Supporting Quality Control Results

Brian Peters
GHD
20818 44th West Suite 190
Lynnwood, WA 98036

Lab ID: **030619-BLK.D**
Collected:
Received:
Matrix:

Project: **Shell Woodland**
Project #: **34033821**
Collected by:

QC type: **Method Blank**
Analyzed: **3/6/2019**
Q Method: **030519.M**

CONSTITUENTS	ssRL ug/L	RESULT ug/L	QUAL
Isopentane (2-Methylbutane)	1.0	1.0	U
1-Pentene	1.0	1.0	U
2-Methyl-1-butene	1.0	1.0	U
Pentane (nC5)	1.0	1.0	U
trans-2-pentene	1.0	1.0	U
cis-2-pentene	1.0	1.0	U
2-Methyl-2-butene (t)	1.0	1.0	U
2,2-Dimethylbutane (t)	1.0	1.0	U
Cyclopentane	1.0	1.0	U
2,3-Dimethylbutane	1.0	1.0	U
2-Methylpentane	1.0	1.0	U
Methyl-tert-butyl ether (MTBE)	0.8	0.8	U
3-Methylpentane	1.0	1.0	U
1-Hexene	1.0	1.0	U
Hexane (nC6)	1.0	1.0	U
Di-isopropyl ether (DIPE)	0.8	0.8	U
trans-2-hexene (t)	1.0	1.0	U
2-Methyl-2-pentene (t)	1.0	1.0	U
cis-2-hexene (t)	1.0	1.0	U
cis-3-Methyl-2-pentene (t)	1.0	1.0	U
Ethyl-tert-butyl ether (ETBE)	0.8	0.8	U
2,2-Dimethylpentane (t)	1.0	1.0	U
Methylcyclopentane	1.0	1.0	U
2,4-Dimethylpentane	1.0	1.0	U
1,2-Dichloroethane (EDC)	0.8	0.8	U
Benzene	1.0	1.0	U
3,3-Dimethylpentane (t)	1.0	1.0	U
Thiophene	0.8	0.8	U
Cyclohexane	1.0	1.0	U
2-Methylhexane	1.0	1.0	U
2,3-Dimethylpentane	1.0	1.0	U

Brian Peters		**Lab ID:**	**030619-BLK.D**
GHD		**Collected:**	
20818 44th West Suite 190		**Received:**	
Lynnwood, WA 98036		**Matrix:**	
Project:	**Shell Woodland**	**QC type:**	**Method Blank**
Project #:	**34033821**	**Analyzed:**	**3/6/2019**
Collected by:		**Q Method:**	**030519.M**

CONSTITUENTS	ssRL ug/L	RESULT ug/L	QUAL
Tert-amyl methyl ether (TAME)	0.8	0.8	U
3-Methylhexane	1.0	1.0	U
trans-1,3-Dimethylcyclopentane (t)	1.0	1.0	U
cis-1,3-Dimethylcyclopentane (t)	1.0	1.0	U
trans-1,2-Dimethylcyclopentane (t)	1.0	1.0	U
2,2,4-Trimethylpentane (isooctane)	3.0	4.8	
1-Heptene	1.0	1.0	U
Heptane (nC7)	1.0	1.0	U
trans-2-heptene (t)	1.0	1.0	U
Methylcyclohexane	1.0	1.0	U
2,5-Dimethylhexane	3.0	3.0	U
2,2,3-Trimethylpentane	1.0	1.0	U
2,4-Dimethylhexane	1.0	1.0	U
2,3,4-Trimethylpentane	1.0	1.0	U
2,3,3-Trimethylpentane	1.0	1.0	U
Toluene	1.0	1.0	U
2-Methylthiophene	0.8	0.8	U
2,3-Dimethylhexane	1.0	1.0	U
3-Methylthiophene	0.8	0.8	U
2-Methylheptane	1.0	1.0	U
4-Methylheptane (t)	1.0	1.0	U
3-Methylheptane	2.0	2.0	U
3-Ethylhexane	2.0	2.0	U
1,2-Dibromoethane (EDB)	1.0	1.0	U
1-Octene	1.0	1.0	U
Octane (nC8)	1.0	1.0	U
2,4-Dimethylheptane (t)	1.0	1.0	U
2,5-Dimethylheptane (t)	1.0	1.0	U
Ethylbenzene	1.0	1.0	U
2-Ethylthiophene	1.5	1.5	U
2,3-Dimethylheptane (t)	1.0	1.0	U

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Lynnwood, WA 98036		**Matrix:**	
Project:	**Shell Woodland**	**QC type:**	**Method Blank**
Project #:	**34033821**	**Analyzed:**	**3/6/2019**
Collected by:		**Q Method:**	**030519.M**

CONSTITUENTS	ssRL ug/L	RESULT ug/L	QUAL
m-Xylene	1.0	1.0	U
p-Xylene	1.0	1.0	U
4-Methyloctane (t)	1.0	1.0	U
2-Methyloctane (t)	1.0	1.0	U
3-Methyloctane (t)	1.0	1.0	U
Styrene	1.0	1.0	U
o-Xylene	1.0	1.0	U
1-Nonene	3.0	3.0	U
Nonane (nC9)	2.0	2.0	U
Isopropylbenzene (cumene)	1.0	1.0	U
n-Propylbenzene	2.0	2.0	U
1-Methyl-3-ethylbenzene	2.0	2.0	U
1-Methyl-4-ethylbenzene	2.0	2.0	U
1,3,5-Trimethylbenzene (mesitylene)	2.0	2.0	U
1-Methyl-2-ethylbenzene	2.0	2.0	U
1,2,4-Trimethylbenzene	1.0	1.0	U
1-Decene	3.0	3.0	U
Decane (nC10)	3.0	3.0	U
sec-Butylbenzene	1.0	1.0	U
1-Methyl-3-isopropylbenzene (m-cymene)	1.0	1.0	U
1-Methyl-4-isopropylbenzene (p-cymene)	1.0	1.0	U
Indane	1.0	1.0	U
Indene	1.0	1.0	U
1-Methyl-2-isopropybenzene (o-cymene)	1.0	1.0	U
1-Methyl-3-propylbenzene	2.0	2.0	U
1-Methyl-4-propylbenzene	1.0	1.0	U
n-Butylbenzene	1.0	1.0	U
1,3-Dimethyl-5-ethylbenzene	1.0	1.0	U
1,2,diethylbenzene	1.0	1.0	U
1-Methyl-2-propylbenzene	1.0	1.0	U
1,4-Dimethyl-2-ethylbenzene	2.0	2.0	U

