019 13:45

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	25	1	0.3	1
10945	Benzene	71-43-2	6	1	0.2	1
10945	t-Butyl alcohol	75-65-0	95	25	10	1
10945	Ethyl t-butyl ether	637-92-3	3	1	0.2	1
10945	Ethylbenzene	100-41-4	3	1	0.2	1
10945	di-Isopropyl ether	108-20-3	0.9 J	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	280	1	0.2	1
10945	Toluene	108-88-3	69	1	0.2	1
10945	Xylene (Total)	1330-20-7	60	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	N.D.	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	1.8	0.50	0.25	5
00228	Sulfate	14808-79-8	9.1	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191024AA	04/13/2019 04:23	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191024AA	04/13/2019 04:22	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191020004A	04/12/2019 11:09	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191020007A	04/12/2019 12:38	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102963117B	04/13/2019 00:31	Anna Campanella	5
00228	Sulfate	EPA 300.0	1	19102963117B	04/13/2019 00:31	Anna Campanella	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-187C Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1031645
ELLE Group #: 2038476
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submission Date/Time: 04/11/2019 17:11
Collection Date/Time: 04/11/2019 14:25

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	19	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	9	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	2	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	550	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	2,600 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
	The holding time was not met.					
00228	Sulfate	14808-79-8	17.5	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191024AA	04/13/2019 04:45	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191024AA	04/13/2019 04:44	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191020004A	04/12/2019 11:17	Connor Lent	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191020007A	04/12/2019 12:57	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102963117B	04/17/2019 02:51	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	19102963117B	04/17/2019 02:51	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19091 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1031646
ELLE Group #: 2038476
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/11/2019 17:11
Collection Date/Time: 04/04/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191024AA	04/12/2019 22:29	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191024AA	04/12/2019 22:28	Hu Yang	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/29/2019 03:17

Group Number: 2038476

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	LOQ**	MDL
	ug/l	ug/l	ug/l
Batch number: D191062AA	Sample number(s): 1031643		
Toluene	N.D.	1	0.2
Batch number: F191023AA	Sample number(s): 1031640-1031643		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: F191024AA	Sample number(s): 1031644-1031646		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 191020004A	Sample number(s): 1031640-1031645		
CO2 by Headspace	N.D.	12,000	2,600
Batch number: 191020007A	Sample number(s): 1031640-1031645		
Methane	N.D.	5.0	3.0
	mg/l	mg/l	mg/l
Batch number: 19102963117A	Sample number(s): 1031640		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30
Batch number: 19102963117B	Sample number(s): 1031641-1031645		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/29/2019 03:17

Group Number: 2038476

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: D191062AA Toluene	20	20.42			102		80-120		
Batch number: F191023AA t-Amyl methyl ether	20	21.57			108		66-120		
Benzene	20	20.92			105		80-120		
t-Butyl alcohol	200	187.73			94		60-130		
Ethyl t-butyl ether	20	20.93			105		68-121		
Ethylbenzene	20	20.54			103		80-120		
di-Isopropyl ether	20	21.25			106		70-124		
Methyl Tertiary Butyl Ether	20	21.25			106		69-122		
Toluene	20	20.41			102		80-120		
Xylene (Total)	60	62.08			103		80-120		
Batch number: F191024AA t-Amyl methyl ether	20	22.19			111		66-120		
Benzene	20	22.23			111		80-120		
t-Butyl alcohol	200	189.08			95		60-130		
Ethyl t-butyl ether	20	21.66			108		68-121		
Ethylbenzene	20	21.25			106		80-120		
di-Isopropyl ether	20	22.47			112		70-124		
Methyl Tertiary Butyl Ether	20	22.09			110		69-122		
Toluene	20	21.2			106		80-120		
Xylene (Total)	60	65.21			109		80-120		
	ug/l	ug/l	ug/l	ug/l					
Batch number: 191020004A CO2 by Headspace	35820	38097.6	35820	38758.6	106	108	85-120	2	20
Batch number: 191020007A Methane	59.83	60.86	59.83	61.05	102	102	85-115	0	20
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19102963117A Nitrate Nitrogen	0.750	0.779			104		90-110		
Sulfate	7.50	7.88			105		90-110		
Batch number: 19102963117B Nitrate Nitrogen	0.750	0.779			104		90-110		
Sulfate	7.50	7.88			105		90-110		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/29/2019 03:17

Group Number: 2038476

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 19102963117B	Sample number(s): 1031641-1031645 UNSPK: 1031641									
Nitrate Nitrogen	1.54	2.50	3.85			93		90-110		
Sulfate	16.44	25	40.57			97		90-110		

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 19102963117B	Sample number(s): 1031641-1031645 BKG: 1031641			
Nitrate Nitrogen	1.54	1.53	0 (1)	15
Sulfate	16.44	16.14	2 (1)	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: F191023AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1031640	100	97	98	100
1031641	102	97	98	100
1031642	101	96	97	99
1031643	100	96	99	101
Blank	100	97	98	98
LCS	99	99	99	100
Limits:	80-120	80-120	80-120	80-120

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: F191024AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1031644	100	98	98	100
1031645	101	98	98	100
1031646	101	101	98	100

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/29/2019 03:17

Group Number: 2038476

Surrogate Quality Control (continued)

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: F191024AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
Blank	100	97	99	99
LCS	100	104	98	101
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191020007A

	Propene
1031640	75
1031641	74
1031642	62
1031643	72
1031644	52
1031645	65
Blank	109
LCS	102
LCSD	99
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

Delivery and Receipt Information

Delivery Method: ELLE Courier Arrival Timestamp: 04/11/2019 17:11
 Number of Packages: 1 Number of Projects: 1
 State/Province of Origin: MD

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	No
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace ≥ 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCI
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Melvin Sanchez (8943) at 17:42 on 04/11/2019

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.*

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	DT42-01	1.3	DT	Wet	Y	Bagged	N

Sample ID Discrepancy Details

Sample ID on COC	Sample ID on Label	Comments
MW-54 [R]	MW-54B	
SVE-1 [R]	SVE-1	
MW-187A [R]	MW-187A	
MW-187B [R]	MW-187B	

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: April 30, 2019 19:21

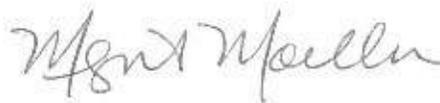
Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2038722
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

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To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-178C [R] Groundwater	04/12/2019 09:20	1032955
MW-184 [R] Groundwater	04/12/2019 10:50	1032956
MW-82B [R] Groundwater	04/12/2019 13:00	1032957
MW-89 [R] Groundwater	04/12/2019 14:00	1032958
TB19095 Water	04/09/2019	1032959

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-178C [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1032955
ELLE Group #: 2038722
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/12/2019 17:35
Collection Date/Time: 04/12/2019 09:20

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	10	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	680	25	10	1
10945	Ethyl t-butyl ether	637-92-3	13	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	3	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	200	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	2,800 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
The container used for the testing had headspace at the time of analysis.						
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	19.1	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191052AA	04/15/2019 17:11	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191052AA	04/15/2019 17:10	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191070018A	04/17/2019 13:21	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191050001A	04/15/2019 11:52	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102987313B	04/13/2019 12:33	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19102987313B	04/13/2019 12:33	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-184 [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1032956
ELLE Group #: 2038722
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/12/2019 17:35
Collection Date/Time: 04/12/2019 10:50

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	2	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	0.3 J	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	4	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	3,000 J	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
The container used for the testing had headspace at the time of analysis.						
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	0.69	0.50	0.25	5
00228	Sulfate	14808-79-8	23.5	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191052AA	04/15/2019 17:35	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191052AA	04/15/2019 17:34	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191070018A	04/17/2019 13:29	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191050001A	04/15/2019 12:10	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102987313B	04/13/2019 12:49	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19102987313B	04/13/2019 12:49	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-82B [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1032957
ELLE Group #: 2038722
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/12/2019 17:35
Collection Date/Time: 04/12/2019 13:00

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	19,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
The container used for the testing had headspace at the time of analysis.						
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	8.2	0.50	0.25	5
00228	Sulfate	14808-79-8	12.3	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191052AA	04/15/2019 18:00	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191052AA	04/15/2019 17:59	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191070018A	04/17/2019 13:37	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191050001A	04/15/2019 12:47	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102987313B	04/13/2019 13:06	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19102987313B	04/13/2019 13:06	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-89 [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1032958
ELLE Group #: 2038722
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/12/2019 17:35
Collection Date/Time: 04/12/2019 14:00

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	45,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
The container used for the testing had headspace at the time of analysis.						
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	13.9	0.50	0.25	5
00228	Sulfate	14808-79-8	16.0	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191052AA	04/15/2019 18:24	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191052AA	04/15/2019 18:23	Alexander D Sechrist	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191070018A	04/17/2019 13:45	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191050001A	04/15/2019 13:05	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19102987313B	04/13/2019 13:22	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19102987313B	04/13/2019 13:22	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19095 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1032959
ELLE Group #: 2038722
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/12/2019 17:35
Collection Date/Time: 04/09/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191052AA	04/15/2019 18:49	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191052AA	04/15/2019 18:48	Alexander D Sechrist	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/30/2019 19:21

Group Number: 2038722

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result ug/l	LOQ** ug/l	MDL ug/l
Batch number: Z191052AA	Sample number(s): 1032955-1032959		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 191050001A	Sample number(s): 1032955-1032958		
Methane	N.D.	5.0	3.0
Batch number: 191070018A	Sample number(s): 1032955-1032958		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19102987313B	Sample number(s): 1032955-1032958		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: Z191052AA	Sample number(s): 1032955-1032959								
t-Amyl methyl ether	20	16.06			80		66-120		
Benzene	20	19.03			95		80-120		
t-Butyl alcohol	200	167.64			84		60-130		
Ethyl t-butyl ether	20	17.74			89		68-121		
Ethylbenzene	20	16.77			84		80-120		
di-Isopropyl ether	20	17.35			87		70-124		
Methyl Tertiary Butyl Ether	20	18.29			91		69-122		
Toluene	20	18.1			90		80-120		
Xylene (Total)	60	52.59			88		80-120		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/30/2019 19:21

Group Number: 2038722

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 191050001A Methane	Sample number(s): 1032955-1032958				93	92	85-115	1	20
	59.83	55.53	59.83	54.86					
Batch number: 191070018A CO2 by Headspace	Sample number(s): 1032955-1032958				88	91	85-120	3	20
	35820	31554.08	35820	32527.09					
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19102987313B Nitrate Nitrogen	Sample number(s): 1032955-1032958				105		90-110		
	0.750	0.789							
Sulfate	7.50	8.14			108		90-110		

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: Z191052AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1032955	104	101	98	96
1032956	106	101	99	96
1032957	105	102	98	95
1032958	107	101	98	95
1032959	106	102	97	94
Blank	107	102	99	94
LCS	105	101	99	98
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191050001A

	Propene
1032955	59
1032956	67
1032957	59
1032958	69
Blank	95
LCS	95
LCSD	94
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/30/2019 19:21

Group Number: 2038722

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

Exxon - Pheonix 28077

Delivery and Receipt Information

Delivery Method:	<u>ELLE Courier</u>	Arrival Timestamp:	<u>04/12/2019 17:35</u>
Number of Packages:	<u>1</u>	Number of Projects:	<u>1</u>
State/Province of Origin:	<u>MD</u>		

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace \geq 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCI
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Darian Jaynes (29952) at 18:09 on 04/12/2019

Samples Chilled Details: Exxon - Pheonix 28077

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Corrected Temp</u>	<u>Therm. Type</u>	<u>Ice Type</u>	<u>Ice Present?</u>	<u>Ice Container</u>	<u>Elevated Temp?</u>
1	DT42-02	1.9	DT	Wet	Y	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: April 25, 2019 13:07

Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2039653
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

(717) 556-7261

To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-92 Groundwater	04/18/2019 13:00	1037477
MW-92C Groundwater	04/18/2019 14:10	1037478
TB19091 Water	04/04/2019	1037479

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-92 Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1037477
ELLE Group #: 2039653
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/18/2019 17:23
Collection Date/Time: 04/18/2019 13:00

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	81,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	7.6	0.50	0.25	5
00228	Sulfate	14808-79-8	N.D.	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	191090008A	04/19/2019 09:29	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191090003A	04/19/2019 14:01	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19108987112B	04/19/2019 11:05	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19108987112B	04/19/2019 11:05	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-92C Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1037478
ELLE Group #: 2039653
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/18/2019 17:23
Collection Date/Time: 04/18/2019 14:10

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified		ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	7,600 J	12,000	2,600	1
07105	Methane	74-82-8	41	5.0	3.0	1
Wet Chemistry		EPA 300.0		mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	N.D.	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	191090008A	04/19/2019 09:36	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191090003A	04/19/2019 14:20	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19108987112B	04/19/2019 11:38	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19108987112B	04/19/2019 11:38	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19091 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1037479
ELLE Group #: 2039653
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/18/2019 17:23
Collection Date/Time: 04/04/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	F191131AA	04/23/2019 10:40	Alexander D Sechrist	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F191131AA	04/23/2019 10:39	Alexander D Sechrist	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/25/2019 13:07

Group Number: 2039653

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result ug/l	LOQ** ug/l	MDL ug/l
Batch number: F191131AA	Sample number(s): 1037479		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 191090003A	Sample number(s): 1037477-1037478		
Methane	N.D.	5.0	3.0
Batch number: 191090008A	Sample number(s): 1037477-1037478		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19108987112B	Sample number(s): 1037477-1037478		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F191131AA	Sample number(s): 1037479								
t-Amyl methyl ether	20	22.81			114		66-120		
Benzene	20	23.81			119		80-120		
t-Butyl alcohol	200	208.8			104		60-130		
Ethyl t-butyl ether	20	23.57			118		68-121		
Ethylbenzene	20	23.24			116		80-120		
di-Isopropyl ether	20	25.57			128*		70-124		
Methyl Tertiary Butyl Ether	20	23.01			115		69-122		
Toluene	20	23.41			117		80-120		
Xylene (Total)	60	69.6			116		80-120		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/25/2019 13:07

Group Number: 2039653

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 191090003A Methane	Sample number(s): 1037477-1037478								
	59.83	63.83	59.83	61.3	107	102	85-115	4	20
Batch number: 191090008A CO2 by Headspace	Sample number(s): 1037477-1037478								
	35820	33521.53	35820	30766.78	94	86	85-120	9	20
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19108987112B Nitrate Nitrogen	Sample number(s): 1037477-1037478								
	0.750	0.681			91		90-110		
Sulfate	7.50	7.95			106		90-110		

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: F191131AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1037479	95	94	101	100
Blank	96	96	101	102
LCS	96	98	100	101
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191090003A

	Propene
1037477	98
1037478	98
Blank	105
LCS	107
LCSD	101
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

14258 Jarrettsville Pike

Delivery and Receipt Information

Delivery Method:	<u>ELLE Courier</u>	Arrival Timestamp:	<u>04/18/2019 17:23</u>
Number of Packages:	<u>1</u>	Number of Projects:	<u>1</u>
State/Province of Origin:	<u>MD</u>		

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace \geq 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCI
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Darian Jaynes (29952) at 18:20 on 04/18/2019

Samples Chilled Details: 14258 Jarrettsville Pike

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Corrected Temp</u>	<u>Therm. Type</u>	<u>Ice Type</u>	<u>Ice Present?</u>	<u>Ice Container</u>	<u>Elevated Temp?</u>
1	DT42-01	3.9	DT	Wet	N	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: April 29, 2019 12:58

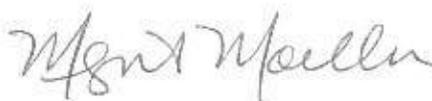
Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2039854
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

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To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-93A Groundwater	04/19/2019 10:55	1038603
MW-73C Groundwater	04/19/2019 13:00	1038604
MW-168 Groundwater	04/19/2019 13:50	1038605
TB19089 Water	04/02/2019	1038606

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-93A Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1038603
ELLE Group #: 2039854
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/19/2019 17:15
Collection Date/Time: 04/19/2019 10:55

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified		ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	23,000	12,000	2,600	1
07105	Methane	74-82-8	6.0	5.0	3.0	1
Wet Chemistry		EPA 300.0		mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	1.6	0.50	0.25	5
00228	Sulfate	14808-79-8	15.2	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	191120006A	04/22/2019 11:13	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191120002A	04/22/2019 12:08	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19110987106B	04/20/2019 14:34	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19110987106B	04/20/2019 14:34	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-73C Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1038604
ELLE Group #: 2039854
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/19/2019 17:15
Collection Date/Time: 04/19/2019 13:00

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles			SW-846 8260B	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	0.3 J	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous			RSKSOP-175 modified	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	N.D.	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry			EPA 300.0	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	N.D.	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191153AA	04/26/2019 00:42	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191153AA	04/26/2019 00:41	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191120006A	04/22/2019 11:21	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191120002A	04/22/2019 12:26	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19110987106B	04/20/2019 15:30	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19110987106B	04/20/2019 15:30	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-168 Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1038605
ELLE Group #: 2039854
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/19/2019 17:15
Collection Date/Time: 04/19/2019 13:50

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	0.5 J	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	21,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	4.5	0.50	0.25	5
00228	Sulfate	14808-79-8	7.7	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191153AA	04/26/2019 01:06	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191153AA	04/26/2019 01:05	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191120006A	04/22/2019 11:29	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191120002A	04/22/2019 13:33	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19110987106B	04/20/2019 15:49	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19110987106B	04/20/2019 15:49	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19089 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1038606
ELLE Group #: 2039854
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/19/2019 17:15
Collection Date/Time: 04/02/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

The recovery for the sample internal standard is outside the QC acceptance limits. The following action was taken:

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191153AA	04/25/2019 22:40	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191153AA	04/25/2019 22:39	Hu Yang	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/29/2019 12:58

Group Number: 2039854

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result ug/l	LOQ** ug/l	MDL ug/l
Batch number: Z191153AA	Sample number(s): 1038604-1038606		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 191120002A	Sample number(s): 1038603-1038605		
Methane	N.D.	5.0	3.0
Batch number: 191120006A	Sample number(s): 1038603-1038605		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19110987106B	Sample number(s): 1038603-1038605		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: Z191153AA	Sample number(s): 1038604-1038606								
t-Amyl methyl ether	20	15.69			78		66-120		
Benzene	20	19.4			97		80-120		
t-Butyl alcohol	200	162.62			81		60-130		
Ethyl t-butyl ether	20	17.99			90		68-121		
Ethylbenzene	20	16.59			83		80-120		
di-Isopropyl ether	20	18.04			90		70-124		
Methyl Tertiary Butyl Ether	20	18.6			93		69-122		
Toluene	20	17.64			88		80-120		
Xylene (Total)	60	52.08			87		80-120		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/29/2019 12:58

Group Number: 2039854

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 191120002A Methane	Sample number(s): 1038603-1038605				104	105	85-115	1	20
	59.83	62.3	59.83	62.79					
Batch number: 191120006A CO2 by Headspace	Sample number(s): 1038603-1038605				91	87	85-120	5	20
	35820	32444.1	35820	31012.78					
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19110987106B Nitrate Nitrogen	Sample number(s): 1038603-1038605				93		90-110		
Sulfate	0.750	0.699			100		90-110		
	7.50	7.52							

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 19110987106B Nitrate Nitrogen	Sample number(s): 1038603-1038605 UNSPK: 1038603					64*		90-110		
Sulfate	1.59	2.50	3.19			79*		90-110		
	15.16	25	34.85							

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 19110987106B Nitrate Nitrogen	Sample number(s): 1038603-1038605 BKG: 1038603			
Sulfate	1.59	1.67	5 (1)	15
	15.16	15.22	0 (1)	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/29/2019 12:58

Group Number: 2039854

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: Z191153AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1038604	104	101	100	94
1038605	106	102	98	94
1038606	124*	111	99	93
Blank	113	105	94	90
LCS	104	104	98	95
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191120002A

	Propene
1038603	95
1038604	96
1038605	96
Blank	108
LCS	109
LCSD	106
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

Delivery and Receipt Information

Delivery Method: ELLE Courier Arrival Timestamp: 04/19/2019 17:15
 Number of Packages: 1 Number of Projects: 1
 State/Province of Origin: MD