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Collected by:

QC type: **Method Blank**
Analyzed: **3/6/2019**
Q Method: **030519.M**

CONSTITUENTS	ssRL ug/L	RESULT ug/L	QUAL
1,3-Dimethyl-4-ethylbenzene	2.0	2.0	U
1,2-Dimethyl-4-ethylbenzene	2.0	2.0	U
1,2-Dimethyl-3-ethylbenzene	2.0	2.0	U
Undecane (nC11)	6.0	6.0	U
1,2,4,5-Tetramethylbenzene	2.0	2.0	U
1,2,3,5-Tetramethylbenzene (t)	2.0	2.0	U
n-Pentylbenzene	1.0	1.0	U
Naphthalene	1.0	1.0	U
Benzothiophene	0.8	0.8	U
Dodecane (nC12)	4.0	4.0	U
1,2,3,4-Tetramethylbenzene (t)	2.0	2.0	U
2-Methylnaphthalene	1.0	1.0	U
1-Methylnaphthalene	1.0	1.0	U
Benzene d-6 (RS)		104	
Toluene-d8 (RS)		97	
Ethylbenzene d10 (RS)		107	

ssRL - Sample Specific Reporting Limit
Results listed as U would have been reported if present at or above the listed ssRL
B - Exceeds PQL - 3 x ssRL
Q - Surrogate recovery limit exceedance
NC - Not calibrated
J - Values greater than the ssRL but less than the PQL.
Note: Extracted by EPA 5030 (Purge and Trap).

US631
030619-BLK.D

Submitted by,
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Project: **Shell Woodland**
Project #: **34033821**
Collected by:

Lab ID: **030619-LCS.D**
Collected:
Received:
Matrix:

QC type: **LCS**
Analyzed: **3/6/2019**
Q Method: **030519.M**

CONSTITUENTS	RESULT ug/L	Recovery %	Spike Conc. ug/L	QUAL
1-Pentene	34.1	67.7	50.4	
Pentane (nC5)	44.7	88.4	50.5	
Cyclopentane	22.1	44.2	50.1	LQ
1-Hexene	40.4	80.6	50.1	
Hexane (nC6)	37.5	74.7	50.1	
Di-isopropyl ether (DIPE)	39.8	158.3	25.1	
Ethyl-tert-butyl ether (ETBE)	27.7	110.6	25.1	
2,4-Dimethylpentane	46.5	93.0	50.0	
Benzene	23.6	93.7	25.2	
Cyclohexane	47.2	93.9	50.3	
Tert-amyl methyl ether (TAME)	25.2	100.2	25.2	
2,2,4-Trimethylpentane (isooctane)	40.9	81.5	50.1	
Heptane (nC7)	55.6	110.3	50.4	
Toluene	24.0	96.1	25.0	
Octane (nC8)	47.7	95.2	50.1	
Ethylbenzene	26.3	104.7	25.1	
m-Xylene	24.9	98.9	25.2	
p-Xylene	25.5	101.0	25.2	
o-Xylene	25.2	100.3	25.1	
Nonane (nC9)	53.6	71.5	75.0	
n-Propylbenzene	27.6	110.1	25.1	
1,3,5-Trimethylbenzene (mesitylene)	25.8	102.3	25.3	
1-Decene	51.9	69.3	75.0	
Decane (nC10)	46.6	61.9	75.3	
n-Butylbenzene	21.7	87.1	25.0	
n-Pentylbenzene	21.9	87.0	25.2	
Dodecane (nC12)	47.6	94.4	50.4	
Benzene d-6 (RS)		94		
Toluene-d8 (RS)		97		
Ethylbenzene d10 (RS)		108		

ssRL - Sample Specific Reporting Limit
Q - Surrogate recovery limit exceedance
I - Matrix Interference
NC - Not calibrated
LQ - Percent difference exceedance (50 - 160)
Note: Extracted by EPA 5030 (Purge and Trap).

US631
030619-LCS.D

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Project: **Shell Woodland**
Project #: **34033821**
Collected by:

Lab ID: **030619-LCSD.D**
Collected:
Received:
Matrix:

QC type: **LCSD**
Analyzed: **3/6/2019**
Q Method: **030519.M**

CONSTITUENTS	RESULT ug/L	Recovery %	Spike Conc. ug/L	RPD %	QUAL
1-Pentene	35.4	70.4	50.4	3.9	
Pentane (nC5)	45.9	90.8	50.5	2.7	
Cyclopentane	23.1	46.0	50.1	4.1	
1-Hexene	42.5	84.8	50.1	5.1	
Hexane (nC6)	55.1	109.8	50.1	38.0	LQ
Di-isopropyl ether (DIPE)	47.1	187.3	25.1	16.8	LQ
Ethyl-tert-butyl ether (ETBE)	28.3	112.9	25.1	2.0	
2,4-Dimethylpentane	46.9	93.7	50.0	0.7	
Benzene	24.2	96.0	25.2	2.5	
Cyclohexane	49.2	97.8	50.3	4.2	
Tert-amyl methyl ether (TAME)	26.8	106.5	25.2	6.1	
2,2,4-Trimethylpentane (isooctane)	42.6	85.0	50.1	4.2	
Heptane (nC7)	54.5	108.2	50.4	1.9	
Toluene	24.8	99.5	25.0	3.5	
Octane (nC8)	49.9	99.5	50.1	4.4	
Ethylbenzene	27.1	107.9	25.1	3.0	
m-Xylene	26.2	104.1	25.2	5.2	
p-Xylene	25.9	102.7	25.2	1.7	
o-Xylene	25.6	102.0	25.1	1.6	
Nonane (nC9)	60.7	81.0	75.0	12.4	
n-Propylbenzene	28.2	112.3	25.1	1.9	
1,3,5-Trimethylbenzene (mesitylene)	26.8	106.1	25.3	3.6	
1-Decene	58.6	78.2	75.0	12.1	
Decane (nC10)	57.6	76.6	75.3	21.2	LQ
n-Butylbenzene	21.4	85.9	25.0	1.4	
n-Pentylbenzene	22.0	87.2	25.2	0.2	
Dodecane (nC12)	54.1	107.4	50.4	12.9	
Benzene d-6 (RS)		96			
Toluene-d8 (RS)		98			
Ethylbenzene d10 (RS)		107			

ssRL - Sample Specific Reporting Limit
Q - Surrogate recovery limit exceedance
I - Matrix Interference

NC - Not calibrated
RQ - Percent difference exceeded (15)
LQ - Percent difference exceedance (50 - 160)
Note: Extracted by EPA 5030 (Purge and Trap).