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	No
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace ≥ 6mm:	Yes
Paperwork Enclosed:	Yes	VOA IDs (≥ 6mm):	See Below
Samples Intact:	Yes	Total Trip Blank Qty:	2
Missing Samples:	No	Trip Blank Type:	HCl
Extra Samples:	No	Air Quality Samples Present:	No
Discrepancy in Container Qty on COC:	No		

VOA Vial IDs (Headspace ≥ 6mm): Trip Blank (2 of 2)

Unpacked by Melvin Sanchez (8943) at 18:09 on 04/19/2019

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* *All Temperatures in °C.*

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	DT131	4.9	DT	Wet	Y	Bagged	N

Sample ID Discrepancy Details

Sample ID on COC	Sample ID on Label	Comments
MW-93A	MW-92A	

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: May 01, 2019 08:47

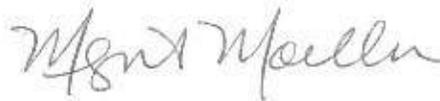
Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2040176
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

(717) 556-7261

To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
SVE-3 [R] Groundwater	04/22/2019 09:30	1040455
MW-181C Groundwater	04/22/2019 10:45	1040456
MW-56C Groundwater	04/22/2019 14:30	1040457
TB19100 Water	04/15/2019	1040458

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: SVE-3 [R] Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1040455
ELLE Group #: 2040176
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/22/2019 17:00
Collection Date/Time: 04/22/2019 09:30

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	7	1	0.3	1
10945	Benzene	71-43-2	5	1	0.2	1
10945	t-Butyl alcohol	75-65-0	10 J	25	10	1
10945	Ethyl t-butyl ether	637-92-3	2	1	0.2	1
10945	Ethylbenzene	100-41-4	0.3 J	1	0.2	1
10945	di-Isopropyl ether	108-20-3	0.9 J	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	48	1	0.2	1
10945	Toluene	108-88-3	19	1	0.2	1
10945	Xylene (Total)	1330-20-7	15	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	18,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	2.2	0.50	0.25	5
00228	Sulfate	14808-79-8	22.6	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191191AA	04/29/2019 22:52	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191191AA	04/29/2019 22:51	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191140002A	04/24/2019 10:06	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191140001A	04/24/2019 14:05	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19113987217A	04/23/2019 22:47	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19113987217A	04/23/2019 22:47	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-181C Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1040456
ELLE Group #: 2040176
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/22/2019 17:00
Collection Date/Time: 04/22/2019 10:45

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	0.3 J	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	0.3 J	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	12	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	N.D.	12,000	2,600	1
07105	Methane	74-82-8	1,100	25	15	5
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	N.D.	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191191AA	04/29/2019 20:26	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191191AA	04/29/2019 20:25	Hu Yang	1
08097	CO2 by Headspace	RSKSOP-175 modified	1	191140002A	04/24/2019 10:13	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191140001A	04/25/2019 16:20	Johanna C Kennedy	5
00368	Nitrate Nitrogen	EPA 300.0	1	19113987217A	04/23/2019 23:04	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19113987217A	04/23/2019 23:04	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-56C Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1040457
ELLE Group #: 2040176
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/22/2019 17:00
Collection Date/Time: 04/22/2019 14:30

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified		ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	15,000	12,000	2,600	1
07105	Methane	74-82-8	520	25	15	5
Wet Chemistry		EPA 300.0		mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	N.D.	0.50	0.25	5
00228	Sulfate	14808-79-8	2.6 J	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	191140002A	04/24/2019 10:21	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191140001A	04/25/2019 16:38	Johanna C Kennedy	5
00368	Nitrate Nitrogen	EPA 300.0	1	19113987217A	04/23/2019 23:21	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19113987217A	04/23/2019 23:21	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19100 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1040458
ELLE Group #: 2040176
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submission Date/Time: 04/22/2019 17:00
Collection Date/Time: 04/15/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191191AA	04/29/2019 19:13	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191191AA	04/29/2019 19:12	Hu Yang	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 05/01/2019 08:47

Group Number: 2040176

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result ug/l	LOQ** ug/l	MDL ug/l
Batch number: Z191191AA	Sample number(s): 1040455-1040456,1040458		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 191140001A	Sample number(s): 1040455-1040457		
Methane	N.D.	5.0	3.0
Batch number: 191140002A	Sample number(s): 1040455-1040457		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19113987217A	Sample number(s): 1040455-1040457		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: Z191191AA	Sample number(s): 1040455-1040456,1040458								
t-Amyl methyl ether	20	16.44			82		66-120		
Benzene	20	19.43			97		80-120		
t-Butyl alcohol	200	175.33			88		60-130		
Ethyl t-butyl ether	20	18.02			90		68-121		
Ethylbenzene	20	17.33			87		80-120		
di-Isopropyl ether	20	18.08			90		70-124		
Methyl Tertiary Butyl Ether	20	18.7			93		69-122		
Toluene	20	18.78			94		80-120		
Xylene (Total)	60	54.69			91		80-120		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 05/01/2019 08:47

Group Number: 2040176

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 191140001A Methane	Sample number(s): 1040455-1040457				106	105	85-115	1	20
	59.83	63.46	59.83	62.53					
Batch number: 191140002A CO2 by Headspace	Sample number(s): 1040455-1040457				90	87	85-120	3	20
	35820	32213.55	35820	31341.47					
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19113987217A Nitrate Nitrogen	Sample number(s): 1040455-1040457				100		90-110		
	0.750	0.752							
Sulfate	7.50	7.42			99		90-110		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/l	MS Spike Added ug/l	MS Conc ug/l	MSD Spike Added ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: Z191191AA	Sample number(s): 1040455-1040456,1040458 UNSPK: 1040456									
t-Amyl methyl ether	0.310	20	15.85	20	16.67	78	82	66-120	5	30
Benzene	N.D.	20	20.03	20	20.82	100	104	80-120	4	30
t-Butyl alcohol	N.D.	200	157.68	200	168.73	79	84	60-130	7	30
Ethyl t-butyl ether	0.268	20	17.82	20	18.5	88	91	68-121	4	30
Ethylbenzene	N.D.	20	17.73	20	17.83	89	89	80-120	1	30
di-Isopropyl ether	N.D.	20	17.97	20	18.78	90	94	70-124	4	30
Methyl Tertiary Butyl Ether	11.54	20	29.85	20	30.44	92	94	69-122	2	30
Toluene	N.D.	20	18.3	20	19.51	92	98	80-120	6	30
Xylene (Total)	N.D.	60	53.43	60	56.32	89	94	80-120	5	30

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: Z191191AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1040455	100	99	100	96
1040456	106	101	102	94

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 05/01/2019 08:47

Group Number: 2040176

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: Z191191AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1040458	106	104	104	90
Blank	105	102	99	94
LCS	102	104	100	96
MS	104	105	98	94
MSD	102	103	99	97
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191140001A

	Propene
1040455	61
1040456	84
1040457	88
Blank	101
LCS	103
LCSD	102
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Group Number(s):

2040176

Client: Kleinfelder

Delivery and Receipt Information

Delivery Method: ELLE Courier Arrival Timestamp: 04/22/2019 17:00
 Number of Packages: 1 Number of Projects: 3
 State/Province of Origin: MD

Arrival Condition Summary

Shipping Container Sealed:	No	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace ≥ 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCl
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	Yes		

Unpacked by Cory Jeremiah (10469) at 19:45 on 04/22/2019

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp)* All Temperatures in °C.

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Corrected Temp</u>	<u>Therm. Type</u>	<u>Ice Type</u>	<u>Ice Present?</u>	<u>Ice Container</u>	<u>Elevated Temp?</u>
2	DT146	5.0	DT	Wet	Y	Bagged	N

Container Quantity Discrepancy Details

<u>Sample ID on COC</u>	<u>Container Qty. Received</u>	<u>Container Qty. on COC</u>	<u>Comments</u>
MW-181C	8	5	

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

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Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value \geq the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ExxonMobil c/o Kleinfelder
550 West C Street
Suite 1200
San Diego CA 92101

Report Date: April 30, 2019 17:45

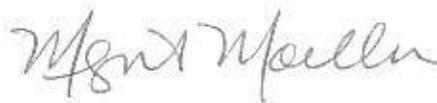
Project: 2-8077 - Phoenix, MD (GW)

Account #: 13459
Group Number: 2040385
PO Number: 51141-335196
Release Number: CHILLEMI
State of Sample Origin: MD

Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD
Electronic Copy To Kleinfelder, MD

Attn: Jennifer Kozak
Attn: Mark Schaaf
Attn: Stacey Schiding
Attn: Charlie Brehm
Attn: Charlie Low
Attn: Brendan Haffey

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

(717) 556-7261

To view our laboratory's current scopes of accreditation please go to <https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/> . Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection Date/Time</u>	<u>ELLE#</u>
MW-56B Groundwater	04/23/2019 10:40	1041254
MW-56A Groundwater	04/23/2019 11:55	1041255
TB19107 Water	04/19/2019	1041256

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Sample Description: MW-56B Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1041254
ELLE Group #: 2040385
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/23/2019 17:22
Collection Date/Time: 04/23/2019 10:40

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified	ug/l	ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	92,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	5.9	0.50	0.25	5
00228	Sulfate	14808-79-8	23.9	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	191160008A	04/26/2019 09:49	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191150001A	04/25/2019 13:53	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19114987209A	04/24/2019 20:06	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19114987209A	04/24/2019 20:06	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-56A Groundwater
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1041255
ELLE Group #: 2040385
Matrix: Groundwater

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/23/2019 17:22
Collection Date/Time: 04/23/2019 11:55

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC Miscellaneous		RSKSOP-175 modified		ug/l	ug/l	
08097	CO2 by Headspace	124-38-9	110,000	12,000	2,600	1
07105	Methane	74-82-8	N.D.	5.0	3.0	1
Wet Chemistry		EPA 300.0		mg/l	mg/l	
00368	Nitrate Nitrogen	14797-55-8	11.4	0.50	0.25	5
00228	Sulfate	14808-79-8	27.1	5.0	1.5	5

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
08097	CO2 by Headspace	RSKSOP-175 modified	1	191160008A	04/26/2019 09:57	Johanna C Kennedy	1
07105	Volatile Headspace Hydrocarbon	RSKSOP-175 modified	1	191150002A	04/25/2019 14:27	Johanna C Kennedy	1
00368	Nitrate Nitrogen	EPA 300.0	1	19114987209A	04/24/2019 20:59	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	19114987209A	04/24/2019 20:59	Clinton M Wilson	5

*=This limit was used in the evaluation of the final result

Sample Description: TB19107 Water
S2010L4236 2-8077 - Phoenix, MD

ExxonMobil c/o Kleinfelder
ELLE Sample #: GW 1041256
ELLE Group #: 2040385
Matrix: Water

Project Name: 2-8077 - Phoenix, MD (GW)

Submittal Date/Time: 04/23/2019 17:22
Collection Date/Time: 04/19/2019

CAT No.	Analysis Name	CAS Number	Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS Volatiles		SW-846 8260B	ug/l	ug/l	ug/l	
10945	t-Amyl methyl ether	994-05-8	N.D.	1	0.3	1
10945	Benzene	71-43-2	N.D.	1	0.2	1
10945	t-Butyl alcohol	75-65-0	N.D.	25	10	1
10945	Ethyl t-butyl ether	637-92-3	N.D.	1	0.2	1
10945	Ethylbenzene	100-41-4	N.D.	1	0.2	1
10945	di-Isopropyl ether	108-20-3	N.D.	1	0.2	1
10945	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	1	0.2	1
10945	Toluene	108-88-3	N.D.	1	0.2	1
10945	Xylene (Total)	1330-20-7	N.D.	5	0.5	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10945	8260 BTEX + 5 Oxys	SW-846 8260B	1	Z191192AA	04/29/2019 19:26	Hu Yang	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z191192AA	04/29/2019 19:25	Hu Yang	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/30/2019 17:45

Group Number: 2040385

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result ug/l	LOQ** ug/l	MDL ug/l
Batch number: Z191192AA	Sample number(s): 1041256		
t-Amyl methyl ether	N.D.	1	0.3
Benzene	N.D.	1	0.2
t-Butyl alcohol	N.D.	25	10
Ethyl t-butyl ether	N.D.	1	0.2
Ethylbenzene	N.D.	1	0.2
di-Isopropyl ether	N.D.	1	0.2
Methyl Tertiary Butyl Ether	N.D.	1	0.2
Toluene	N.D.	1	0.2
Xylene (Total)	N.D.	5	0.5
Batch number: 191150001A	Sample number(s): 1041254		
Methane	N.D.	5.0	3.0
Batch number: 191150002A	Sample number(s): 1041255		
Methane	N.D.	5.0	3.0
Batch number: 191160008A	Sample number(s): 1041254-1041255		
CO2 by Headspace	N.D.	12,000	2,600
	mg/l	mg/l	mg/l
Batch number: 19114987209A	Sample number(s): 1041254-1041255		
Nitrate Nitrogen	N.D.	0.10	0.050
Sulfate	N.D.	1.0	0.30

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: Z191192AA	Sample number(s): 1041256								
t-Amyl methyl ether	20	16.97			85		66-120		
Benzene	20	19.98			100		80-120		
t-Butyl alcohol	200	181.24			91		60-130		
Ethyl t-butyl ether	20	19.51			98		68-121		
Ethylbenzene	20	17.69			88		80-120		
di-Isopropyl ether	20	19.72			99		70-124		
Methyl Tertiary Butyl Ether	20	20.31			102		69-122		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/30/2019 17:45

Group Number: 2040385

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Toluene	20	19.08			95		80-120		
Xylene (Total)	60	60.82			101		80-120		
	ug/l	ug/l	ug/l	ug/l					
Batch number: 191150001A	Sample number(s): 1041254								
Methane	59.83	60.94			102		85-115		
Batch number: 191150002A	Sample number(s): 1041255								
Methane	59.83	65.2			109		85-115		
Batch number: 191160008A	Sample number(s): 1041254-1041255								
CO2 by Headspace	35820	32224.71	35820	31755.53	90	89	85-120	1	20
	mg/l	mg/l	mg/l	mg/l					
Batch number: 19114987209A	Sample number(s): 1041254-1041255								
Nitrate Nitrogen	0.750	0.716	0.750	0.710	95	95	90-110	1	20
Sulfate	7.50	7.44	7.50	7.35	99	98	90-110	1	20

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 19114987209A	Sample number(s): 1041254-1041255 UNSPK: 1041254									
Nitrate Nitrogen	5.85	2.50	9.02			127*		90-110		
Sulfate	23.89	25	53.56			119*		90-110		

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 19114987209A	Sample number(s): 1041254-1041255 BKG: 1041254			
Nitrate Nitrogen	5.85	6.03	3	15
Sulfate	23.89	24.67	3 (1)	15

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: ExxonMobil c/o Kleinfelder
Reported: 04/30/2019 17:45

Group Number: 2040385

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: 8260 BTEX + 5 Oxys
Batch number: Z191192AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
1041256	106	105	99	86
Blank	104	100	99	92
LCS	107	102	98	97
Limits:	80-120	80-120	80-120	80-120

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191150001A

	Propene
1041254	90
Blank	103
LCS	102
Limits:	46-135

Analysis Name: Volatile Headspace Hydrocarbon
Batch number: 191150002A

	Propene
1041255	99
Blank	102
LCS	97
Limits:	46-135

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



Client: Kleinfelder

Delivery and Receipt Information

Delivery Method: ELLE Courier Arrival Timestamp: 04/23/2019 17:22
 Number of Packages: 1 Number of Projects: 1
 State/Province of Origin: MD

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace \geq 6mm:	No
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	2
Samples Intact:	Yes	Trip Blank Type:	HCI
Missing Samples:	No	Air Quality Samples Present:	No
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Melvin Sanchez (8943) at 17:53 on 04/23/2019

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* All Temperatures in °C.

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Corrected Temp</u>	<u>Therm. Type</u>	<u>Ice Type</u>	<u>Ice Present?</u>	<u>Ice Container</u>	<u>Elevated Temp?</u>	<u>Samples Collected Same Day as Receipt?</u>
1	DT131	8.9	DT	Wet	Y	Loose	Y	Y

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

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Data Qualifiers

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P^	Concentration difference between the primary and confirmation column $> 40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods. Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.



APPENDIX B

Laboratory Analytical Reports - Microbial

SITE LOGIC Report

QuantArray[®]-Petro Study

Contact: Stacey Schiding

Phone: 410-850-0404

Address: Kleinfelder
1745 Dorsey Road
Suite J
Hanover, MD 21076

Email: sschiding@kleinfelder.com

MI Identifier: 039QD

Report Date: 04/16/2019

Project: EM28077 Phoenix, 20183146
Comments:

NOTICE: This report is intended only for the addressee shown above and may contain confidential or privileged information. If the recipient of this material is not the intended recipient or if you have received this in error, please notify Microbial Insights, Inc. immediately. The data and other information in this report represent only the sample(s) analyzed and are rendered upon condition that it is not to be reproduced without approval from Microbial Insights, Inc. Thank you for your cooperation.

The QuantArray[®]-Petro Approach

Comprehensive evaluation of biodegradation potential at petroleum impacted sites is inherently problematic due to two factors:

- (1) Petroleum products are complex mixtures of hundreds of aliphatic, aromatic, cyclic, and heterocyclic compounds.
- (2) Even for common classes of contaminants like benzene, toluene, ethylbenzene, and xylenes (BTEX), biodegradation can proceed by a multitude of pathways.

The QuantArray[®]-Petro has been designed to address both of these issues by providing the simultaneous quantification of the specific functional genes responsible for both aerobic and anaerobic biodegradation of BTEX, PAHs, and a variety of short and long chain alkanes.

Thus, when combined with chemical and geochemical groundwater monitoring programs, the QuantArray[®]-Petro allows site managers to simultaneously yet economically evaluate the potential for biodegradation of a spectrum of petroleum hydrocarbons through a multitude of aerobic and anaerobic pathways to give a much clearer and comprehensive view of contaminant biodegradation.

The QuantArray[®]-Petro is used to quantify specific microorganisms and functional genes to evaluate aerobic and anaerobic biodegradation of the following classes of compounds present in petroleum products:

BTEX and MTBE

Toluene dioxygenase (TOD) and monooxygenase (RMO, RDEG, PHE, TOL) genes for aerobic BTEX biodegradation

Includes MTBE utilizing strain *Methylibium petroleiphilum* PM1 and TBA monooxygenase

Benzylsuccinate synthase (BSS) for anaerobic biodegradation of toluene, ethylbenzene, and xylenes

Benzene carboxylase (ABC) for anaerobic benzene biodegradation]

Naphthalene and PAHs

Includes two groups of naphthalene dioxygenase genes (NAH, PHN) for aerobic biodegradation

Naphthylmethylsuccinate synthase (MNSSA) for anaerobic biodegradation of methyl-naphthalenes

Naphthalene carboxylase (ANC) initiates the only known pathway for anaerobic naphthalene biodegradation

Alkanes/TPH

The *n*-alkanes are a substantial portion of petroleum products

The QuantArray[®]-Petro includes quantification of alkane monooxygenase genes (ALK and ALMA)

Also includes quantification of alkylsuccinate synthase (assA) genes to evaluate anaerobic biodegradation of alkanes

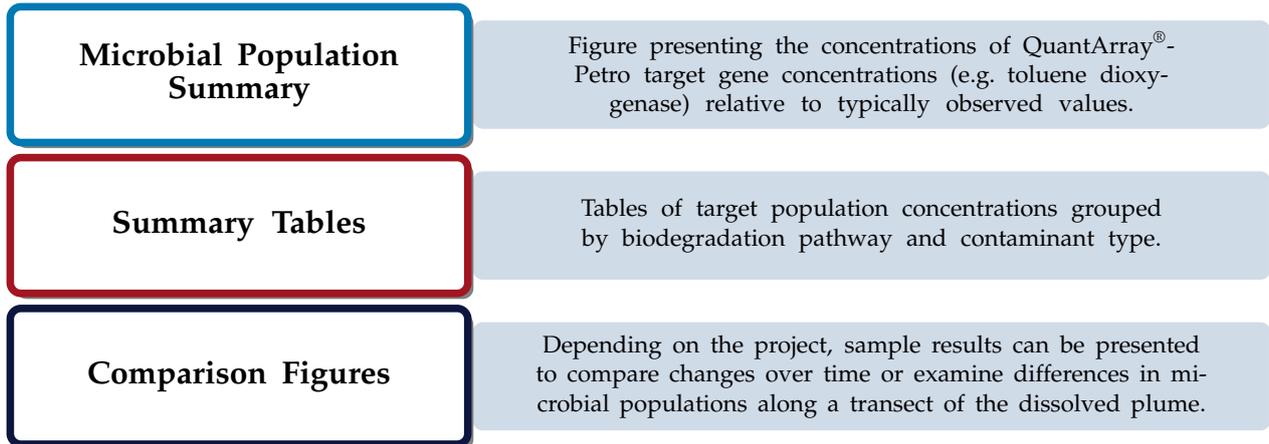
How do QuantArrays[®] work?

The QuantArray[®]-Petro in many respects is a hybrid technology combining the highly parallel detection of microarrays with the accurate and precise quantification provided by qPCR into a single platform. The key to highly parallel qPCR reactions is the nanoliter fluidics platform for low volume, solution phase qPCR reactions.

How are QuantArray® results reported?

One of the primary advantages of the QuantArray®-Petro is the simultaneous quantification of a broad spectrum of different microorganisms and key functional genes involved in a variety of pathways for hydrocarbon biodegradation. However, highly parallel quantification combined with various metabolic and cometabolic capabilities of different target organisms can complicate data presentation. Therefore, in addition to Summary Tables, QuantArray®-Petro results will be presented as Microbial Population Summary and Comparison Figures to aid in the data interpretation and subsequent evaluation of site management activities.

Types of Tables and Figures:



Results

Table 1: Summary of the QuantArray®-Petro results obtained for samples MW-54B [R], MW-138D, MW-187A [R], MW-187B [R], and MW-187C.

Sample Name	MW-54B [R]	MW-138D	MW-187A [R]	MW-187B [R]	MW-187C
Sample Date	04/11/2019	04/11/2019	04/11/2019	04/11/2019	04/11/2019
<i>Aerobic BTEX and MTBE</i>	cells/mL	cells/mL	cells/mL	cells/mL	cells/mL
Toluene/Benzene Dioxygenase (TOD)	2.60E+00 (J)	1.75E+01	4.83E+01	<5.80E+00	<5.10E+00
Phenol Hydroxylase (PHE)	1.13E+04	1.16E+04	2.65E+04	8.54E+03	5.82E+03
Toluene 2 Monooxygenase/Phenol Hydroxylase (RDEG)	3.74E+04	1.48E+04	1.34E+04	3.29E+04	5.14E+03
Toluene Ring Hydroxylating Monooxygenases (RMO)	5.73E+04	1.20E+05	1.55E+05	4.88E+03	3.88E+03
Xylene/Toluene Monooxygenase (TOL)	<4.60E+00	6.00E-01 (J)	4.59E+01	<5.80E+00	<5.10E+00
Ethylbenzene/Isopropylbenzene Dioxygenase (EDO)	<4.60E+00	<4.60E+00	8.65E+03	1.54E+01	<5.10E+00
Biphenyl/Isopropylbenzene Dioxygenase (BPH4)	<4.60E+00	<4.60E+00	<9.60E+00	5.35E+02	<5.10E+00
<i>Methylibium petroleiphilum</i> PM1 (PM1)	9.94E+04	2.56E+05	1.21E+05	5.61E+04	4.40E+04
TBA Monooxygenase (TBA)	3.41E+04	3.36E+02	4.63E+01	4.94E+02	1.06E+03
<i>Aerobic PAHs and Alkanes</i>					
Naphthalene Dioxygenase (NAH)	<4.60E+00	<4.60E+00	1.16E+02	<5.80E+00	<5.10E+00
Naphthalene-inducible Dioxygenase (NidA)	1.43E+01	<4.60E+00	<9.60E+00	5.58E+02	<5.10E+00
Phenanthrene Dioxygenase (PHN)	5.00E-01 (J)	5.00E-01 (J)	1.37E+01	3.70E+01	<5.10E+00
Alkane Monooxygenase (ALK)	2.43E+03	1.71E+01	5.00E-01 (J)	1.82E+02	<5.10E+00
Alkane Monooxygenase (ALMA)	<4.60E+00	<4.60E+00	<9.60E+00	<5.80E+00	<5.10E+00
<i>Anaerobic BTEX</i>					
Benzoyl Coenzyme A Reductase (BCR)	1.68E+03	4.77E+03	5.95E+02	3.34E+03	2.20E+02
Benzylsuccinate Synthase (BSS)	1.27E+02	1.93E+02	1.81E+02	1.55E+03	<5.10E+00
Benzene Carboxylase (ABC)	<4.60E+00	3.80E+00 (J)	<9.60E+00	5.27E+01	<5.10E+00
<i>Anaerobic PAHs and Alkanes</i>					
Naphthylmethylsuccinate Synthase (MNSSA)	<4.60E+00	<4.60E+00	<9.60E+00	<5.80E+00	<5.10E+00
Naphthalene Carboxylase (ANC)	<4.60E+00	<4.60E+00	<9.60E+00	<5.80E+00	<5.10E+00
Alkylsuccinate Synthase (ASSA)	<4.60E+00	<4.60E+00	2.61E+01	4.74E+01	<5.10E+00
<i>Other</i>					
Total Eubacteria (EBAC)	2.74E+06	2.53E+07	7.07E+06	4.35E+05	1.08E+05
Sulfate Reducing Bacteria (APS)	1.85E+04	1.26E+05	6.36E+02	7.82E+03	4.57E+03

Legend:

NA = Not Analyzed
I = Inhibited

NS = Not Sampled
< = Result Not Detected

J = Estimated Gene Copies Below PQL but Above LQL

Microbial Populations MW-54B [R]

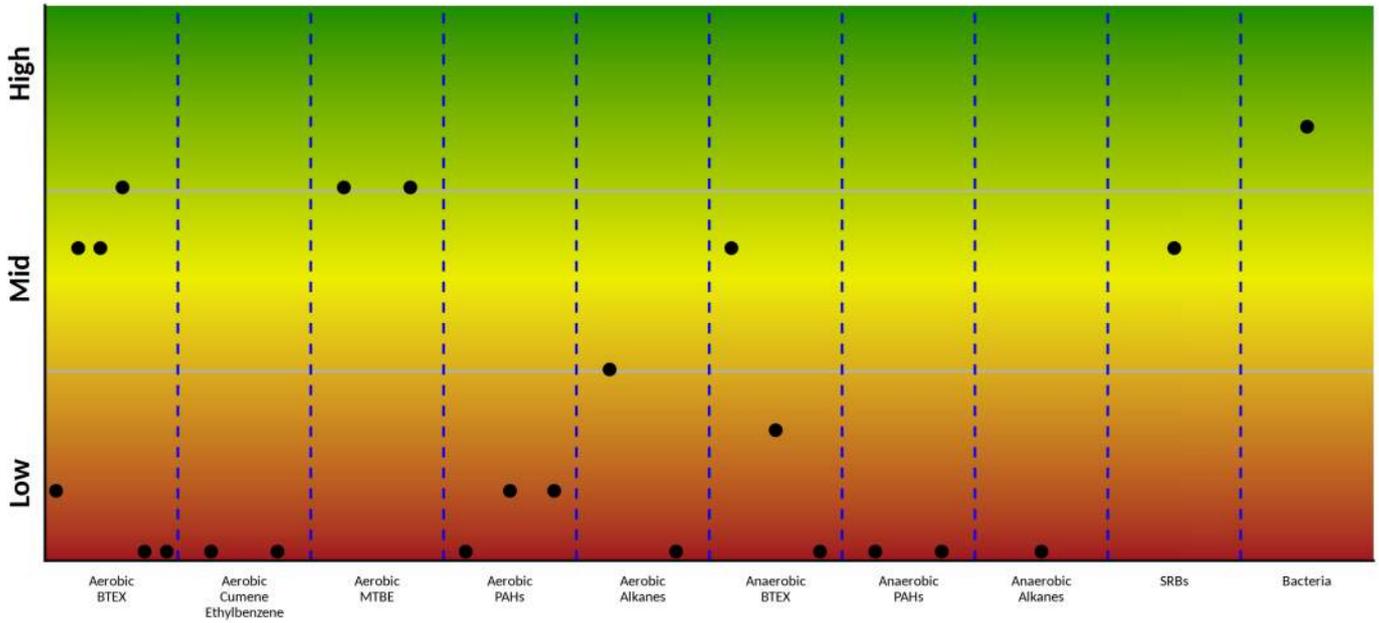


Figure 1: Microbial population summary to aid in evaluating potential pathways and biodegradation of specific contaminants.

Aerobic		Anaerobic	
BTEX	TOD, PHE, RDEG, RMO, TOL, EDO	BTEX	BCR, BSS, ABC
Cumene, Ethylbenzene	EDO, BPH4	Naphthalene/Methylnaphthalene	MNSSA, ANC
MTBE/TBA	PM1, TBA	Alkanes	assA
Naphthalene	NAH, NidA		
Phenanthrene	PHN		
Alkanes	ALK, ALMA		

Microbial Populations MW-138D

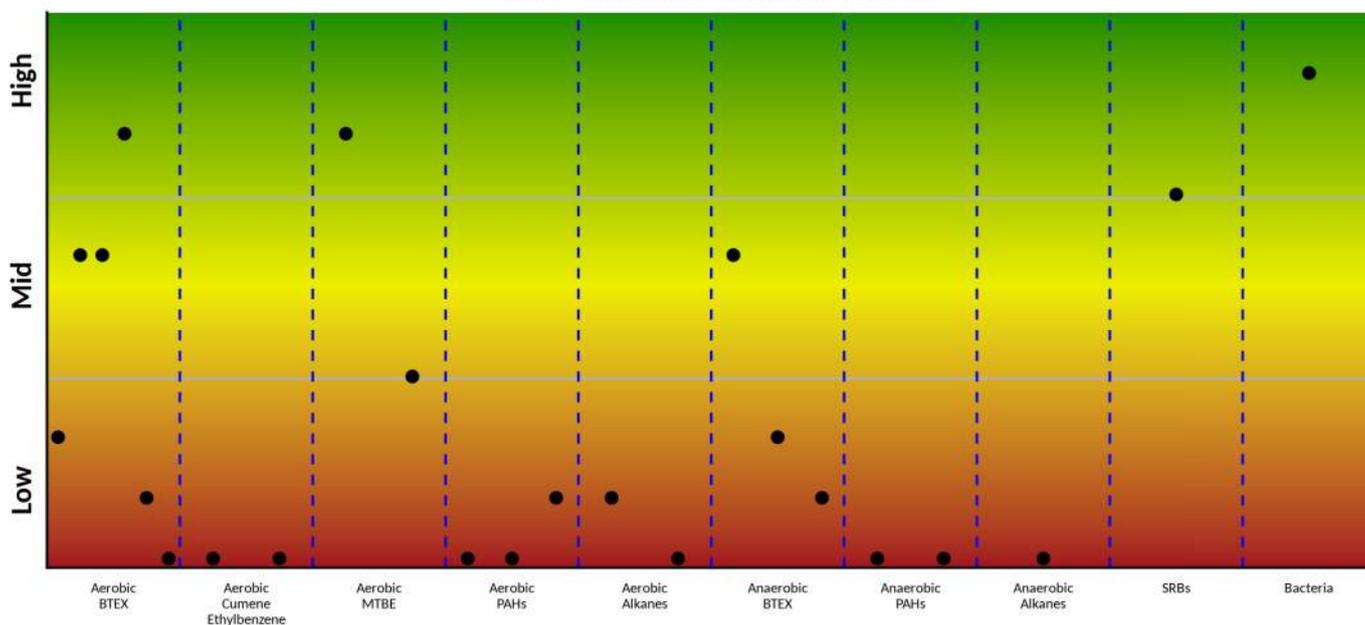


Figure 2: Microbial population summary to aid in evaluating potential pathways and biodegradation of specific contaminants.

Aerobic		Anaerobic	
BTEX	TOD, PHE, RDEG, RMO, TOL, EDO	BTEX	BCR, BSS, ABC
Cumene, Ethylbenzene	EDO, BPH4	Naphthalene/Methylnaphthalene	MNSSA, ANC
MTBE/TBA	PM1, TBA	Alkanes	assA
Naphthalene	NAH, NidA		
Phenanthrene	PHN		
Alkanes	ALK, ALMA		

Microbial Populations MW-187A [R]

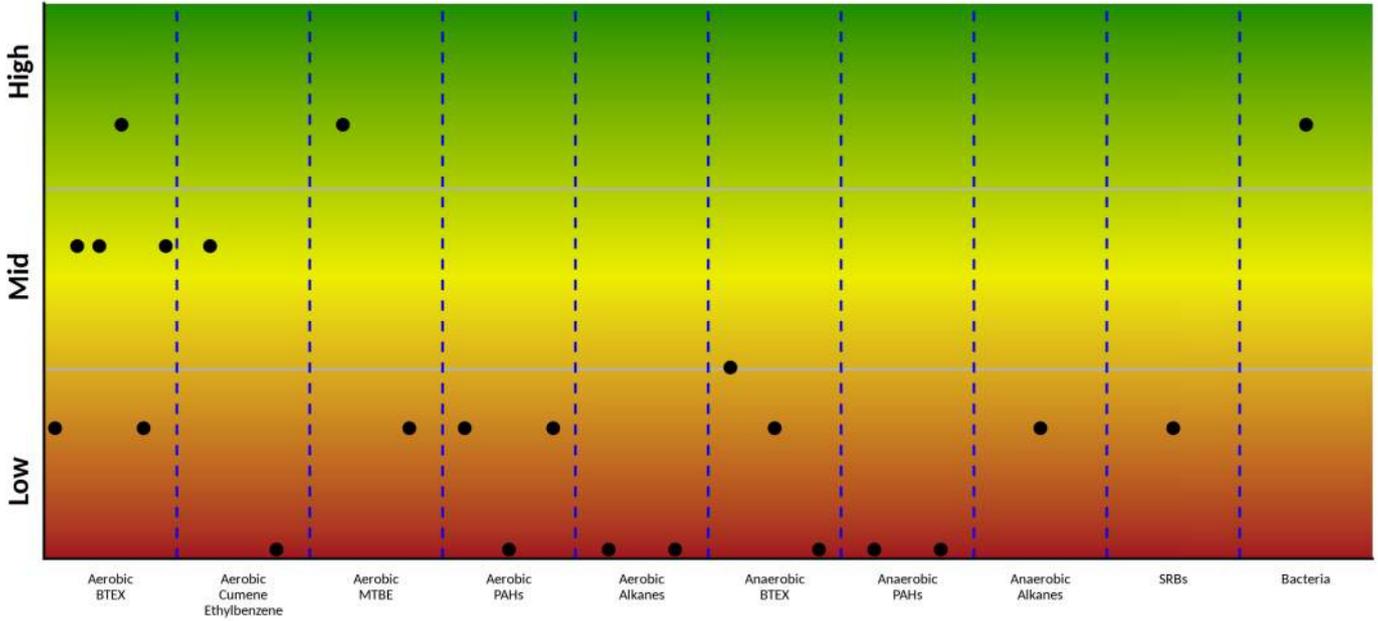


Figure 3: Microbial population summary to aid in evaluating potential pathways and biodegradation of specific contaminants.

Aerobic		Anaerobic	
BTEX	TOD, PHE, RDEG, RMO, TOL, EDO	BTEX	BCR, BSS, ABC
Cumene, Ethylbenzene	EDO, BPH4	Naphthalene/Methylnaphthalene	MNSSA, ANC
MTBE/TBA	PM1, TBA	Alkanes	assA
Naphthalene	NAH, NidA		
Phenanthrene	PHN		
Alkanes	ALK, ALMA		

Microbial Populations MW-187B [R]

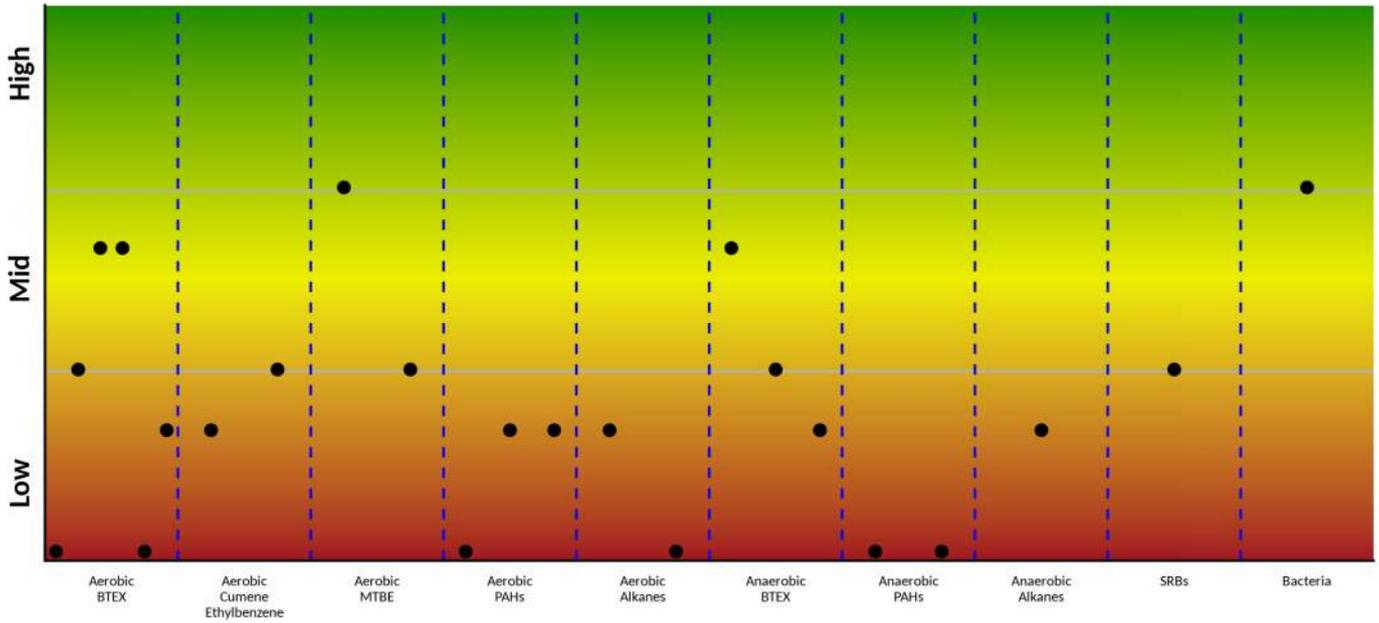


Figure 4: Microbial population summary to aid in evaluating potential pathways and biodegradation of specific contaminants.