US631
030619-LCSD.D

Submitted by,
Pace Energy Services, LLC

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Lab ID: **030619-SRM.D**
Collected:
Received:
Matrix: **Product/Soil**

Project: **Shell Woodland**
Project #: **34033821**
Collected by:

QC type: **NIST SRM 2295**
Q Method: **030519.M**

CONSTITUENTS	RESULT mg/kg	ssRL mg/kg	D Flag	NIST Result mg/kg	Passing Diff. %	Actual Diff. %	QUAL
1-Pentene	4267.0	520.8		7400.0	45	53.7	SQ
Pentane (nC5)	22875.3	4166.7	D	35700.0	45	43.8	
Methyl-tert-butyl ether (MTBE)	129611.7	4166.7	D	145400.0	45	11.5	
Hexane (nC6)	36429.4	520.8		37000.0	45	1.6	
2,4-Dimethylpentane	75228.4	520.8		79000.0	45	4.9	
Benzene	9182.8	520.8		9900.0	45	7.5	
Thiophene	262.8	520.8		260.0	45	1.1	
Cyclohexane	83200.5	4166.7	D	88400.0	45	6.1	
2,2,4-Trimethylpentane (isooctane)	94622.9	4166.7	D	118000.0	45	22.0	
1-Heptene	19667.2	520.8		15000.0	45	26.9	
Heptane (nC7)	75556.8	4166.7	D	77700.0	45	2.8	
Toluene	92986.6	4166.7	D	78900.0	45	16.4	
3-Methylthiophene	293.6	520.8		300.0	45	2.2	
Octane (nC8)	59901.7	520.8		79800.0	45	28.5	
Ethylbenzene	26589.9	520.8		19600.0	45	30.3	
m,p-Xylenes	47879.5	4166.7	D	58700.0	45	20.3	
o-Xylene	26924.1	520.8		19700.0	45	31.0	
1,3,5-Trimethylbenzene (mesitylene)	26254.7	520.8		19700.0	45	28.5	
1,2,4-Trimethylbenzene	28275.1	520.8		20010.0	45	34.2	
Decane (nC10)	37661.9	520.8		41400.0	45	9.5	
1,2,4,5-Tetramethylbenzene	11601.6	520.8		9600.0	45	18.9	
Naphthalene	15192.1	520.8		11500.0	45	27.7	
Benzothiophene	497.6	520.8		440.0	45	12.3	
Benzene d-6 (RS)	86						
Toluene-d8 (RS)	95						
Ethylbenzene d10 (RS)	107						

ssRL - Sample Specific Reporting Limit
D - Secondary dilution perfomed
Q - Surrogate recovery limit exceedance
SQ - SRM percent difference exceeded
I - Matrix Interference
NC - Not calibrated
Note: Extracted by EPA 5030 (Purge and Trap).

US631
030619-SRM.D

Submitted by,
Pace Energy Services, LLC

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20818 44th West Suite 190
Lynnwood, WA 98036

Lab ID:	**10ppb C3-C12 CCV**		
Collected:			
Received:			
Matrix:	**Water**		
Project:	**Shell Woodland**	**QC type:**	**CCV**
Project #:	**34033821**		
Collected by:		**Q Method:**	**030519.M**

CONSTITUENTS	AMOUNT ng/ml	Calc. ng/ml	Dev. %	RRF Q
Isopentane (2-Methylbutane)	24.2	20.0	21.0	
1-Pentene	24.1	20.1	20.1	
2-Methyl-1-butene	24.1	19.1	26.6	
Pentane (nC5)	36.2	29.4	23.2	
trans-2-pentene	24.2	21.1	14.8	
cis-2-pentene	36.3	31.4	15.5	
Cyclopentane	12.1	10.2	18.6	
2,3-Dimethylbutane	12.0	10.3	17.5	
2-Methylpentane	24.1	19.8	21.5	
Methyl-tert-butyl ether (MTBE)	12.0	10.6	13.4	
3-Methylpentane	36.3	31.7	14.3	
1-Hexene	36.0	32.3	11.4	
Hexane (nC6)	36.0	22.9	57.2	CQ
Di-isopropyl ether (DIPE)	24.1	18.0	34.0	
Ethyl-tert-butyl ether (ETBE)	12.1	11.8	2.6	
Methylcyclopentane	24.0	22.7	5.9	
2,4-Dimethylpentane	36.2	34.2	5.8	
1,2-Dichloroethane (EDC)	36.2	32.4	11.7	
Benzene	24.0	22.3	7.4	
Thiophene	36.1	33.8	6.9	
Cyclohexane	36.1	34.4	4.8	
2-Methylhexane	36.2	38.9	7.1	
2,3-Dimethylpentane	36.3	36.4	0.3	
Tert-amyl methyl ether (TAME)	24.2	25.4	4.6	
3-Methylhexane	35.9	36.2	1.0	
2,2,4-Trimethylpentane (isooctane)	36.1	34.3	5.2	
1-Heptene	36.2	36.4	0.6	
Heptane (nC7)	36.1	38.8	6.9	
Methylcyclohexane	36.2	37.3	3.0	
2,5-Dimethylhexane	36.2	33.2	9.2	
2,2,3-Trimethylpentane	12.0	11.5	4.5	
2,4-Dimethylhexane	30.0	31.0	3.3	
2,3,4-Trimethylpentane	36.1	35.6	1.5	