Aerobic		Anaerobic
BTEX	TOD, PHE, RDEG, RMO, TOL, EDO	BTEX
Cumene, Ethylbenzene	EDO, BPH4	Naphthalene/Methylnaphthalene
MTBE/TBA	PM1, TBA	Alkanes
Naphthalene	NAH, NidA	BCR, BSS, ABC
Phenanthrene	PHN	MNSSA, ANC
Alkanes	ALK, ALMA	assA

Microbial Populations MW-187C

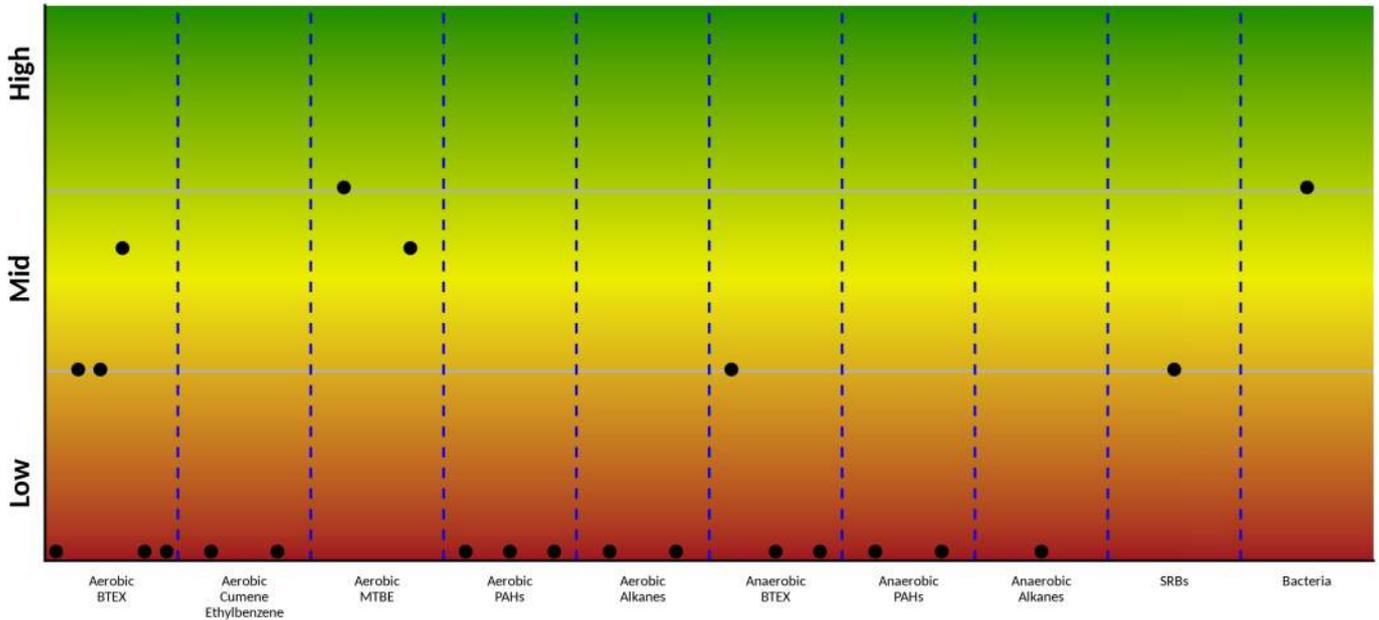


Figure 5: Microbial population summary to aid in evaluating potential pathways and biodegradation of specific contaminants.

Aerobic		Anaerobic	
BTEX	TOD, PHE, RDEG, RMO, TOL, EDO	BTEX	BCR, BSS, ABC
Cumene, Ethylbenzene	EDO, BPH4	Naphthalene/Methylnaphthalene	MNSSA, ANC
MTBE/TBA	PM1, TBA	Alkanes	assA
Naphthalene	NAH, NidA		
Phenanthrene	PHN		
Alkanes	ALK, ALMA		

Table 2: Summary of the QuantArray®-Petro results for microorganisms responsible for aerobic biodegradation of BTEX and MTBE for samples MW-54B [R], MW-138D, MW-187A [R], MW-187B [R], and MW-187C.

Sample Name	MW-54B [R]	MW-138D	MW-187A [R]	MW-187B [R]	MW-187C
Sample Date	04/11/2019	04/11/2019	04/11/2019	04/11/2019	04/11/2019
<i>Aerobic BTEX and MTBE</i>	cells/mL	cells/mL	cells/mL	cells/mL	cells/mL
Toluene/Benzene Dioxygenase (TOD)	2.60E+00 (J)	1.75E+01	4.83E+01	<5.80E+00	<5.10E+00
Phenol Hydroxylase (PHE)	1.13E+04	1.16E+04	2.65E+04	8.54E+03	5.82E+03
Toluene 2 Monooxygenase/Phenol Hydroxylase (RDEG)	3.74E+04	1.48E+04	1.34E+04	3.29E+04	5.14E+03
Toluene Ring Hydroxylating Monooxygenases (RMO)	5.73E+04	1.20E+05	1.55E+05	4.88E+03	3.88E+03
Xylene/Toluene Monooxygenase (TOL)	<4.60E+00	6.00E-01 (J)	4.59E+01	<5.80E+00	<5.10E+00
Ethylbenzene/Isopropylbenzene Dioxygenase (EDO)	<4.60E+00	<4.60E+00	8.65E+03	1.54E+01	<5.10E+00
Biphenyl/Isopropylbenzene Dioxygenase (BPH4)	<4.60E+00	<4.60E+00	<9.60E+00	5.35E+02	<5.10E+00
<i>Methylibium petroleiphilum</i> PM1 (PM1)	9.94E+04	2.56E+05	1.21E+05	5.61E+04	4.40E+04
TBA Monooxygenase (TBA)	3.41E+04	3.36E+02	4.63E+01	4.94E+02	1.06E+03

Microbial Populations - Aerobic BTEX and MTBE

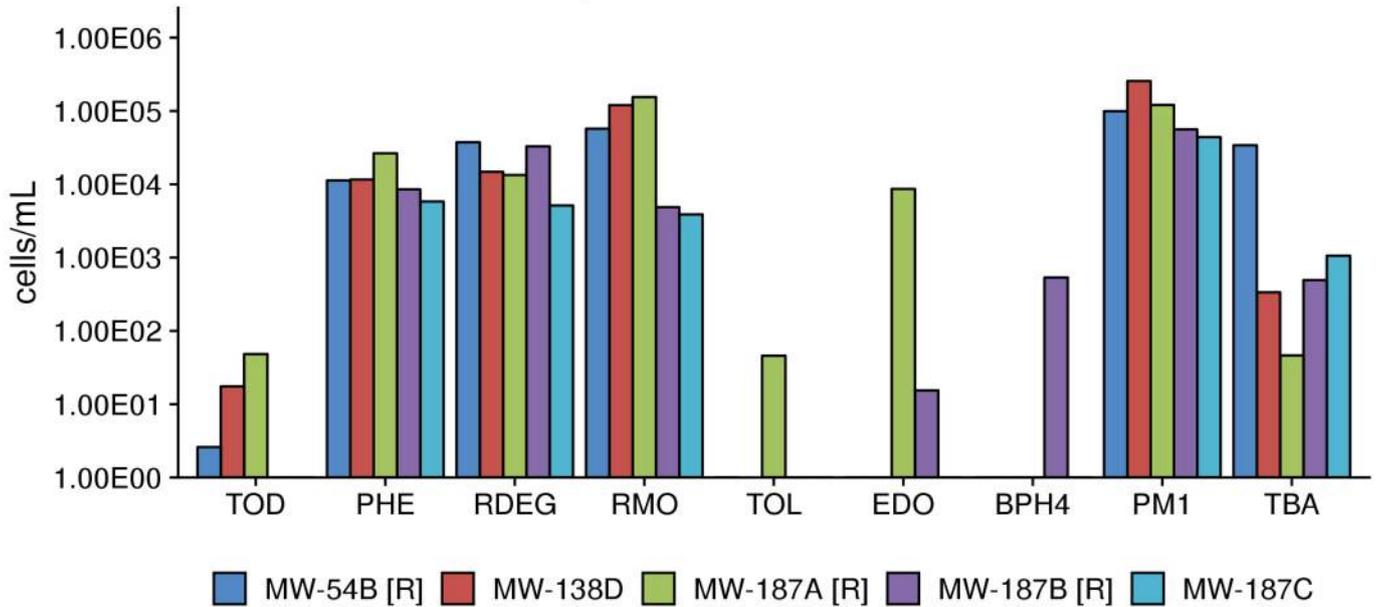


Figure 6: Comparison - microbial populations involved in aerobic biodegradation of BTEX and MTBE.

Table 3: Summary of the QuantArray®-Petro results for microorganisms responsible for aerobic biodegradation of PAHs and alkanes for samples MW-54B [R], MW-138D, MW-187A [R], MW-187B [R], and MW-187C.

Sample Name	MW-54B [R]	MW-138D	MW-187A [R]	MW-187B [R]	MW-187C
Sample Date	04/11/2019	04/11/2019	04/11/2019	04/11/2019	04/11/2019
<i>Aerobic PAHs and Alkanes</i>	cells/mL	cells/mL	cells/mL	cells/mL	cells/mL
Naphthalene Dioxygenase (NAH)	<4.60E+00	<4.60E+00	1.16E+02	<5.80E+00	<5.10E+00
Naphthalene-inducible Dioxygenase (NidA)	1.43E+01	<4.60E+00	<9.60E+00	5.58E+02	<5.10E+00
Phenanthrene Dioxygenase (PHN)	5.00E-01 (J)	5.00E-01 (J)	1.37E+01	3.70E+01	<5.10E+00
Alkane Monooxygenase (ALK)	2.43E+03	1.71E+01	5.00E-01 (J)	1.82E+02	<5.10E+00
Alkane Monooxygenase (ALMA)	<4.60E+00	<4.60E+00	<9.60E+00	<5.80E+00	<5.10E+00

Microbial Populations - Aerobic PAHs and Alkanes

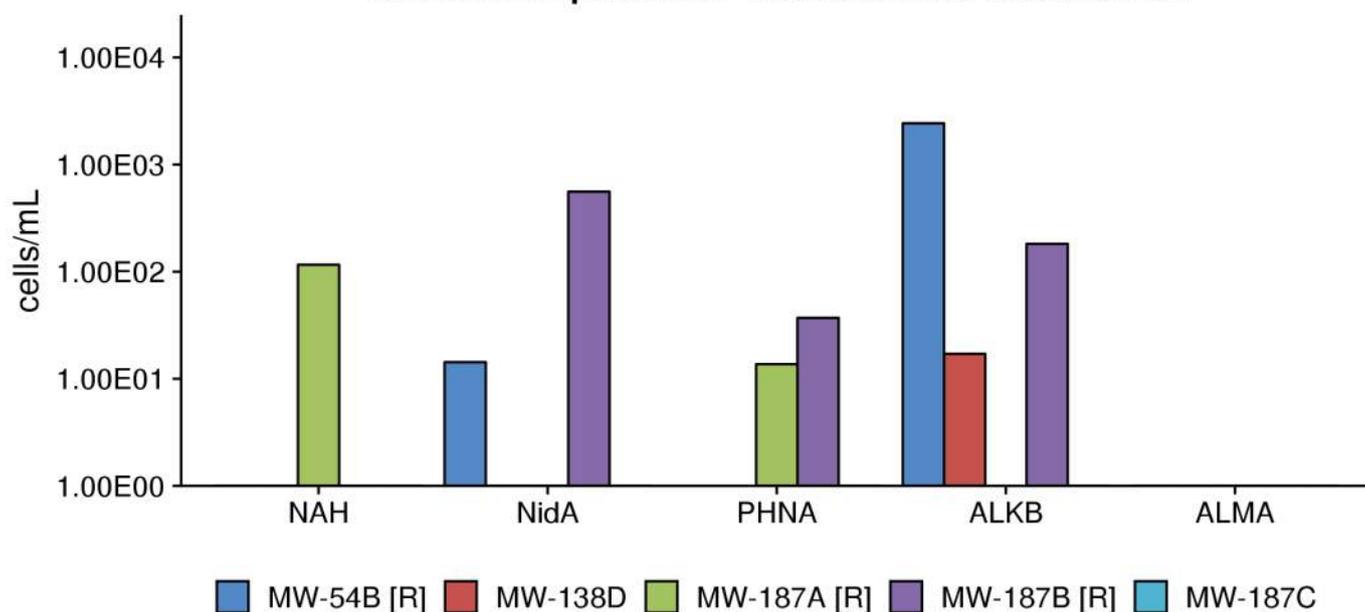


Figure 7: Comparison - microbial populations involved in aerobic biodegradation of PAHs and alkanes.

Table 4: Summary of the QuantArray®-Petro results for microorganisms responsible for anaerobic biodegradation of BTEX, PAHs and alkanes for samples MW-54B [R], MW-138D, MW-187A [R], MW-187B [R], and MW-187C.

Sample Name	MW-54B [R]	MW-138D	MW-187A [R]	MW-187B [R]	MW-187C
Sample Date	04/11/2019	04/11/2019	04/11/2019	04/11/2019	04/11/2019
<i>Anaerobic BTEX</i>	cells/mL	cells/mL	cells/mL	cells/mL	cells/mL
Benzoyl Coenzyme A Reductase (BCR)	1.68E+03	4.77E+03	5.95E+02	3.34E+03	2.20E+02
Benzylsuccinate Synthase (BSS)	1.27E+02	1.93E+02	1.81E+02	1.55E+03	<5.10E+00
Benzene Carboxylase (ABC)	<4.60E+00	3.80E+00 (J)	<9.60E+00	5.27E+01	<5.10E+00
<i>Anaerobic PAHs and Alkanes</i>					
Naphthylmethylsuccinate Synthase (MNSSA)	<4.60E+00	<4.60E+00	<9.60E+00	<5.80E+00	<5.10E+00
Naphthalene Carboxylase (ANC)	<4.60E+00	<4.60E+00	<9.60E+00	<5.80E+00	<5.10E+00
Alkylsuccinate Synthase (ASS)	<4.60E+00	<4.60E+00	2.61E+01	4.74E+01	<5.10E+00

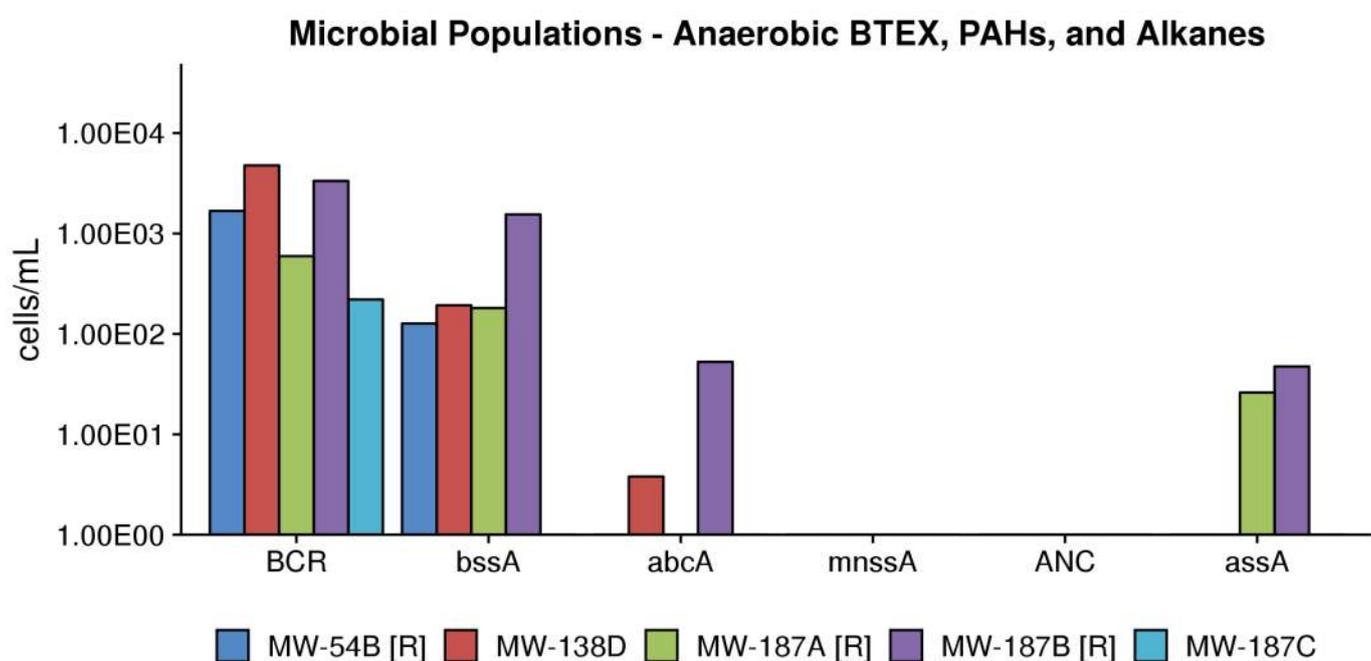


Figure 8: Comparison - microbial populations involved in anaerobic biodegradation of BTEX, PAHs and alkanes.

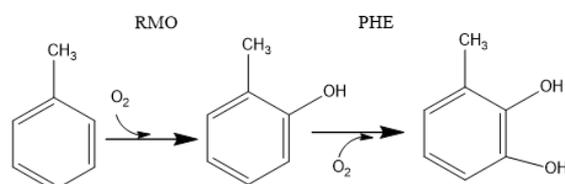
Interpretation

The overall purpose of the QuantArray[®]-Petro is to give site managers the ability to simultaneously yet economically evaluate the potential for biodegradation of a spectrum of contaminants found in petroleum products through a multitude of aerobic and anaerobic pathways to give a much more clear and comprehensive view of contaminant biodegradation. The following discussion describes interpretation of results in general terms and is meant to serve as a guide.

Aerobic Biodegradation - Benzene Toluene, Ethylbenzene, and Xylenes (BTEX): At sites impacted by petroleum products, aromatic hydrocarbons including BTEX are often contaminants of concern. Aerobic biodegradation of aromatic hydrocarbons has been intensively studied and multiple catabolic pathways have been well characterized. The substrate specificity of each pathway (range of compounds biodegraded via each pathway) is largely determined by the specificity of the initial oxygenase enzyme. The QuantArray[®]-Petro includes a suite of assays targeting the initial oxygenase genes of the known pathways for aerobic BTEX biodegradation.

Toluene/Benzene Dioxygenase (TOD): Toluene/benzene dioxygenase (TOD) incorporates both atoms of molecular oxygen into the aromatic ring. Although commonly called toluene dioxygenase, the substrate specificity of this enzyme is relaxed, allowing growth on toluene and benzene along with co-oxidation of a variety of compounds including ethylbenzene, *o*-xylene, *m*-xylene, and trichloroethene (TCE) when expressed.

Toluene/Benzene Monooxygenases (RMO/RDEG) and Phenol Hydroxylases (PHE): The next three known pathways for aerobic biodegradation of toluene (as well as benzene and xylenes) involve two steps: (1) an initial oxidation mediated by a toluene monooxygenase and (2) a second oxidation step catalyzed by a phenol hydroxylase. In these pathways, the toluene monooxygenases have been referred to as “ring hydroxylating monooxygenases” because they initiate biodegradation of toluene by incorporating oxygen directly into the aromatic ring rather than at a methyl group. The ring hydroxylating monooxygenases (RMOs) can be further described as toluene-2-monooxygenases, toluene-3-monooxygenases, or toluene-4-monooxygenases based upon where they attack the aromatic ring.



In General, phenol hydroxylases (PHE) catalyze the continued oxidation of phenols produced by RMOs. However, the difference between toluene monooxygenases (RMOs) and phenol hydroxylases (PHEs) is not absolute in terms of substrate specificity and catabolic function. For example, the TbmD toluene/benzene-2-monooxygenase [1] may be responsible for both the initial and second oxidation step [2].

The RMO, RDEG, and PHE assays target groups of genes encoding enzymes which perform the critical first and/or second steps in the aerobic biodegradation of BTEX compounds. In general terms, the RMO assay quantifies families of toluene-3-monooxygenase and toluene-4-monooxygenase genes. The RDEG assay is used to quantify groups of toluene-2-monooxygenase and phenol hydroxylase genes. Similarly, the PHE assay targets phenol hydroxylase genes and several benzene monooxygenase genes which catalyze both oxidation steps.

Toluene/Xylene Monooxygenase (TOL): The final known pathway for aerobic toluene biodegradation involves initial monooxygenase attack at the methyl group by a toluene/xylene monooxygenase.

Ethylbenzene Dioxygenase (EDO): Similar to TOD, this group of aromatic oxygenases exhibits relatively broad specificity and is responsible for aerobic biodegradation of alkylbenzenes including ethylbenzene and isopropylbenzene or cumene [3].

Biphenyl Dioxygenase (BPH4): In environmental restoration, biphenyl dioxygenases are best known for cometabolism of polychlorinated biphenyls (PCBs). However, this subfamily includes benzene [4] and isopropylbenzene [5] dioxygenases from *Rhodococcus* spp.

Aerobic Biodegradation - MTBE and TBA: With increased use in the 1990s, the fuel oxygenate methyl *tert*-butyl ether (MTBE) has become one of the most commonly detected groundwater contaminants at gasoline contaminated sites. Pure cultures capable of utilizing MTBE as a growth supporting substrate have been isolated [6] and aerobic biodegradation of MTBE and the intermediate *tert*-butyl alcohol (TBA) has been reasonably well characterized. The QuantArray[®]-Petro includes quantification of two gene targets to assess the potential for aerobic biodegradation of MTBE and TBA.

***Methylibium petroleiphilum* PM1 (PM1):** One of the few organisms isolated to date which is capable of utilizing MTBE and TBA as growth supporting substrates [6].

TBA Monooxygenase (TBA): Targets the TBA monooxygenase gene responsible for oxidation of TBA by *Methylibium petroleiphilum* PM1 [7].

Aerobic Biodegradation - Naphthalene and Other PAHs:

Naphthalene Dioxygenase (NAH): Naphthalene dioxygenase incorporates both atoms of molecular oxygen into naphthalene to initiate aerobic metabolism of the compound. However, the broad substrate specificity of naphthalene dioxygenase has been widely noted. When expressed, naphthalene dioxygenase is capable of catalyzing the oxidation of larger PAHs like anthracene, phenanthrene, acenaphthylene, fluorene, and acenaphthene. For a more comprehensive list of reactions mediated by naphthalene dioxygenases, see the University of Minnesota Biocatalysis/Biodegradation Database. (<http://eawag-bbd.ethz.ch/naph/ndo.html>, [8]).

Phenanthrene Dioxygenases (PHN): The PHN assays quantify phenanthrene/naphthalene dioxygenase genes from a diverse collection of microorganisms including *Pseudomonas*, *Burkholderia*, *Sphingomonas*, and *Acidovorax* spp. As with other naphthalene dioxygenases, substrate specificity is relatively broad and phenanthrene dioxygenases have been implicated in the biodegradation of naphthalene, phenanthrene, and anthracene and the co-oxidation of larger PAHs. Moreover, at least one research group has suggested that the PHN group of phenanthrene/naphthalene dioxygenases may be more environmentally relevant than the classical *nah*-like naphthalene dioxygenase [9].

Aerobic Biodegradation - *n*-alkanes: The *n*-alkanes are a substantial portion of petroleum products and are a component of TPH concentrations. The QuantArray[®]-Petro also includes quantification of alkane monooxygenase genes (ALK) which allow a wide range of *Proteobacteria* and *Actinomycetals* to grow on *n*-alkanes with carbon lengths from C₅ to C₁₆ [10]. The QuantArray[®]-Petro also includes a second type of alkane hydroxylase (*almA*) which catalyzes the aerobic biodegradation of longer chain alkanes (C₂₀-C₃₂) by some *Alcanivorax* spp. considered dominant in marine systems [11].

Anaerobic Biodegradation - Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX): BTEX compounds are also susceptible to biodegradation under anoxic and anaerobic conditions although biodegradation pathways for each compound are not as well characterized as aerobic pathways. The QuantArray[®]-Petro includes sets of assays targeting a number of upper and lower pathway functional genes involved in the anaerobic catabolism of BTEX compounds for better evaluation of anaerobic biodegradation at petroleum contaminated sites.

Benzylsuccinate Synthase (BSS): Of the BTEX compounds, toluene biodegradation under anaerobic conditions is the most extensively studied and best characterized. The first step in this pathway, mediated by benzylsuccinate synthase (*bssA*) is the addition of fumarate onto the toluene methyl group to form benzylsuccinate. While additional pathways are possible, some bacterial isolates capable of anaerobic biodegradation of ethylbenzene and xylenes follow the same metabolic approach where the first step is the addition of fumarate.

Anaerobic Benzene Carboxylase (ABC): Although additional pathways are possible, the only pathway for anaerobic biodegradation of benzene elucidated to date is initiated by a benzene carboxylase enzyme.

Benzoyl Coenzyme A Reductase (BCR): Benzoyl-CoA is the central intermediate in the anaerobic biodegradation of many aromatic hydrocarbons. Benzoyl-CoA Reductase (BCR) is the essential enzyme for reducing the benzene ring structure.

Anaerobic Biodegradation - PAHs: The anaerobic biodegradation of PAHs involves analogous mechanisms to those described for anaerobic biodegradation of BTEX compounds. For example, the anaerobic biodegradation of methyl-substituted PAHs like 2-methylnaphthalene is initiated by fumarate addition to the methyl group while the only characterized pathway for anaerobic naphthalene biodegradation is initiated by a carboxylase.

Naphthylmethylsuccinate Synthase (MNSSA): MNSSA is analogous to the benzylsuccinate synthase described above for anaerobic biodegradation of toluene. Naphthylmethylsuccinate synthase catalyzes the addition of fumarate onto the methyl group of 2-methylnaphthalene [12].

Anaerobic Naphthalene Carboxylase (ANC): To date, the only pathway that has been characterized for anaerobic biodegradation of naphthalene is initiated by a naphthalene carboxylase enzyme [13].

Anaerobic Biodegradation - *n*-alkanes: As mentioned previously, the *n*-alkanes are a substantial portion of petroleum products and should be considered particularly when site cleanup goals include TPH reduction. The addition of fumarate is a common mechanism for activating and initiating biodegradation of a variety of petroleum hydrocarbons under anaerobic conditions including *n*-alkanes. The QuantArray[®]-Petro includes quantification of alkyl succinate synthase genes (*assA*) which have been characterized in nitrate reducing and sulfate reducing isolates utilizing *n*-alkanes from C₆ to at least C₁₈ [14].

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SITE LOGIC Report

QuantArray[®]-Petro Study

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Report Date: 06/13/2019

Project: Exxon Mobil 28077, 20193011
Comments:

The QuantArray[®]-Petro Approach

Comprehensive evaluation of biodegradation potential at petroleum impacted sites is inherently problematic due to two factors:

- (1) Petroleum products are complex mixtures of hundreds of aliphatic, aromatic, cyclic, and heterocyclic compounds.
- (2) Even for common classes of contaminants like benzene, toluene, ethylbenzene, and xylenes (BTEX), biodegradation can proceed by a multitude of pathways.

The QuantArray[®]-Petro has been designed to address both of these issues by providing the simultaneous quantification of the specific functional genes responsible for both aerobic and anaerobic biodegradation of BTEX, PAHs, and a variety of short and long chain alkanes.

Thus, when combined with chemical and geochemical groundwater monitoring programs, the QuantArray[®]-Petro allows site managers to simultaneously yet economically evaluate the potential for biodegradation of a spectrum of petroleum hydrocarbons through a multitude of aerobic and anaerobic pathways to give a much clearer and comprehensive view of contaminant biodegradation.

The QuantArray[®]-Petro is used to quantify specific microorganisms and functional genes to evaluate aerobic and anaerobic biodegradation of the following classes of compounds present in petroleum products:

BTEX and MTBE

Toluene dioxygenase (TOD) and monooxygenase (RMO, RDEG, PHE, TOL) genes for aerobic BTEX biodegradation

Includes MTBE utilizing strain *Methylibium petroleiphilum* PM1 and TBA monooxygenase

Benzylsuccinate synthase (BSS) for anaerobic biodegradation of toluene, ethylbenzene, and xylenes

Benzene carboxylase (ABC) for anaerobic benzene biodegradation]

Naphthalene and PAHs

Includes two groups of naphthalene dioxygenase genes (NAH, PHN) for aerobic biodegradation

Naphthylmethylsuccinate synthase (MNSSA) for anaerobic biodegradation of methyl-naphthalenes

Naphthalene carboxylase (ANC) initiates the only known pathway for anaerobic naphthalene biodegradation

Alkanes/TPH

The *n*-alkanes are a substantial portion of petroleum products

The QuantArray[®]-Petro includes quantification of alkane monooxygenase genes (ALK and ALMA)

Also includes quantification of alkylsuccinate synthase (assA) genes to evaluate anaerobic biodegradation of alkanes

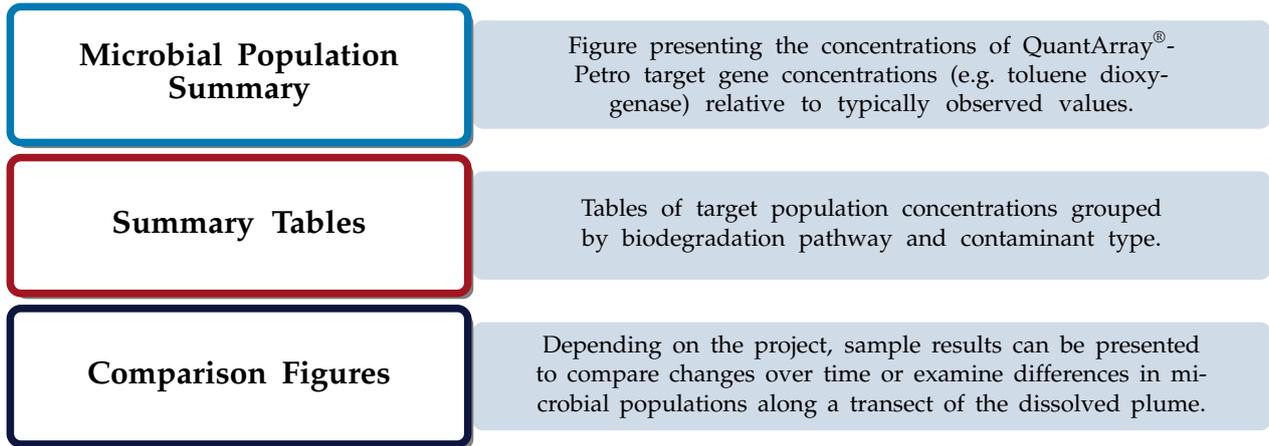
How do QuantArrays[®] work?

The QuantArray[®]-Petro in many respects is a hybrid technology combining the highly parallel detection of microarrays with the accurate and precise quantification provided by qPCR into a single platform. The key to highly parallel qPCR reactions is the nanoliter fluidics platform for low volume, solution phase qPCR reactions.

How are QuantArray® results reported?

One of the primary advantages of the QuantArray®-Petro is the simultaneous quantification of a broad spectrum of different microorganisms and key functional genes involved in a variety of pathways for hydrocarbon biodegradation. However, highly parallel quantification combined with various metabolic and cometabolic capabilities of different target organisms can complicate data presentation. Therefore, in addition to Summary Tables, QuantArray®-Petro results will be presented as Microbial Population Summary and Comparison Figures to aid in the data interpretation and subsequent evaluation of site management activities.

Types of Tables and Figures:



Results

Table 1: Summary of the QuantArray®-Petro results obtained for samples MW-54C, MW-40, MW-189D, and MW-188D.

Sample Name	MW-54C	MW-40	MW-189D	MW-188D
Sample Date	06/07/2019	06/07/2019	06/07/2019	06/07/2019
<i>Aerobic BTEX and MTBE</i>				
	cells/bead	cells/bead	cells/bead	cells/bead
Toluene/Benzene Dioxygenase (TOD)	1.24E+03	<2.50E+02	<2.50E+02	<2.50E+02
Phenol Hydroxylase (PHE)	7.62E+04	8.46E+04	1.21E+03	3.66E+04
Toluene 2 Monooxygenase/Phenol Hydroxylase (RDEG)	1.70E+05	6.34E+04	<2.50E+02	1.75E+04
Toluene Ring Hydroxylating Monooxygenases (RMO)	<2.50E+02	6.76E+04	6.84E+03	5.00E+04
Xylene/Toluene Monooxygenase (TOL)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Ethylbenzene/Isopropylbenzene Dioxygenase (EDO)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Biphenyl/Isopropylbenzene Dioxygenase (BPH4)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
<i>Methylibium petroleiphilum</i> PM1 (PM1)	6.82E+05	4.80E+05	8.59E+04	3.75E+05
TBA Monooxygenase (TBA)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
<i>Aerobic PAHs and Alkanes</i>				
Naphthalene Dioxygenase (NAH)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Naphthalene-inducible Dioxygenase (NidA)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Phenanthrene Dioxygenase (PHN)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Alkane Monooxygenase (ALK)	<2.50E+02	<2.50E+02	<2.50E+02	1.03E+03
Alkane Monooxygenase (ALMA)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
<i>Anaerobic BTEX</i>				
Benzoyl Coenzyme A Reductase (BCR)	2.21E+03	1.94E+04	1.23E+04	1.17E+03
Benzylsuccinate Synthase (BSS)	<2.50E+02	5.80E+01 (J)	<2.50E+02	3.39E+03
Benzene Carboxylase (ABC)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
<i>Anaerobic PAHs and Alkanes</i>				
Naphthylmethylsuccinate Synthase (MNSSA)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Naphthalene Carboxylase (ANC)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Alkylsuccinate Synthase (ASSA)	<2.50E+02	2.95E+02	<2.50E+02	<2.50E+02
<i>Other</i>				
Total Eubacteria (EBAC)	2.15E+07	1.30E+07	4.42E+06	1.29E+07
Sulfate Reducing Bacteria (APS)	5.70E+03	1.09E+05	7.87E+04	8.03E+04

Legend:

NA = Not Analyzed
I = Inhibited

NS = Not Sampled
< = Result Not Detected

J = Estimated Gene Copies Below PQL but Above LQL

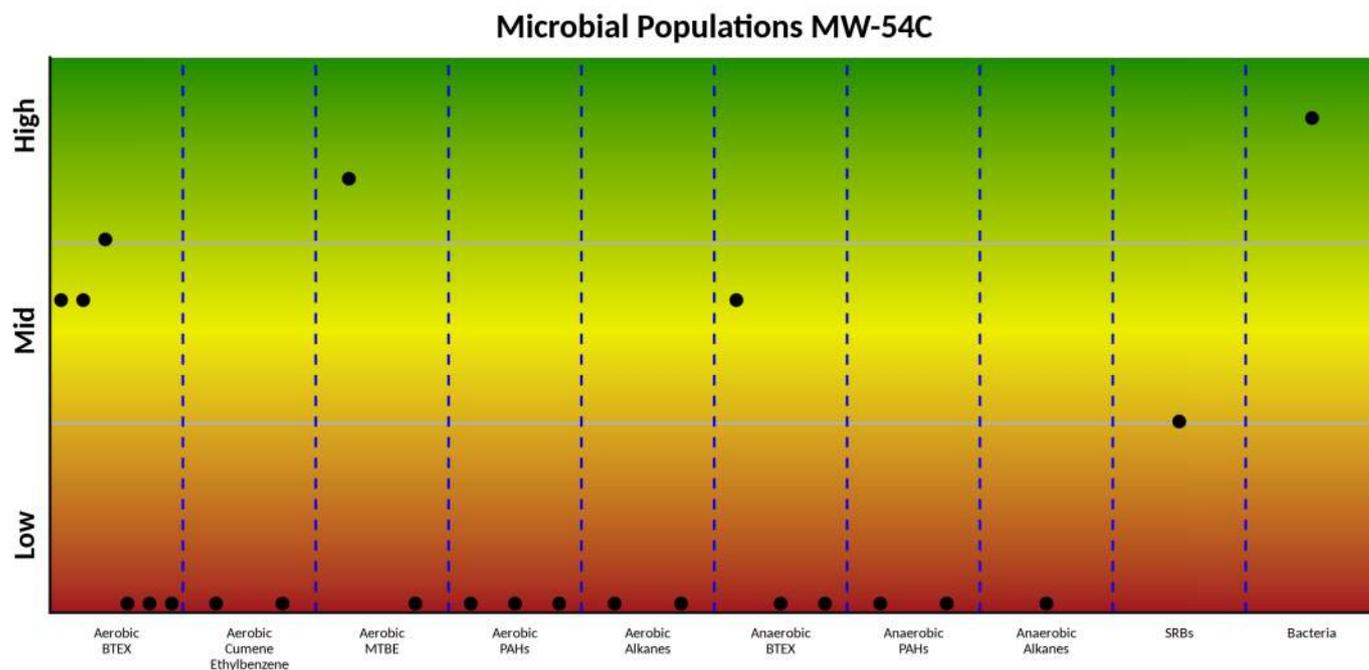


Figure 1: Microbial population summary to aid in evaluating potential pathways and biodegradation of specific contaminants.

Aerobic		Anaerobic	
BTEX	TOD, PHE, RDEG, RMO, TOL, EDO	BTEX	BCR, BSS, ABC
Cumene, Ethylbenzene	EDO, BPH4	Naphthalene/Methylnaphthalene	MNSSA, ANC
MTBE/TBA	PM1, TBA	Alkanes	assA
Naphthalene	NAH, NidA		
Phenanthrene	PHN		
Alkanes	ALK, ALMA		

Microbial Populations MW-40

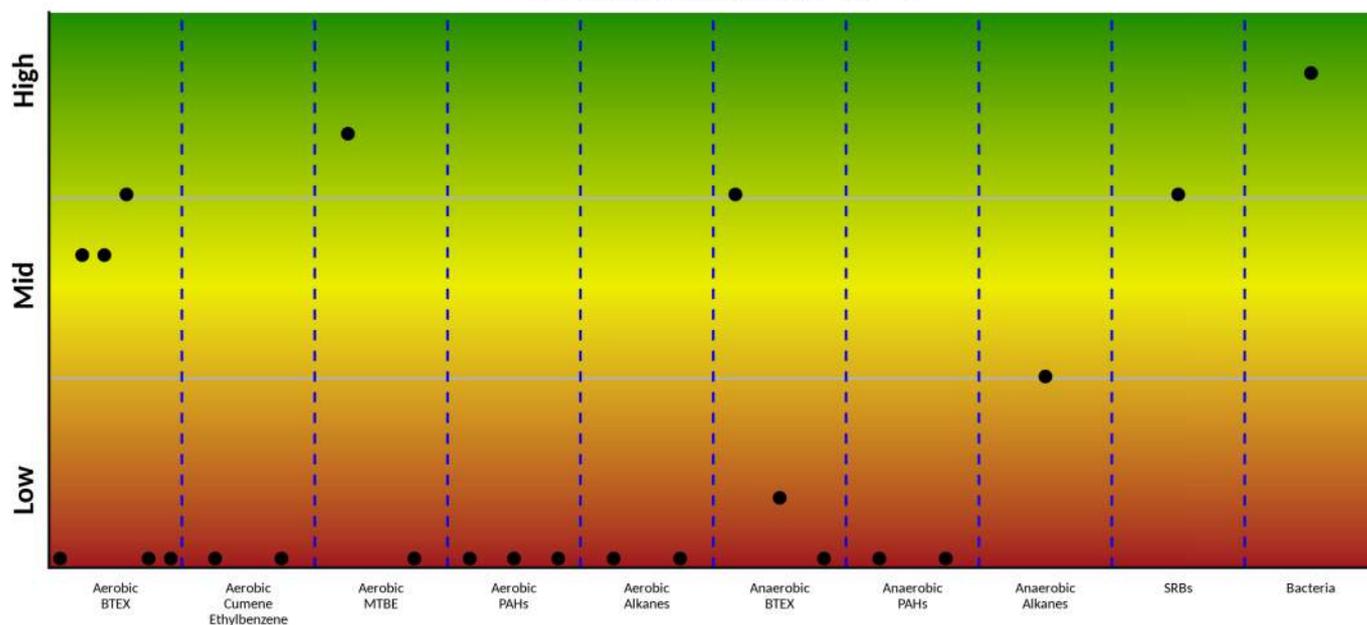


Figure 2: Microbial population summary to aid in evaluating potential pathways and biodegradation of specific contaminants.