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Lab ID: **10ppb C3-C12 CCV**
Collected:
Received:
Matrix: **Water**

Project: **Shell Woodland**
Project #: **34033821**
Collected by:

QC type: **CCV**
Q Method: **030519.M**

CONSTITUENTS	AMOUNT ng/ml	Calc. ng/ml	Dev. %	RRF Q
2,3,3-Trimethylpentane	36.2	34.9	3.7	
Toluene	12.1	12.1	0.2	
2-Methylthiophene	36.2	37.3	3.1	
2,3-Dimethylhexane	37.0	36.7	0.8	
3-Methylthiophene	36.1	36.2	0.2	
2-Methylheptane	36.2	38.6	6.3	
3-Methylheptane	36.2	51.2	29.2	
3-Ethylhexane	36.1	41.5	13.1	
1,2-Dibromoethane (EDB)	36.1	32.9	9.7	
1-Octene	36.1	41.4	12.7	
Octane (nC8)	36.2	38.5	6.0	
Ethylbenzene	12.0	12.6	4.2	
2-Ethylthiophene	24.2	24.4	0.9	
m-Xylene	12.0	11.6	3.5	
p-Xylene	12.1	12.0	1.1	
Styrene	12.0	12.1	0.6	
o-Xylene	12.1	12.3	2.2	
1-Nonene	36.2	40.3	10.2	
Nonane (nC9)	36.1	37.6	3.9	
Isopropylbenzene (cumene)	12.1	12.6	3.8	
n-Propylbenzene	12.0	12.0	0.1	
1-Methyl-3-ethylbenzene	12.0	12.2	0.9	
1-Methyl-4-ethylbenzene	12.0	12.7	5.6	
1,3,5-Trimethylbenzene (mesitylene)	12.0	12.3	2.0	
1-Methyl-2-ethylbenzene	12.0	12.4	2.8	
1,2,4-Trimethylbenzene	12.0	12.2	1.2	
1-Decene	36.1	38.4	6.0	
Decane (nC10)	36.1	28.2	28.3	
sec-Butylbenzene	12.0	12.6	4.2	
1-Methyl-3-isopropylbenzene (m-cymene)	12.0	12.3	1.7	
1-Methyl-4-isopropylbenzene (p-cymene)	12.0	13.3	9.1	

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Lab ID: **10ppb C3-C12 CCV**
Collected:
Received:
Matrix: **Water**

Project: **Shell Woodland**
Project #: **34033821**
Collected by:

QC type: **CCV**
Q Method: **030519.M**

CONSTITUENTS	AMOUNT ng/ml	Calc. ng/ml	Dev. %	RRF Q
Indane	12.0	12.4	2.7	
Indene	12.0	11.3	6.7	
1-Methyl-2-isopropybenzene (o-cymene)	12.0	12.4	3.4	
1-Methyl-3-propylbenzene	12.0	12.2	1.3	
1-Methyl-4-propylbenzene	12.1	12.9	6.6	
n-Butylbenzene	12.0	12.9	7.1	
1,3-Dimethyl-5-ethylbenzene	12.0	12.6	4.9	
1,2,diethylbenzene	12.0	11.8	2.2	
1-Methyl-2-propylbenzene	12.1	12.5	3.2	
1,4-Dimethyl-2-ethylbenzene	12.1	12.4	2.9	
1,3-Dimethyl-4-ethylbenzene	12.0	12.4	3.1	
1,2-Dimethyl-4-ethylbenzene	12.1	12.4	3.0	
1,2-Dimethyl-3-ethylbenzene	12.1	12.6	4.0	
Undecane (nC11)	24.1	18.5	30.1	
1,2,4,5-Tetramethylbenzene	12.0	12.2	1.1	
n-Pentylbenzene	12.1	11.5	5.2	
Naphthalene	12.1	13.2	8.0	
Benzothiophene	12.0	13.0	7.3	
Dodecane (nC12)	24.2	18.8	28.7	
2-Methylnaphthalene	12.0	11.3	6.6	
1-Methylnaphthalene	12.1	12.0	0.8	
Benzene d-6 (RS)	20.0	18.7	7.2	
Toluene-d8 (RS)	20.0	20.1	0.5	
Ethylbenzene d10 (RS)	20.0	21.3	6.0	

CQ - Continuing calibration % difference exceeded
Note: Extracted by EPA 5030 (Purge and Trap).

US631
030619-CCV.D

Submitted by,
Pace Energy Services, LLC

(C8-C40) Semi-Quantitative Molecular Characterization
by GC/MS - full scan mode
TIC, n-Alkanes, Iso-Alkanes, Isoprenoids, Alkylcyclohexanes,
C4-monoaromatics, Bicyclanes, Terpanes, Steranes

C8-C40 - Semi Quantitative Hydrocarbons Characterization
by GC/MS - full scan mode

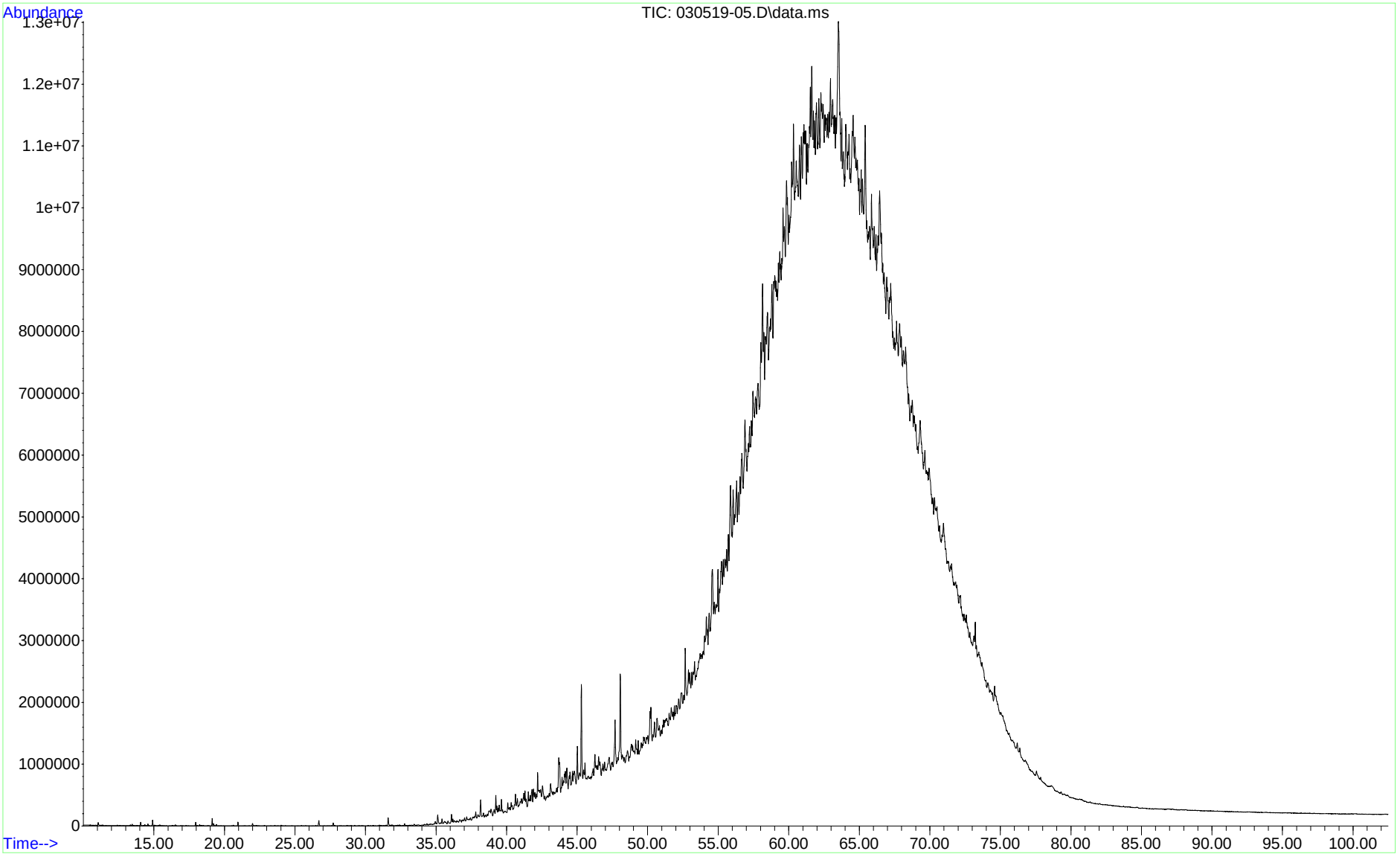
Mass Chromatograms

ION (m/z)	COMPOUND CLASS
TIC	All Compounds
85	n-Paraffins
113	Isoparaffins
83	Alkylcyclohexanes
134	C3-C4 Monoaromatics
123	Bicyclanes
191	Terpanes
217	Steranes
253	Monoaromatice Steranes
231	Triaromatic Steranes
Bar Diagram	Monoaromatic and Polyaromatic Hydrocarbon Distribution

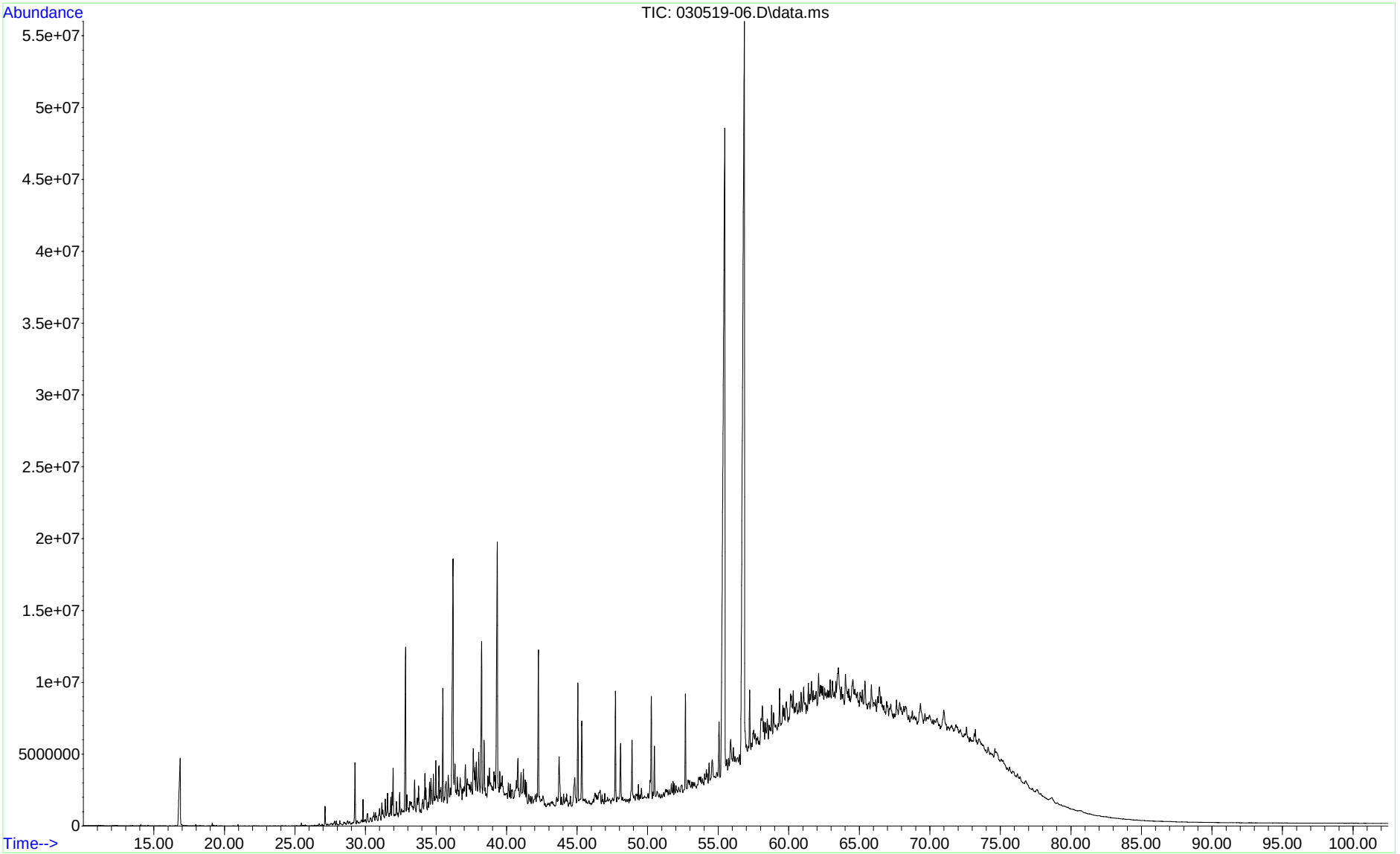
note: Chromatograms and data follow this cover page.