Aerobic		Anaerobic	
BTEX	TOD, PHE, RDEG, RMO, TOL, EDO	BTEX	BCR, BSS, ABC
Cumene, Ethylbenzene	EDO, BPH4	Naphthalene/Methylnaphthalene	MNSSA, ANC
MTBE/TBA	PM1, TBA	Alkanes	assA
Naphthalene	NAH, NidA		
Phenanthrene	PHN		
Alkanes	ALK, ALMA		

Microbial Populations MW-189D

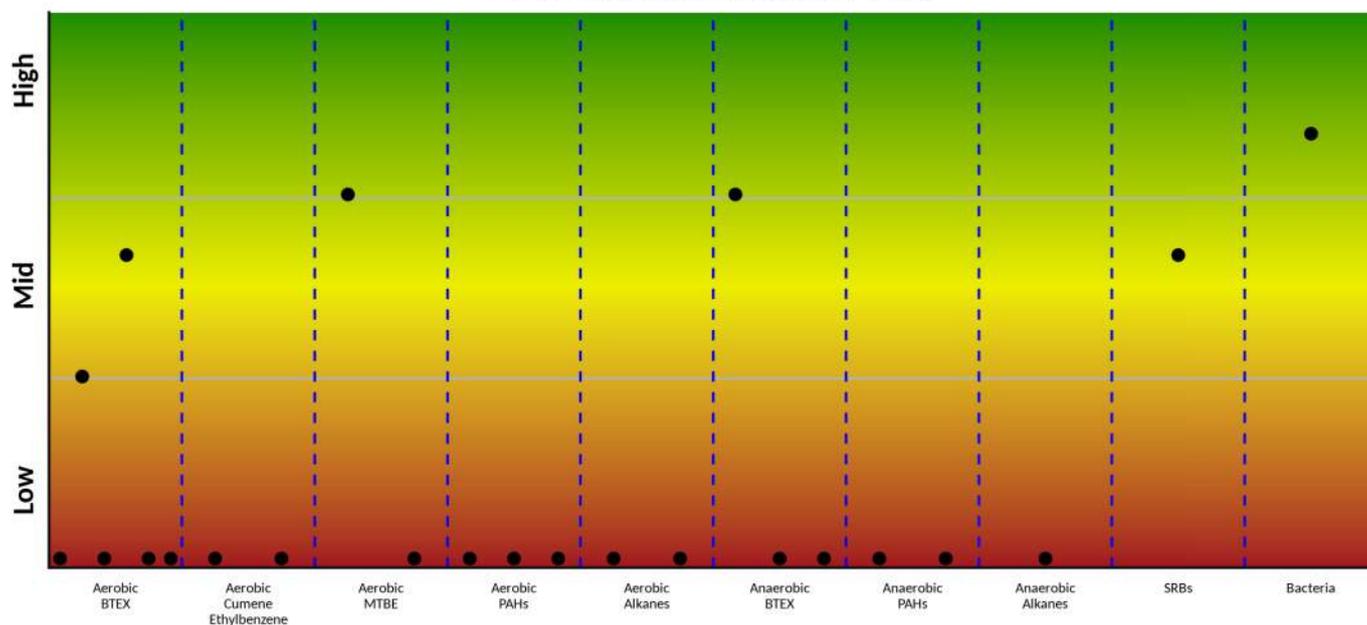


Figure 3: Microbial population summary to aid in evaluating potential pathways and biodegradation of specific contaminants.

Aerobic		Anaerobic	
BTEX	TOD, PHE, RDEG, RMO, TOL, EDO	BTEX	BCR, BSS, ABC
Cumene, Ethylbenzene	EDO, BPH4	Naphthalene/Methylnaphthalene	MNSSA, ANC
MTBE/TBA	PM1, TBA	Alkanes	assA
Naphthalene	NAH, NidA		
Phenanthrene	PHN		
Alkanes	ALK, ALMA		

Microbial Populations MW-188D

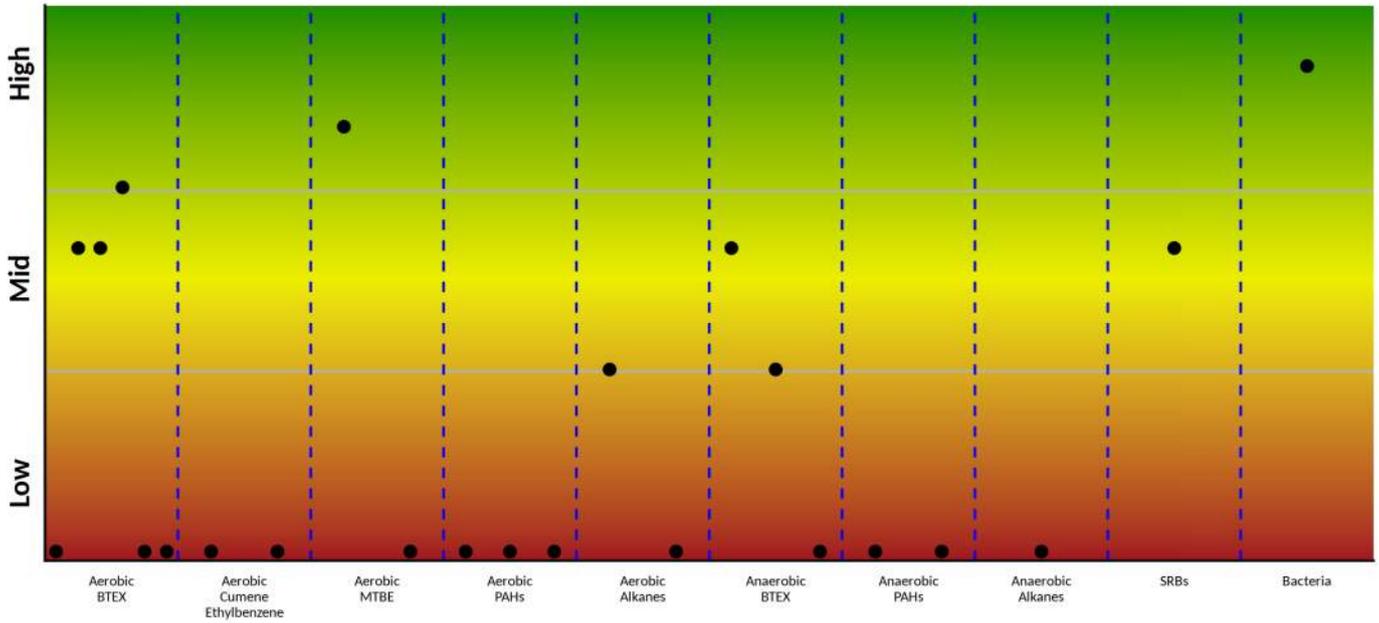


Figure 4: Microbial population summary to aid in evaluating potential pathways and biodegradation of specific contaminants.

Aerobic		Anaerobic	
BTEX	TOD, PHE, RDEG, RMO, TOL, EDO	BTEX	BCR, BSS, ABC
Cumene, Ethylbenzene	EDO, BPH4	Naphthalene/Methylnaphthalene	MNSSA, ANC
MTBE/TBA	PM1, TBA	Alkanes	assA
Naphthalene	NAH, NidA		
Phenanthrene	PHN		
Alkanes	ALK, ALMA		

Table 2: Summary of the QuantArray[®]-Petro results for microorganisms responsible for aerobic biodegradation of BTEX and MTBE for samples MW-54C, MW-40, MW-189D, and MW-188D.

Sample Name	MW-54C	MW-40	MW-189D	MW-188D
Sample Date	06/07/2019	06/07/2019	06/07/2019	06/07/2019
<i>Aerobic BTEX and MTBE</i>	cells/bead	cells/bead	cells/bead	cells/bead
Toluene/Benzene Dioxygenase (TOD)	1.24E+03	<2.50E+02	<2.50E+02	<2.50E+02
Phenol Hydroxylase (PHE)	7.62E+04	8.46E+04	1.21E+03	3.66E+04
Toluene 2 Monooxygenase/Phenol Hydroxylase (RDEG)	1.70E+05	6.34E+04	<2.50E+02	1.75E+04
Toluene Ring Hydroxylating Monooxygenases (RMO)	<2.50E+02	6.76E+04	6.84E+03	5.00E+04
Xylene/Toluene Monooxygenase (TOL)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Ethylbenzene/Isopropylbenzene Dioxygenase (EDO)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Biphenyl/Isopropylbenzene Dioxygenase (BPH4)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
<i>Methylobium petroleiphilum</i> PM1 (PM1)	6.82E+05	4.80E+05	8.59E+04	3.75E+05
TBA Monooxygenase (TBA)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02

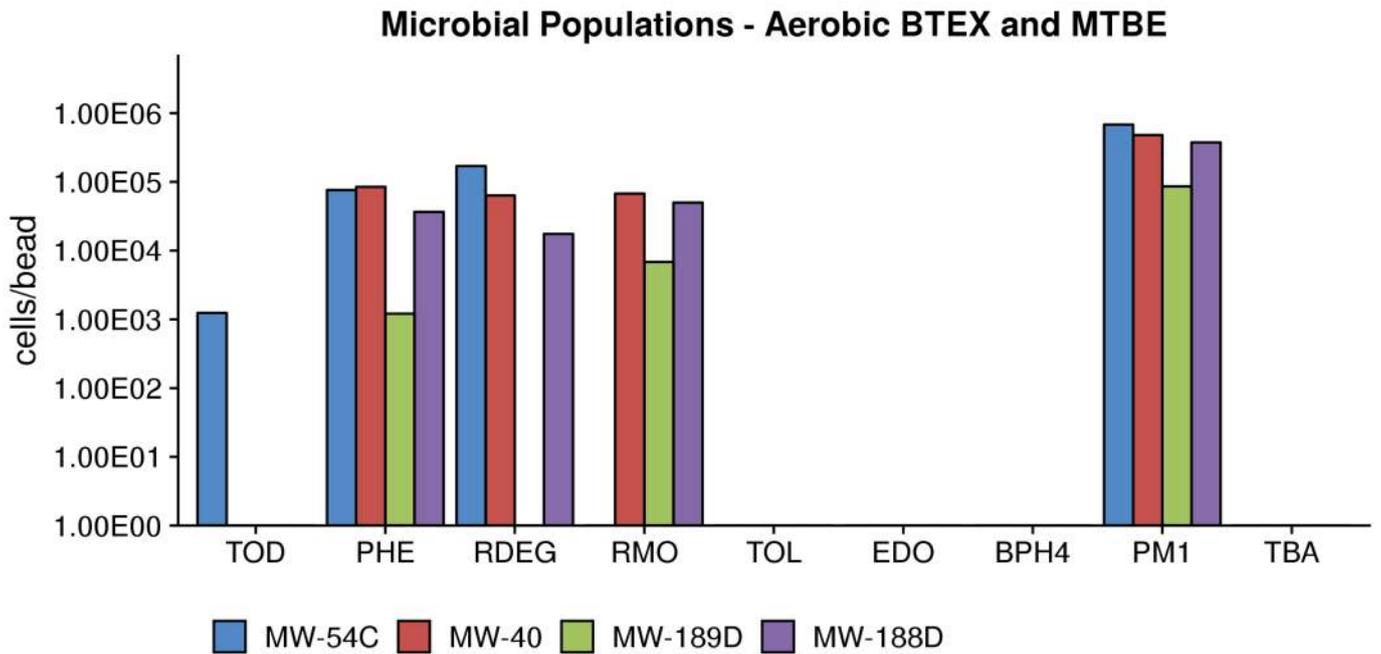


Figure 5: Comparison - microbial populations involved in aerobic biodegradation of BTEX and MTBE.

Table 3: Summary of the QuantArray®-Petro results for microorganisms responsible for aerobic biodegradation of PAHs and alkanes for samples MW-54C, MW-40, MW-189D, and MW-188D.

Sample Name	MW-54C	MW-40	MW-189D	MW-188D
Sample Date	06/07/2019	06/07/2019	06/07/2019	06/07/2019
<i>Aerobic PAHs and Alkanes</i>	cells/bead	cells/bead	cells/bead	cells/bead
Naphthalene Dioxygenase (NAH)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Naphthalene-inducible Dioxygenase (NidA)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Phenanthrene Dioxygenase (PHN)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Alkane Monooxygenase (ALK)	<2.50E+02	<2.50E+02	<2.50E+02	1.03E+03
Alkane Monooxygenase (ALMA)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02

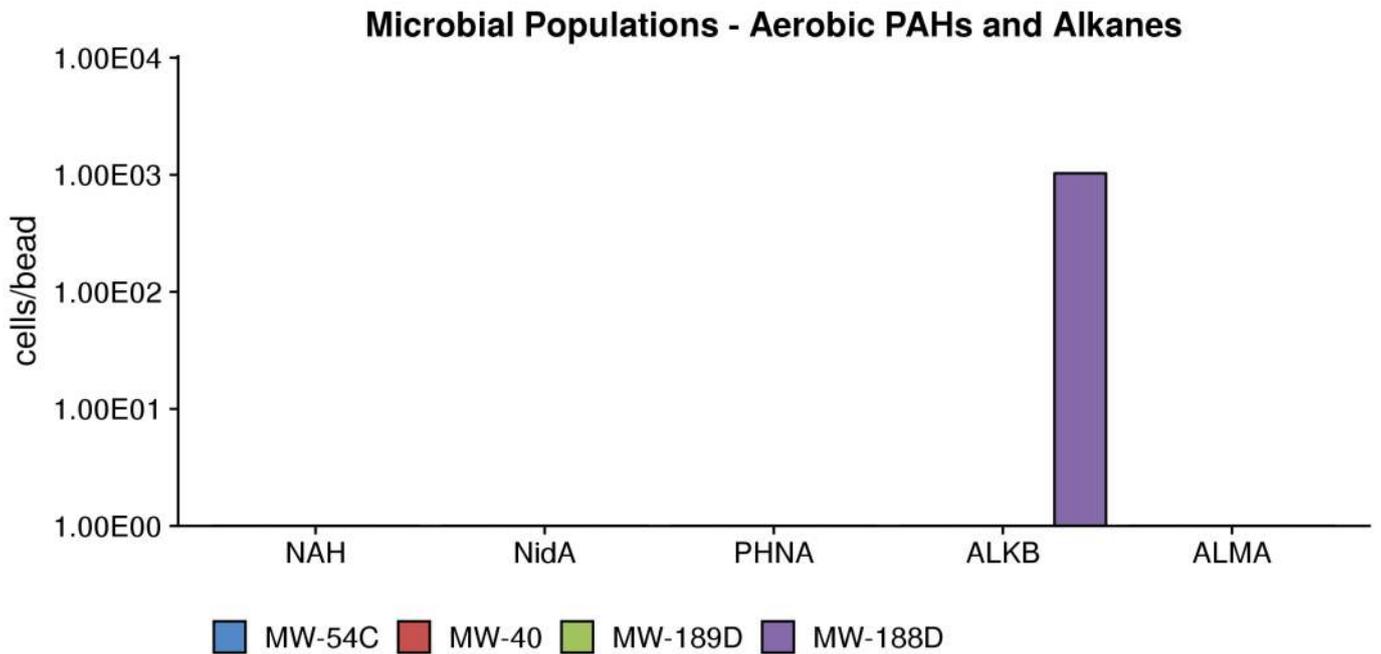


Figure 6: Comparison - microbial populations involved in aerobic biodegradation of PAHs and alkanes.

Table 4: Summary of the QuantArray[®]-Petro results for microorganisms responsible for anaerobic biodegradation of BTEX, PAHs and alkanes for samples MW-54C, MW-40, MW-189D, and MW-188D.

Sample Name	MW-54C	MW-40	MW-189D	MW-188D
Sample Date	06/07/2019	06/07/2019	06/07/2019	06/07/2019
<i>Anaerobic BTEX</i>	cells/bead	cells/bead	cells/bead	cells/bead
Benzoyl Coenzyme A Reductase (BCR)	2.21E+03	1.94E+04	1.23E+04	1.17E+03
Benzylsuccinate Synthase (BSS)	<2.50E+02	5.80E+01 (J)	<2.50E+02	3.39E+03
Benzene Carboxylase (ABC)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
<i>Anaerobic PAHs and Alkanes</i>				
Naphthylmethylsuccinate Synthase (MNSSA)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Naphthalene Carboxylase (ANC)	<2.50E+02	<2.50E+02	<2.50E+02	<2.50E+02
Alkylsuccinate Synthase (ASS)	<2.50E+02	2.95E+02	<2.50E+02	<2.50E+02

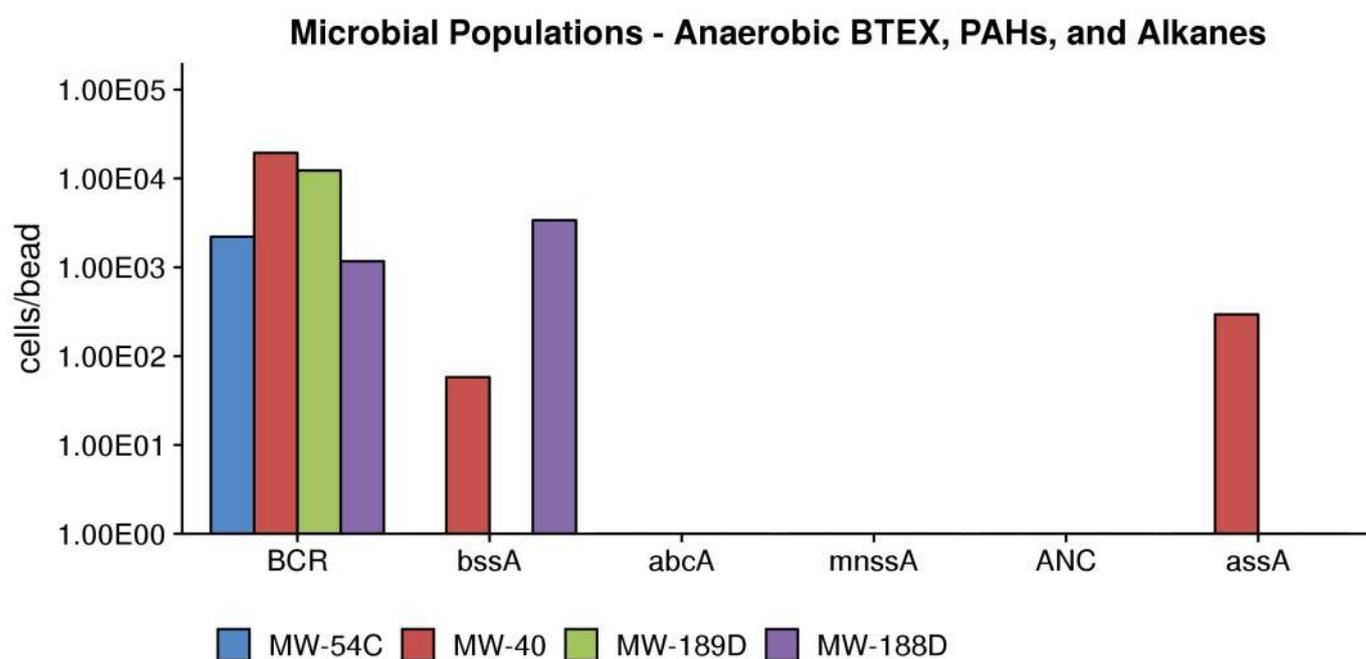


Figure 7: Comparison - microbial populations involved in anaerobic biodegradation of BTEX, PAHs and alkanes.

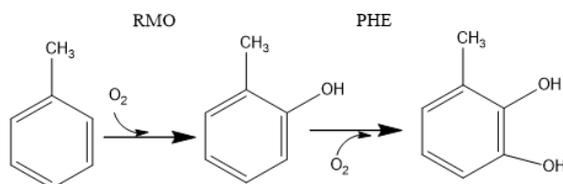
Interpretation

The overall purpose of the QuantArray[®]-Petro is to give site managers the ability to simultaneously yet economically evaluate the potential for biodegradation of a spectrum of contaminants found in petroleum products through a multitude of aerobic and anaerobic pathways to give a much more clear and comprehensive view of contaminant biodegradation. The following discussion describes interpretation of results in general terms and is meant to serve as a guide.

Aerobic Biodegradation - Benzene Toluene, Ethylbenzene, and Xylenes (BTEX): At sites impacted by petroleum products, aromatic hydrocarbons including BTEX are often contaminants of concern. Aerobic biodegradation of aromatic hydrocarbons has been intensively studied and multiple catabolic pathways have been well characterized. The substrate specificity of each pathway (range of compounds biodegraded via each pathway) is largely determined by the specificity of the initial oxygenase enzyme. The QuantArray[®]-Petro includes a suite of assays targeting the initial oxygenase genes of the known pathways for aerobic BTEX biodegradation.

Toluene/Benzene Dioxygenase (TOD): Toluene/benzene dioxygenase (TOD) incorporates both atoms of molecular oxygen into the aromatic ring. Although commonly called toluene dioxygenase, the substrate specificity of this enzyme is relaxed, allowing growth on toluene and benzene along with co-oxidation of a variety of compounds including ethylbenzene, *o*-xylene, *m*-xylene, and trichloroethene (TCE) when expressed.

Toluene/Benzene Monooxygenases (RMO/RDEG) and Phenol Hydroxylases (PHE): The next three known pathways for aerobic biodegradation of toluene (as well as benzene and xylenes) involve two steps: (1) an initial oxidation mediated by a toluene monooxygenase and (2) a second oxidation step catalyzed by a phenol hydroxylase. In these pathways, the toluene monooxygenases have been referred to as “ring hydroxylating monooxygenases” because they initiate biodegradation of toluene by incorporating oxygen directly into the aromatic ring rather than at a methyl group. The ring hydroxylating monooxygenases (RMOs) can be further described as toluene-2-monooxygenases, toluene-3-monooxygenases, or toluene-4-monooxygenases based upon where they attack the aromatic ring.



In General, phenol hydroxylases (PHE) catalyze the continued oxidation of phenols produced by RMOs. However, the difference between toluene monooxygenases (RMOs) and phenol hydroxylases (PHEs) is not absolute in terms of substrate specificity and catabolic function. For example, the TbmD toluene/benzene-2-monooxygenase [1] may be responsible for both the initial and second oxidation step [2].

The RMO, RDEG, and PHE assays target groups of genes encoding enzymes which perform the critical first and/or second steps in the aerobic biodegradation of BTEX compounds. In general terms, the RMO assay quantifies families of toluene-3-monooxygenase and toluene-4-monooxygenase genes. The RDEG assay is used to quantify groups of toluene-2-monooxygenase and phenol hydroxylase genes. Similarly, the PHE assay targets phenol hydroxylase genes and several benzene monooxygenase genes which catalyze both oxidation steps.

Toluene/Xylene Monooxygenase (TOL): The final known pathway for aerobic toluene biodegradation involves initial monooxygenase attack at the methyl group by a toluene/xylene monooxygenase.

Ethylbenzene Dioxygenase (EDO): Similar to TOD, this group of aromatic oxygenases exhibits relatively broad specificity and is responsible for aerobic biodegradation of alkylbenzenes including ethylbenzene and isopropylbenzene or cumene [3].

Biphenyl Dioxygenase (BPH4): In environmental restoration, biphenyl dioxygenases are best known for cometabolism of polychlorinated biphenyls (PCBs). However, this subfamily includes benzene [4] and isopropylbenzene [5] dioxygenases from *Rhodococcus* spp.

Aerobic Biodegradation - MTBE and TBA: With increased use in the 1990s, the fuel oxygenate methyl *tert*-butyl ether (MTBE) has become one of the most commonly detected groundwater contaminants at gasoline contaminated sites. Pure cultures capable of utilizing MTBE as a growth supporting substrate have been isolated [6] and aerobic biodegradation of MTBE and the intermediate *tert*-butyl alcohol (TBA) has been reasonably well characterized. The QuantArray[®]-Petro includes quantification of two gene targets to assess the potential for aerobic biodegradation of MTBE and TBA.

***Methylibium petroleiphilum* PM1 (PM1):** One of the few organisms isolated to date which is capable of utilizing MTBE and TBA as growth supporting substrates [6].

TBA Monooxygenase (TBA): Targets the TBA monooxygenase gene responsible for oxidation of TBA by *Methylibium petroleiphilum* PM1 [7].

Aerobic Biodegradation - Naphthalene and Other PAHs:

Naphthalene Dioxygenase (NAH): Naphthalene dioxygenase incorporates both atoms of molecular oxygen into naphthalene to initiate aerobic metabolism of the compound. However, the broad substrate specificity of naphthalene dioxygenase has been widely noted. When expressed, naphthalene dioxygenase is capable of catalyzing the oxidation of larger PAHs like anthracene, phenanthrene, acenaphthylene, fluorene, and acenaphthene. For a more comprehensive list of reactions mediated by naphthalene dioxygenases, see the University of Minnesota Biocatalysis/Biodegradation Database. (<http://eawag-bbd.ethz.ch/naph/ndo.html>, [8]).

Phenanthrene Dioxygenases (PHN): The PHN assays quantify phenanthrene/naphthalene dioxygenase genes from a diverse collection of microorganisms including *Pseudomonas*, *Burkholderia*, *Sphingomonas*, and *Acidovorax* spp. As with other naphthalene dioxygenases, substrate specificity is relatively broad and phenanthrene dioxygenases have been implicated in the biodegradation of naphthalene, phenanthrene, and anthracene and the co-oxidation of larger PAHs. Moreover, at least one research group has suggested that the PHN group of phenanthrene/naphthalene dioxygenases may be more environmentally relevant than the classical *nah*-like naphthalene dioxygenase [9].

Aerobic Biodegradation - *n*-alkanes: The *n*-alkanes are a substantial portion of petroleum products and are a component of TPH concentrations. The QuantArray[®]-Petro also includes quantification of alkane monooxygenase genes (ALK) which allow a wide range of *Proteobacteria* and *Actinomycetals* to grow on *n*-alkanes with carbon lengths from C₅ to C₁₆ [10]. The QuantArray[®]-Petro also includes a second type of alkane hydroxylase (*almA*) which catalyzes the aerobic biodegradation of longer chain alkanes (C₂₀-C₃₂) by some *Alcanivorax* spp. considered dominant in marine systems [11].

Anaerobic Biodegradation - Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX): BTEX compounds are also susceptible to biodegradation under anoxic and anaerobic conditions although biodegradation pathways for each compound are not as well characterized as aerobic pathways. The QuantArray[®]-Petro includes sets of assays targeting a number of upper and lower pathway functional genes involved in the anaerobic catabolism of BTEX compounds for better evaluation of anaerobic biodegradation at petroleum contaminated sites.

Benzylsuccinate Synthase (BSS): Of the BTEX compounds, toluene biodegradation under anaerobic conditions is the most extensively studied and best characterized. The first step in this pathway, mediated by benzylsuccinate synthase (*bssA*) is the addition of fumarate onto the toluene methyl group to form benzylsuccinate. While additional pathways are possible, some bacterial isolates capable of anaerobic biodegradation of ethylbenzene and xylenes follow the same metabolic approach where the first step is the addition of fumarate.

Anaerobic Benzene Carboxylase (ABC): Although additional pathways are possible, the only pathway for anaerobic biodegradation of benzene elucidated to date is initiated by a benzene carboxylase enzyme.

Benzoyl Coenzyme A Reductase (BCR): Benzoyl-CoA is the central intermediate in the anaerobic biodegradation of many aromatic hydrocarbons. Benzoyl-CoA Reductase (BCR) is the essential enzyme for reducing the benzene ring structure.

Anaerobic Biodegradation - PAHs: The anaerobic biodegradation of PAHs involves analogous mechanisms to those described for anaerobic biodegradation of BTEX compounds. For example, the anaerobic biodegradation of methyl-substituted PAHs like 2-methylnaphthalene is initiated by fumarate addition to the methyl group while the only characterized pathway for anaerobic naphthalene biodegradation is initiated by a carboxylase.

Naphthylmethylsuccinate Synthase (MNSSA): MNSSA is analogous to the benzylsuccinate synthase described above for anaerobic biodegradation of toluene. Naphthylmethylsuccinate synthase catalyzes the addition of fumarate onto the methyl group of 2-methylnaphthalene [12].

Anaerobic Naphthalene Carboxylase (ANC): To date, the only pathway that has been characterized for anaerobic biodegradation of naphthalene is initiated by a naphthalene carboxylase enzyme [13].

Anaerobic Biodegradation - *n*-alkanes: As mentioned previously, the *n*-alkanes are a substantial portion of petroleum products and should be considered particularly when site cleanup goals include TPH reduction. The addition of fumarate is a common mechanism for activating and initiating biodegradation of a variety of petroleum hydrocarbons under anaerobic conditions including *n*-alkanes. The QuantArray[®]-Petro includes quantification of alkyl succinate synthase genes (*assA*) which have been characterized in nitrate reducing and sulfate reducing isolates utilizing *n*-alkanes from C₆ to at least C₁₈ [14].

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SITE LOGIC Report

Stable Isotope Probing (SIP)

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MI Identifier: 027QF

Report Date: July 18, 2019

Project: Exxon Mobil 28077, 20193011

Comments:

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Executive Summary

A Stable Isotope Probing (SIP) study was performed to determine whether biodegradation of benzene or methyl *tert*-butyl ether (MTBE) is occurring under existing site conditions. A Bio-Trap[®] sampler baited with ¹³C-labeled benzene was deployed in MW-54C, and three Bio-Trap[®] samplers baited with ¹³C-labeled methyl *tert*-butyl ether (MTBE) were deployed in wells MW-27B, MW-40 and MW-189D. Following a 36-day deployment period, the Bio-Traps were recovered to quantify ¹³C incorporation into biomass and dissolved inorganic carbon (DIC). A complete summary of the SIP results is provided in Table 1 and Figures 1 through 6. Following are the key observations from the results obtained for the monitoring wells.

MW-54C Benzene Stable Isotope Probing Results

- Quantification of ¹³C-enriched PLFA demonstrated that benzene was metabolized under existing site conditions. The average PLFA $\delta^{13}\text{C}$ value in MW-54C was 453‰, indicating a moderate level of incorporation of ¹³C-labeled benzene into microbial biomass.
- The DIC $\delta^{13}\text{C}$ value in MW-54C was near background levels, indicating that benzene mineralization under current site conditions may be limited.
- The total PLFA biomass concentration in MW-54C was on the order of 10⁴ cells/bead, which was within the low range and fell between the reporting and detection limits for PLFA analysis.
- The PLFA community structures were solely composed of indicators of proteobacteria followed by normal saturates.

MW-27B, MW-40, and MW-189D MTBE Stable Isotope Probing Results

- Quantification of ¹³C-enriched PLFA demonstrated that MTBE was metabolized under existing site conditions in well MW-27B. The average PLFA $\delta^{13}\text{C}$ value in MW-27B was 11‰, indicating at least some incorporation of ¹³C-labeled MTBE into microbial biomass occurred. ¹³C-enriched PLFA was not detected in wells MW-40 or MW-189D.
- The DIC $\delta^{13}\text{C}$ values for all three samples were near background levels suggesting that little to no MTBE was mineralized during the deployment period.
- The total PLFA biomass concentration in MW-27B was on the order of 10⁴ cells/bead, falling between the reporting and detection limits for PLFA analysis, while biomass levels in MW-40 and MW-189D were in the moderate range at 10⁵ cells/bead.
- The PLFA community structures for all MTBE samples were primarily composed of indicators of proteobacteria followed by normal saturates. Eukaryote indicators were also detected in all three wells (9-16%) with indicators of actinomycetes appearing in MW-40 (1.37%) and MW-189D (4.27%). Indicators of firmicutes and anaerobic metal reducers were also detected in MW-40 (8.04%, 8.07%, respectively).

Overview of Approach

Stable Isotope Probing (SIP)

Stable isotope probing (SIP) is an innovative approach to conclusively determine whether *in situ* biodegradation of a contaminant of concern is occurring.

With the SIP method, a Bio-Trap[®] is amended with a specially synthesized ¹³C form of the contaminant of concern (e.g. ¹³C-benzene). The ¹³C essentially serves as a “label” to track biodegradation. For petroleum hydrocarbons and many other contaminants, biodegradation is a process whereby some microorganisms use the contaminant of concern as a carbon and energy source. When used as carbon source, contaminant carbon is incorporated into biomolecules such as phospholipids, DNA, and proteins supporting growth of new cells (biomass). When used as an energy source, contaminant carbon is oxidized to CO₂ as part of cellular metabolism. Thus, detection of the ¹³C “label” in the end products of biodegradation (bacterial biomass and CO₂) at the end of the SIP study provides conclusive evidence of contaminant biodegradation.

To perform a SIP study, a Bio-Trap[®] is amended with the ¹³C form of the contaminant of concern (e.g. ¹³C-benzene) and deployed in an existing monitoring well for a period of 30 to 60 days. If present and active under the existing subsurface conditions, bacteria capable of utilizing the ¹³C labeled contaminant of concern will colonize and grow in the Bio-Trap[®] over the course of the deployment period. Following recovery from the well, the Bio-Trap[®] is shipped to the laboratory and two approaches are used to conclusively evaluate contaminant biodegradation:

- Quantification of ¹³C enriched phospholipid fatty acids (PLFA)
- Quantification of ¹³C enriched dissolved inorganic carbon (DIC)

PLFA are a primary component of the membrane of bacterial cells and have long been used as a measure of microbial biomass. The detection of ¹³C enriched PLFA during a SIP study indicates incorporation into microbial biomass and therefore conclusively demonstrates contaminant biodegradation.

Detection of ¹³C enriched DIC which includes ¹³CO₂ conclusively indicates contaminant biodegradation and mineralization.

Results

Table 1. Summary of the stable isotope probing results obtained from the Bio-Trap® Units.

Sample Name	MW-54C	MW-27B	MW-40	MW-189D
Sample Date	6/7/2019	6/7/2019	6/7/2019	6/7/2019
MI ID	027QF1	027QF2	027QF3	027QF4

¹³C Contaminant Loss

¹³ C Benzene Pre-deployment (µg/bead)	145 ± 6	---	---	---
¹³ C Benzene Post-deployment (µg/bead)	156 ± 2	---	---	---
¹³ C MTBE Pre-deployment (µg/bead)	---	26 ± 3	26 ± 3	26 ± 3
¹³ C MTBE Post-deployment (µg/bead)	---	6 ± 1	13 ± 1	16 ± 1

Biomass & ¹³C Incorporation

Total Biomass (Cells/bead)	3.78E+04 (J)	4.10E+04 (J)	3.45E+05	1.09E+05
¹³ C Enriched Biomass (Cells/bead)	5.94E+02	4.14E+01	ND	ND
Average PLFA Delta (‰)	453	11	ND	ND
Maximum PLFA Delta (‰)	1189	11	ND	ND

¹³C Mineralization

DIC Delta (‰)	-11	-19	-14	-21
---------------	-----	-----	-----	-----

Community Structure (% total PLFA)

Firmicutes (TerBrSats)	0.00	0.00	8.04	0.00
Proteobacteria (Monos)	70.44	45.92	54.94	53.27
Anaerobic metal reducers (BrMonos)	0.00	0.00	8.07	0.00
Actinomycetes (MidBrSats)	0.00	0.00	1.37	4.27
General (Nsats)	29.56	38.31	17.96	27.86
Eukaryotes (Polyenoics)	0.00	15.77	9.60	14.60

Physiological Status (Proteobacteria only)

Slowed Growth	0.77	0.21	0.06	0.19
Decreased Permeability	0.00	0.00	0.20	0.00

Legend:

NA = Not analyzed NS = Not sampled J = Estimated result below PQL but above LQL I = Inhibited ND = Result not detected

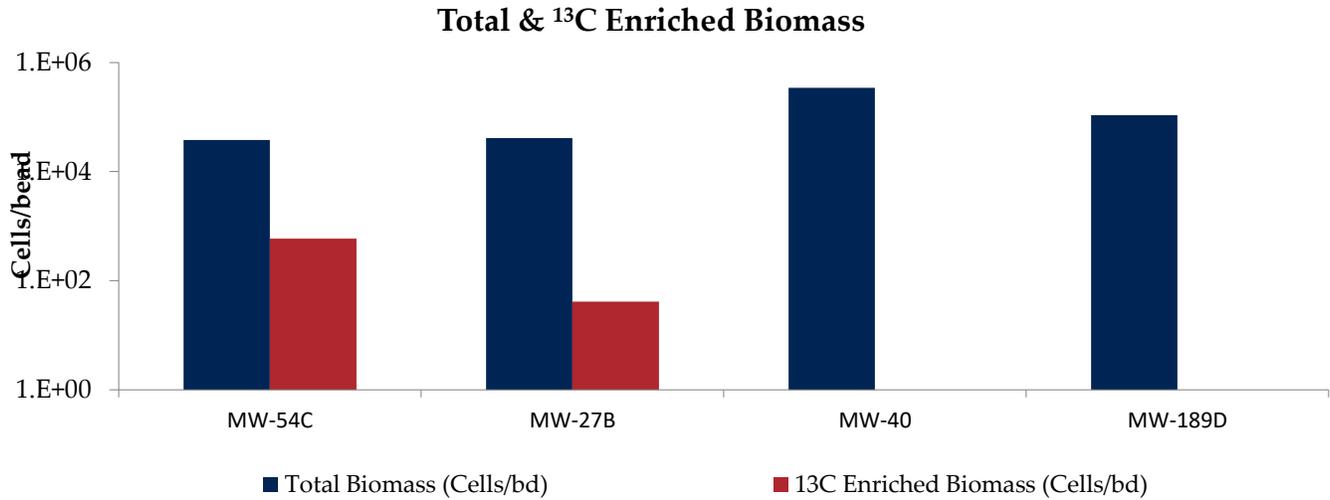


Figure 1. Biomass content is presented as a cell equivalent based on the total amount of phospholipid fatty acids (PLFA) extracted from a given sample. Total biomass is calculated based upon PLFA attributed to bacterial and eukaryotic biomass (associated with higher organisms).

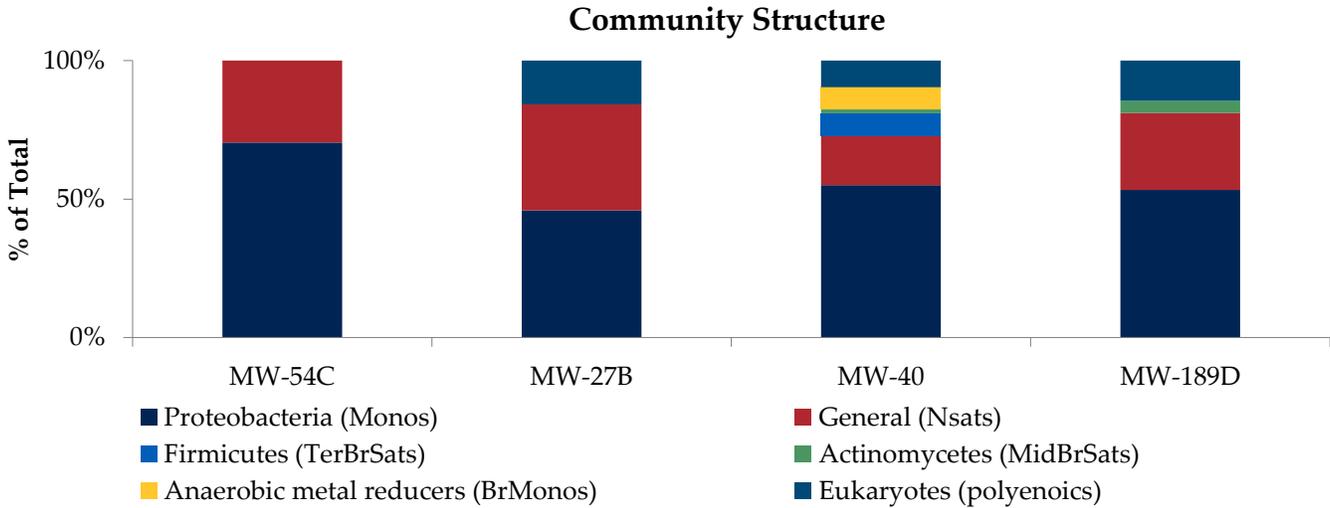


Figure 2. Relative percentages of total PLFA structural groups in the samples analyzed. Structural groups are assigned according to PLFA chemical structure, which is related to fatty acid biosynthesis. See the table in the interpretation section for detailed descriptions of the structural groups.

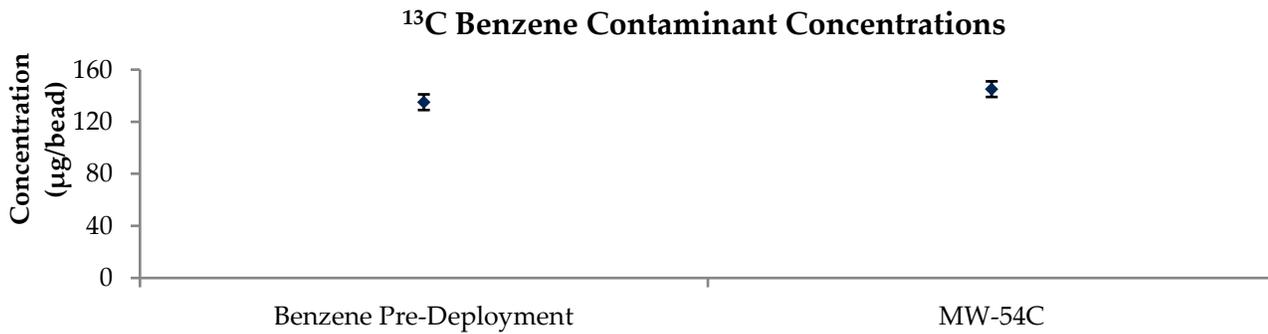


Figure 3. Comparison of Benzene Pre-deployment concentrations loaded on Bio-Sep beads to the concentrations detected after incubation.