Submitted by,
Pace Analytical Energy Services

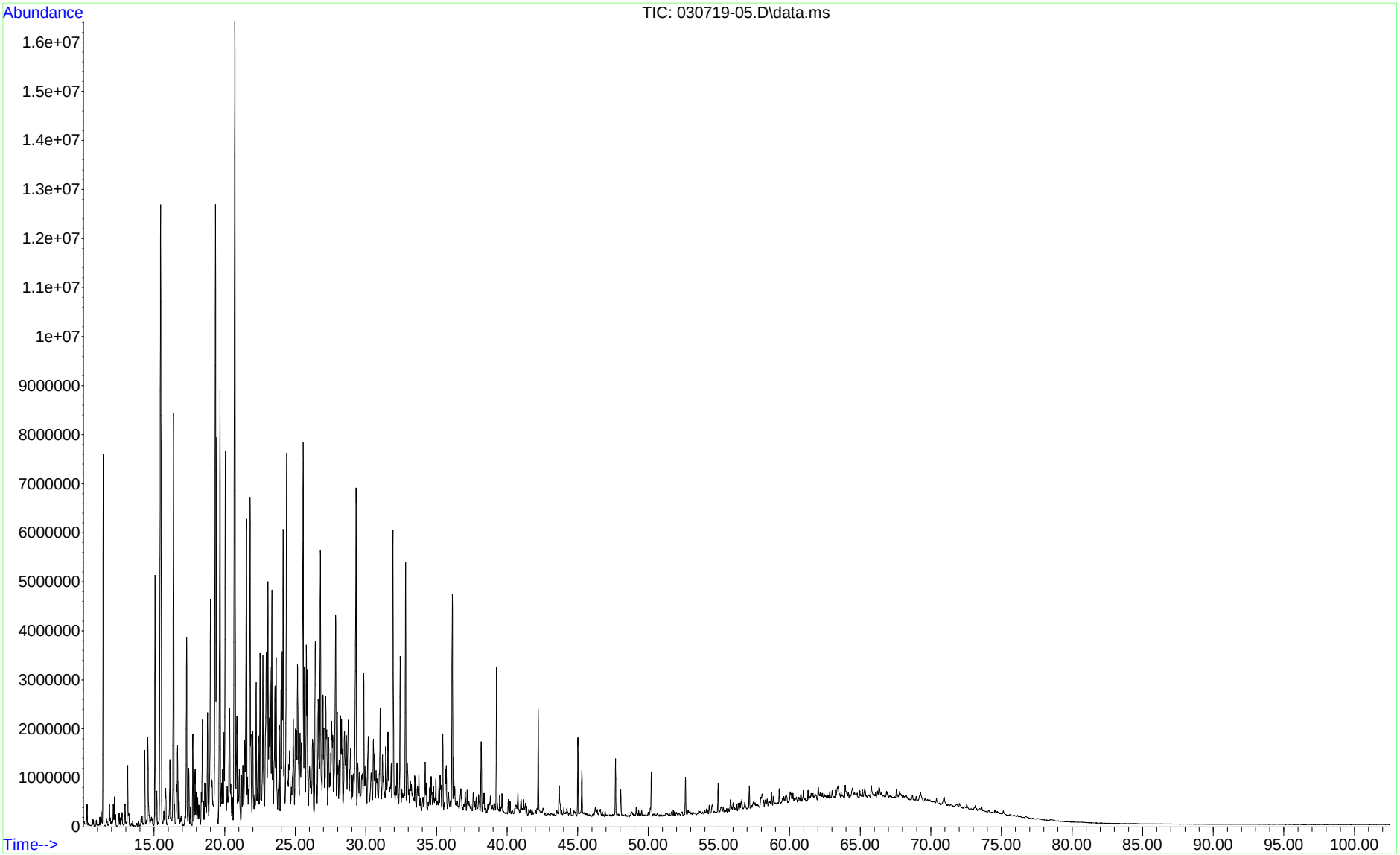
Sample Name: 29604-1 [P.060866.022619.DT.SUMP]
Misc Info : 0.4578g 321-11-11



Sample Name: 29604-2 [P.060866.022619.DT.STAND PIPE]
Misc Info : 0.4428g 321-11-12



Sample Name: 29604-3 [P.060866.022619.DT.MW10] 1/10
Misc Info : 0.4252g 321-11-13



Chromatogram Key & Numerical Results: 85 m/z n-Paraffins

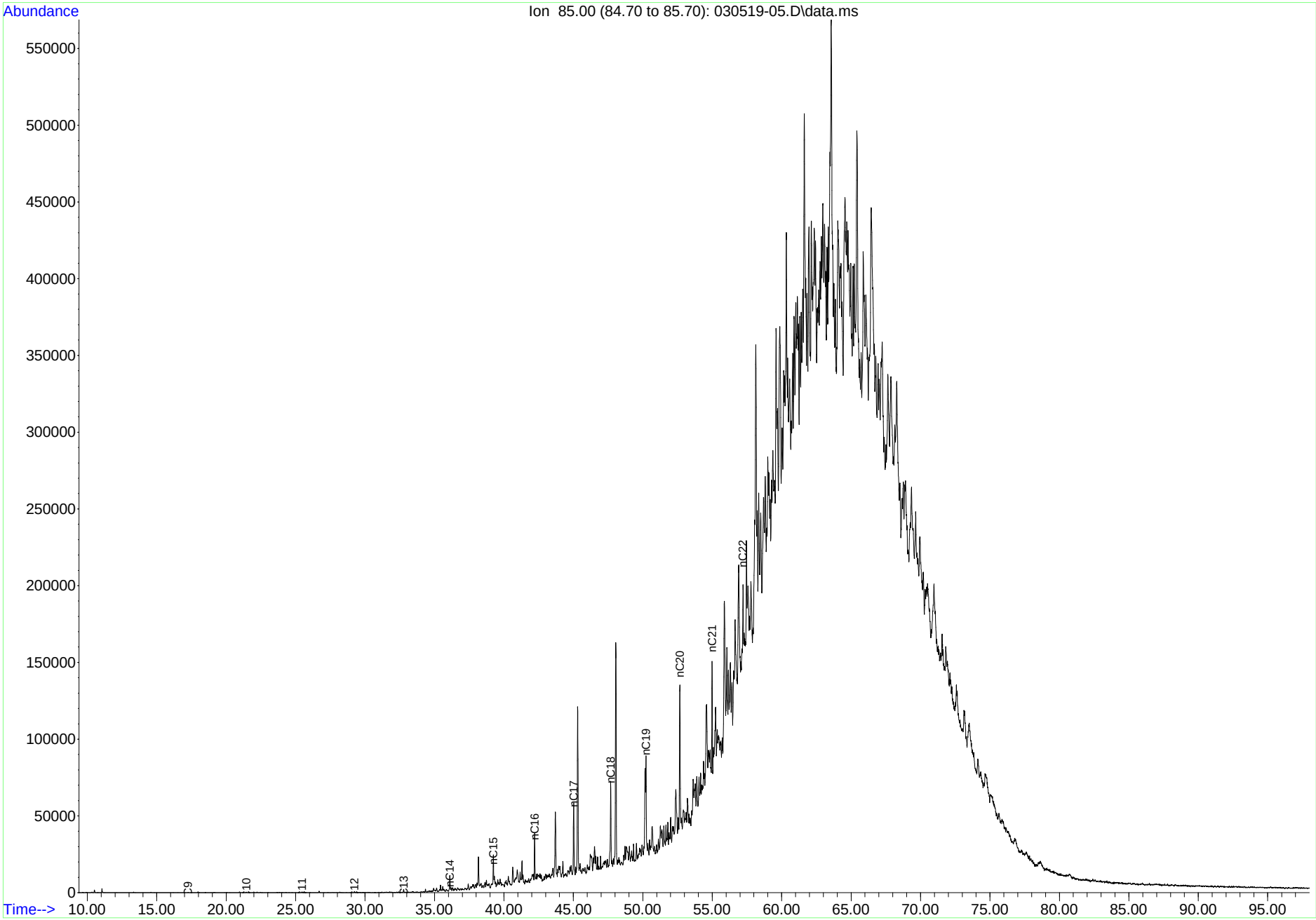
Project Manager:	Brian Peters	Lab ID:	29604-1
Client:	GHD	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.SUMP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (85 m/z)
n-Octane	nC8	85	ND	ND	ND
n-Nonane	nC9	85	17.3	365.0	0.1%
n-Decane	nC10	85	21.5	415.0	0.1%
n-Undecane	nC11	85	25.5	574.0	0.1%
n-Dodecane	nC12	85	29.2	673.0	0.2%
n-Tridecane	nC13	85	32.8	1923.0	0.4%
n-Tetradecane	nC14	85	36.1	10463.0	2.4%
n-Pentadecane	nC15	85	39.2	19157.0	4.3%
n-Hexadecane	nC16	85	42.2	30866.0	7.0%
n-Heptadecane	nC17	85	45.0	46920.0	10.6%
n-Octadecane	nC18	85	47.7	56016.0	12.7%
n-Nonadecane	nC19	85	50.2	62811.0	14.2%
n-icosane	nC20	85	52.7	94120.0	21.3%
n-Henicosane	nC21	85	55.0	73144.0	16.5%
n-Docosane	nC22	85	57.2	44613.0	10.1%
n-Tricosane	nC23	85	ND	ND	ND
n-Tetracosane	nC24	85	ND	ND	ND
n-Pentacosane	nC25	85	ND	ND	ND
n-Hexacosane	nC26	85	ND	ND	ND
n-Heptacosane	nC27	85	ND	ND	ND
n-Octacosane	nC28	85	ND	ND	ND
n-Nonacosane	nC29	85	ND	ND	ND
n-Triacontane	nC30	85	ND	ND	ND
n-Hentriacontane	nC31	85	ND	ND	ND
n-Dotriacontane	nC32	85	ND	ND	ND
n-Tritriacontane	nC33	85	ND	ND	ND
n-Tetratriacontane	nC34	85	ND	ND	ND
n-Pentatriacontane	nC35	85	ND	ND	ND
n-Hexatriacontane	nC36	85	ND	ND	ND
n -Heptatriacontane	nC37	85	ND	ND	ND
n -Octatriacontane	nC38	85	ND	ND	ND
n -Nonatriacontane	nC39	85	ND	ND	ND
n-Tetracontane	nC40	85	ND	ND	ND

0.4578g 321-11-11
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-1 [P.060866.022619.DT.SUMP]
0.4578g 321-11-11