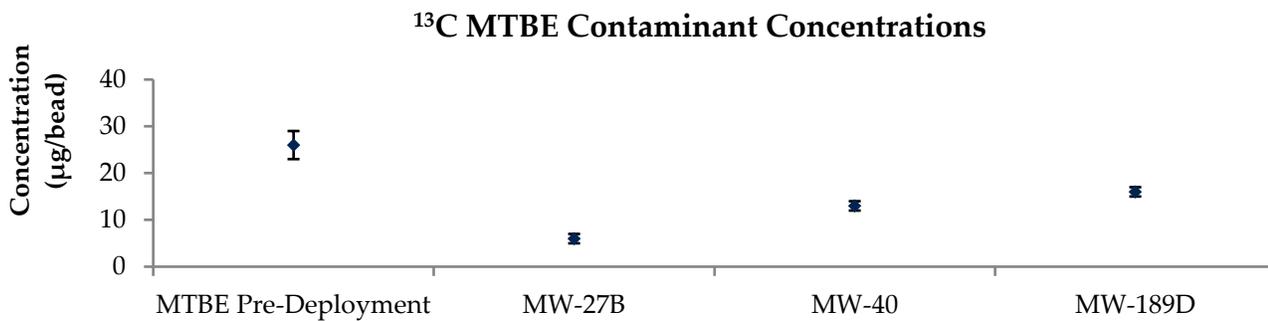


Figure 4. Comparison of MTBE Pre-deployment concentrations loaded on Bio-Sep beads to the concentrations detected after incubation.

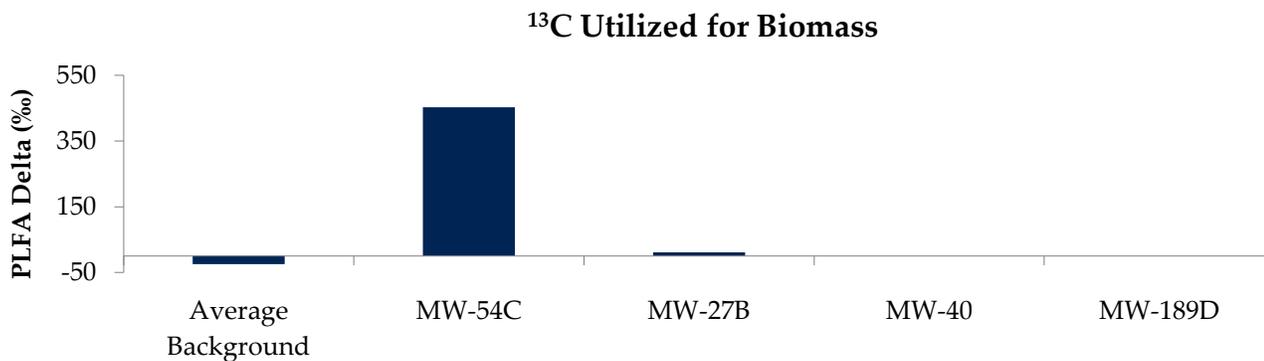


Figure 5. Comparison of the average Delta value obtained from PLFA biomarkers from each Bio-Trap® unit to the average background Delta observed in samples not exposed to ¹³C enriched compounds.

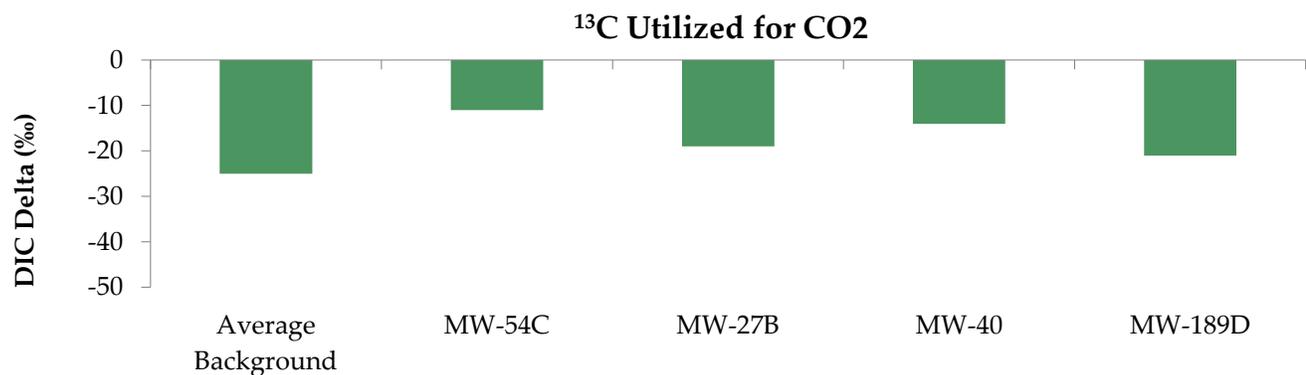


Figure 6. Comparison of the Delta value obtained from DIC from each Bio-Trap[®] unit to the average background Delta observed in samples not exposed to ¹³C enriched compounds.

Interpretation

Interpretation of the results of the SIP Bio-Trap® study must be performed with due consideration of site conditions, site activities, and the desired treatment mechanism. The following discussion describes interpretation of results in general terms and is meant to serve as a guide.

Contaminant Concentration: Bio-Traps® are baited with a ¹³C labeled contaminant of concern and a pre-deployment concentration is determined prior to shipping. Following deployment, Bio-Traps® are recovered for analysis including measurement of the concentration of the ¹³C labeled contaminant remaining. Pre- and post-deployment concentrations are used to calculate percent loss.

Biomass Concentrations: PLFA analysis is one of the most reliable and accurate methods available for the determination of viable (live) biomass. Phospholipids break down rapidly upon cell death (1,2), so biomass calculations based on PLFA content do not include “fossil” lipids from dead cells. Total biomass (cells/bead) is calculated from total PLFA using a conversion factor of 20,000 cells/pmole of PLFA. When making comparisons between wells, treatments, or over time, differences of one order of magnitude or more are considered significant.

Total Biomass		
Low	Moderate	High
10 ³ to 10 ⁴ cells	10 ⁵ to 10 ⁶ cells	10 ⁷ to 10 ⁸ cells

¹³C Enriched Biomass: For SIP studies, ¹³C enriched PLFA is determined to quantify ¹³C incorporation into biomass as a line of evidence. The detection of ¹³C enriched biomass provides conclusive evidence of contaminant biodegradation. However, biodegradation of a contaminant of concern is almost always performed by a small subset of the total microbial community. Therefore, the ¹³C enriched biomass is typically several orders of magnitude lower than total biomass.

Average and Maximum PLFA Delta ¹³C: Isotopic data is often reported as a delta value. The delta value is the difference between the isotopic ratio (¹³C/¹²C) of the sample (R_x) and a standard (R_{std}) normalized to the isotopic ratio of the standard (R_{std}) and multiplied by 1,000 (units are parts per thousand or “per mill” and denoted ‰). R_{std} is the international standard Vienna PeeDee Belemnite (VPDB) with an anomalously high ¹³C/¹²C ratio of 0.011237. Due to the high value of the R_{std}, computed delta ¹³C values for most natural compounds are negative on a per mill basis.

Under natural conditions, the background delta ¹³C value for PLFA is between -20 and -30‰. For a SIP Bio-Trap® study, biodegradation and incorporation of the ¹³C labeled compound into PLFA results in a larger ¹³C/¹²C ratio (R_x) and thus delta values greater than under natural conditions.

Typical PLFA delta values are provided below.

PLFA Delta (‰)

Low	Moderate	High
0 to 100	100 to 1,000	>1,000

Dissolved Inorganic Carbon (DIC): Often, bacteria can utilize the ¹³C labeled compound as both a carbon and energy source. The ¹³C portion used as a carbon source for growth can be incorporated into PLFA as discussed above, while the ¹³C used for energy is oxidized to ¹³CO₂ (mineralized).

¹³C enriched CO₂ data is often reported as a delta value as described above for PLFA. Under natural conditions, the delta ¹³C value for CO₂ is typically in the range of -25‰ to -10‰ (3). For an SIP Bio-Trap® study, mineralization of the ¹³C labeled contaminant of concern (increased ¹³CO₂ production) would lead to a greater value of R_x and thus a positive delta value.

The detection of even low levels of ¹³C enriched DIC provides conclusive evidence of contaminant biodegradation. However, delta values between 0 and 100‰ are generally considered relatively low, values between 100 and 1,000‰ are considered moderate, and values greater than 1,000‰ are considered high.

Dissolved Inorganic Carbon (DIC) Delta and ‰ ¹³ C		
Low	Moderate	High
0 to 100	100 to 1,000	>1,000

Community Structure (% total PLFA): Community structure data is presented as a percentage of PLFA structural groups normalized to the total PLFA biomass. The relative proportions of the PLFA structural groups provide a “fingerprint” of the types of microbial groups (e.g. anaerobes, sulfate reducers, etc.) present and therefore offer insight into the dominant metabolic processes occurring at the sample location. Thorough interpretation of the PLFA structural groups depends in part on an understanding of site conditions and the desired microbial biodegradation pathways. For example, an increase in mid chain branched saturated PLFA (MidBrSats), indicative of sulfate reducing bacteria (SRB) and Actinomycetes, may be desirable at a site where anaerobic BTEX biodegradation is the treatment mechanism, but would not be desirable for a corrective action promoting aerobic BTEX or MTBE biodegradation. The following table provides a brief summary of each PLFA structural group and its potential relevance to bioremediation.

Description of PLFA structural groups.

PLFA Structural Group	General classification	Potential Relevance to Bioremediation Studies
Monoenoic (Monos)	Abundant in Proteobacteria (Gram negative bacteria), typically fast growing, utilize many carbon sources, and adapt quickly to a variety of environments.	Proteobacteria is one of the largest groups of bacteria and represents a wide variety of both aerobes and anaerobes. The majority of Hydrocarbon utilizing bacteria fall within the Proteobacteria
Terminally Branched Saturated (TerBrSats)	Characteristic of Firmicutes (Low G+C Gram-positive bacteria), and also found in Bacteriodes, and some Gram-negative bacteria (especially anaerobes).	Firmicutes are indicative of presence of anaerobic fermenting bacteria (mainly <i>Clostridial/Bacteriodes</i> -like), which produce the H ₂ necessary for reductive dechlorination
Branched Monoenoic (BrMonos)	Found in the cell membranes of micro-aerophiles and anaerobes, such as sulfate- or iron-reducing	In contaminated environments high proportions are often associated with anaerobic sulfate and iron reducing bacteria

	bacteria	
Mid-Chain Branched Saturated (MidBrSats)	Common in sulfate reducing bacteria and also Actinobacteria (High G+C Gram-positive bacteria).	In contaminated environments high proportions are often associated with anaerobic sulfate and iron reducing bacteria
Normal Saturated (Nsats)	Found in all organisms.	High proportions often indicate less diverse populations.
Polyenoic	Found in higher plants, and animals.	Eukaryotic scavengers will often prey on contaminant utilizing bacteria.

Physiological Status (Proteobacteria): Some Proteobacteria modify specific PLFA as a strategy to adapt to stressful environmental conditions (4, 5). For example, *cis* monounsaturated fatty acids may be modified to cyclopropyl fatty acids during periods of slowed growth or modified to *trans* monounsaturated fatty acids to decrease membrane permeability in response to environmental stress. The ratio of product to substrate fatty acid thus provides an index of their health and metabolic activity. In general, status ratios greater than 0.25 indicate a response to unfavorable environmental conditions.

Glossary

Delta (δ): A Delta value is the difference between the isotopic ratio ($^{13}\text{C}/^{12}\text{C}$) of the sample (R_x) and a standard (R_{std}) normalized to the isotopic ratio of the standard (R_{std}) and multiplied by 1,000 (units are parts per thousand denoted ‰).

$$\text{Delta} = (R_x - R_{\text{std}}) / R_{\text{std}} \times 1000$$

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APPENDIX C

Microbial Insights Protocols

SAMPLING INSTRUCTIONS

Handling:

- Bio-Trap Samplers used for Stable Isotope Probing (SIP) are baited with ¹³C-labeled contaminant of interest (e.g. benzene, MTBE, chlorobenzene) adsorbed onto the powder activated carbon (PAC). Controlled laboratory conditions show only minimal loss of contaminant due to volatilization. However, special considerations must be taken into account when handling SIP Bio-Trap Samplers in order to reduce the risk of volatilization.
- SIP Bio-Trap Samplers are shipped out chilled, on blue ice, and it is essential that they should be kept cool (not frozen) until deployment.
- When retrieving the Bio-Trap Samplers that have been deployed in the field, they should immediately be placed on ice and shipped on ice for next day delivery. These steps will ensure the most accurate results.
- Although the contaminant is absorbed onto the beads, caution should be used in handling these Bio-Trap Samplers because the contaminant compounds are associated with possible health and safety risks.

Note: Clean latex gloves (or similar) should be used at all times when handling the Bio-Trap Samplers.

Storage:

It is important to minimize the amount of time that Bio-Trap Samplers are stored prior to being installed in the field. The physical properties of the Bio-Trap Samplers that make them an ideal medium for collecting microbes also increase the chances of microbial or chemical contamination. Bio-Trap Samplers need to remain sealed and refrigerated (not frozen) until they can be installed in the field.

Installation:

- Prior to installing Bio-Trap Sampler, the monitoring well may need to be purged if it has not been sampled in a while. If purging is necessary, MI recommends that three well volumes be removed to ensure contact with formation water and reduce well bore effect.
- Attach the Bio-Trap Sampler's nylon loop (provided) to a nylon line (not provided) and suspend Bio-Trap Sampler at a depth where significant contaminant concentrations exist. If no data are available on the vertical distribution of contaminants, then suspend the Bio-Trap Sampler in the middle of the saturated screened interval.
- If large fluctuations in the water level are anticipated during the period of incubation, the Bio-Trap Sampler should be suspended from a float (contact MI for further details). Be sure not to suspend the bio-trap in the NAPL zone.
- Once installed, incubation times can vary depending upon the scope of the project. A typical Stable Isotope Probing (SIP) study incubation period is 30 days but is project dependant. Please contact us if you have questions regarding the optimum deployment period for your samples.

Retrieval:

- Open the monitoring well and pull up the Bio-Trap Sampler. Cut and remove the braided nylon line used to suspend the Bio-Trap Sampler.
- Transfer the recovered Bio-Trap Sampler to labeled (well number and date) zippered bags, seal and then double bag in a larger (one-gallon) zippered bag, immediately place on blue ice in a cooler.
- Repeat above for all the Bio-Trap Samplers from the site.
- A chain of custody (COC) form must be included with each shipment of samples.
- In order to minimize the potential effect of these samplers on the monitoring well, MI recommends purging three well volumes from the test well following the retrieval of the SIP Bio-Trap Samplers.

Hold time for this analysis is 24-48 hours.

SHIPPING INSTRUCTIONS

Packaging Samples:

1. Samples should be shipped in a cooler with ice or blue ice for next day delivery. If regular ice is used, the ice should be double bagged.
2. A chain of custody form must be included with each shipment of samples. Access our chain of custody at www.microbe.com.

Shipment for Weekday Delivery:

Samples for weekday delivery should be shipped to: Sample Custodian
Microbial Insights, Inc.
10515 Research Drive
Knoxville, TN 37932
(865) 573-8188

Shipment for Saturday Delivery:

Note: Microbial Insights, Inc is **closed** on Sunday, however we can receive samples on Saturday. Please contact us prior to shipping if the delivery of the samples is going to be on a Saturday.

Samples for **Saturday delivery** should be shipped to:

Microbial Insights, Inc.
FedEx Drop Location
10601 Murdock Drive
Knoxville, TN 37932
(865) 573-8188

Notes:

- **Stable Isotope Probing (SIP) may preclude subsequent Compound Specific Isotope Analysis (CSIA) in the study well for a period of time. CSIA can be performed prior to SIP or at another location.**

SAMPLING INSTRUCTIONS

The recommended sampling container is a 1L Poly bottle with a screw cap. Amber glass bottles can be used but are not recommended due to the likelihood of breakage during shipment. Microbial Insights, Inc. can provide the proper sampling supplies upon request.

Once the proper sampling bottle is obtained be sure not to contaminate the inside of the sample bottle with skin, dirt or any form of debris (this helps to ensure the accuracy of the data results). Wearing latex gloves (or similar) is recommended when sampling.

The required volume of water to conduct DNA based analyses from groundwater samples is 1L.

* Note: It is important to collect as close to the required amounts as possible to ensure the ability to properly conduct the analysis requested.

Hold time is 24-48 hours for this analysis.

To Submit Sample:

1. Once the required amount of groundwater has been collected into the proper sampling container, seal the container tightly with a screw cap lid.
2. Properly affix a label with the sample name, date and analysis.
3. Be sure to fill out the Chain of Custody (COC) form correctly and accurately and ship it along with the samples. A COC form is required for QA/QC purposes.
4. Once the bottles have been correctly labeled, place them in the designated cooler. Be sure to fill the remaining space in the cooler with blue ice or regular ice that has been double bagged in Ziploc bags. Use sufficient ice to keep the entire shipment around 4°C, especially during the summer months.
5. All paperwork to be sent with the samples should be placed within a waterproof pouch or Ziploc bag and placed on top of the samples or affixed to the inside lid of the cooler.
6. Seal the cooler lid with a strong packaging tape.

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Packaging Samples:

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2. A chain of custody form must be included with each shipment of samples. Access our chain of custody at www.microbe.com.

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10515 Research Drive
Knoxville, TN 37932
(865) 573-8188

Shipment for Saturday Delivery:

Coolers to be delivered on Saturday must be sent to our **FedEx Drop Location**. To ensure proper handling the following steps must be taken:

1. FedEx shipping label should be marked under (6) Special Handling, check Hold Saturday,
2. The cooler must be taped with FedEx SATURDAY tape.
3. The shipping label must be filled out with the Drop Location address below. Our laboratory name must be on the address label.
4. You **MUST notify by email** customerservice@microbe.com with the tracking number of the package on Friday (prior to 4pm Eastern Time) to arrange for Saturday pickup. Please make sure you write "Saturday Delivery" in the subject line of the message. **Without proper labeling and the tracking number, there is no guarantee that the samples will be collected.**

Samples for **Saturday delivery** should be shipped to:

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Storage:

It is important to minimize the amount of time that Bio-Trap Samplers are stored prior to being installed in the field. The physical properties of the Bio-Trap Samplers that make them an ideal medium for collecting microbes also increase the chances of microbial or chemical contamination. Bio-Trap Samplers need to remain sealed and refrigerated (not frozen) until they can be installed in the field.

Note: Clean latex gloves (or similar) should be used at all times when handling Bio-Trap Samplers.

Installation:

- Prior to installing the Bio-Trap Sampler, the monitoring well may need to be purged if it has not been sampled in a while. If purging is necessary, MI recommends that three well volumes be removed to ensure contact with formation water and reduce well bore effect.
- Attach the Bio-Trap Sampler's nylon loop (provided) to a nylon line (not provided) and suspend the Bio-Trap Sampler at a depth where significant contaminant concentrations exist. If no data is available on the vertical distribution of contaminants, then suspend the Bio-Trap Sampler in the middle of the saturated screened interval.
- If large fluctuations in the water level are anticipated during the period of incubation, the Bio-Trap Sampler should be suspended from a float (contact MI for further details). Be sure not to suspend the Bio-Trap in the NAPL zone.
- Once installed, incubation times can vary depending upon the scope of the project (routine monitoring and stable isotope probing (SIP) - 30 days and "baited" - 60 days).

Retrieval:

- Open the monitoring well and pull up the Bio-Trap Sampler. Cut and remove the braided nylon line used to suspend the Bio-Trap Sampler.
- Transfer the recovered Bio-Trap Sampler to labeled (well number and date) zippered bags, seal and then double bag in a larger (one-gallon) zippered bag, immediately place on blue ice in a cooler.
- Repeat the above for all Bio-Trap Samplers from the site. Individual zippered bags containing the Bio-Trap Samplers can be placed in the same one-gallon zippered bag (if there is enough space).
- A chain of custody (COC) form must be included with each shipment of samples.

Hold time for this analysis is 24-48 hours.

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