Chromatogram Key & Numerical Results: 85 m/z n-Paraffins

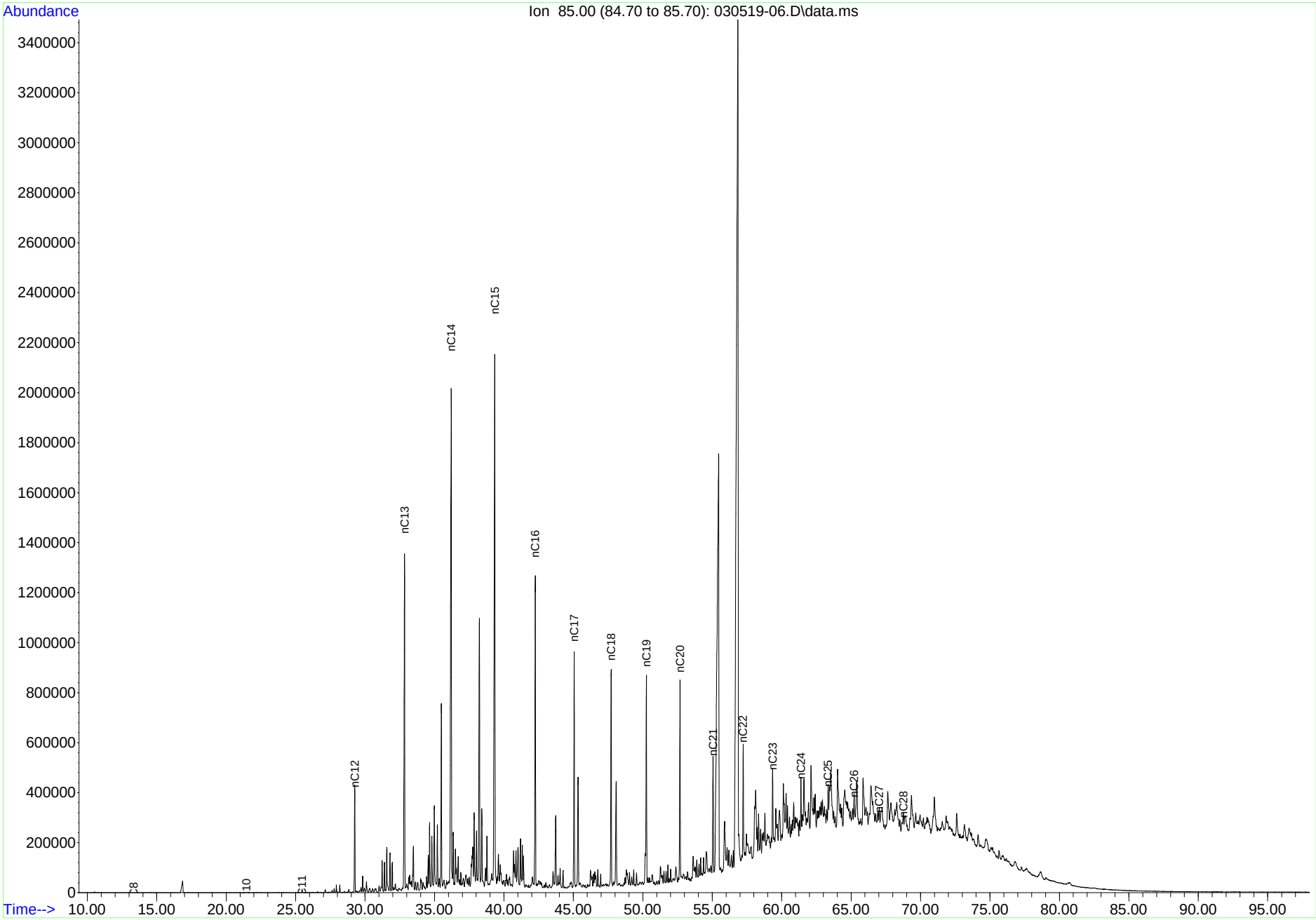
Project Manager:	Brian Peters	Lab ID:	29604-2
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.STAND PIPE
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (85 m/z)
n-Octane	nC8	85	13.3	406.0	0.0%
n-Nonane	nC9	85	ND	ND	ND
n-Decane	nC10	85	21.5	912.0	0.0%
n-Undecane	nC11	85	25.5	14326.0	0.1%
n-Dodecane	nC12	85	29.3	430173.0	3.5%
n-Tridecane	nC13	85	32.8	1340010.0	10.8%
n-Tetradecane	nC14	85	36.2	1979120.0	16.0%
n-Pentadecane	nC15	85	39.3	2117770.0	17.1%
n-Hexadecane	nC16	85	42.3	1239540.0	10.0%
n-Heptadecane	nC17	85	45.1	942608.0	7.6%
n-Octadecane	nC18	85	47.7	867640.0	7.0%
n-Nonadecane	nC19	85	50.3	832587.0	6.7%
n-icosane	nC20	85	52.7	799488.0	6.5%
n-Henicosane	nC21	85	55.1	465849.0	3.8%
n-Docosane	nC22	85	57.2	454208.0	3.7%
n-Tricosane	nC23	85	59.4	293132.0	2.4%
n-Tetracosane	nC24	85	61.4	213343.0	1.7%
n-Pentacosane	nC25	85	63.3	145259.0	1.2%
n-Hexacosane	nC26	85	65.2	116515.0	0.9%
n-Heptacosane	nC27	85	67.0	62989.0	0.5%
n-Octacosane	nC28	85	68.8	46848.0	0.4%
n-Nonacosane	nC29	85	ND	ND	ND
n-Triacontane	nC30	85	ND	ND	ND
n-Hentriacontane	nC31	85	ND	ND	ND
n-Dotriacontane	nC32	85	ND	ND	ND
n-Tritriacontane	nC33	85	ND	ND	ND
n-Tetratriacontane	nC34	85	ND	ND	ND
n-Pentatriacontane	nC35	85	ND	ND	ND
n-Hexatriacontane	nC36	85	ND	ND	ND
n -Heptatriacontane	nC37	85	ND	ND	ND
n -Octatriacontane	nC38	85	ND	ND	ND
n -Nonatriacontane	nC39	85	ND	ND	ND
n-Tetracontane	nC40	85	ND	ND	ND

0.4428g 321-11-12
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-2 [P.060866.022619.DT.STAND PIPE]
0.4428g 321-11-12



Chromatogram Key & Numerical Results: 85 m/z n-Paraffins

Project Manager: Brian Peters
Client: GHD Inc

Address: 20818 44th Ave W, Ste 190
Lynnwood, WA 98036

Project: Shell Woodland
Project #: 60866
Collected by: D.Trudeau

Lab ID: 29604-3
Collected: 2/26/2019

Received: 3/1/2019
Matrix: Product

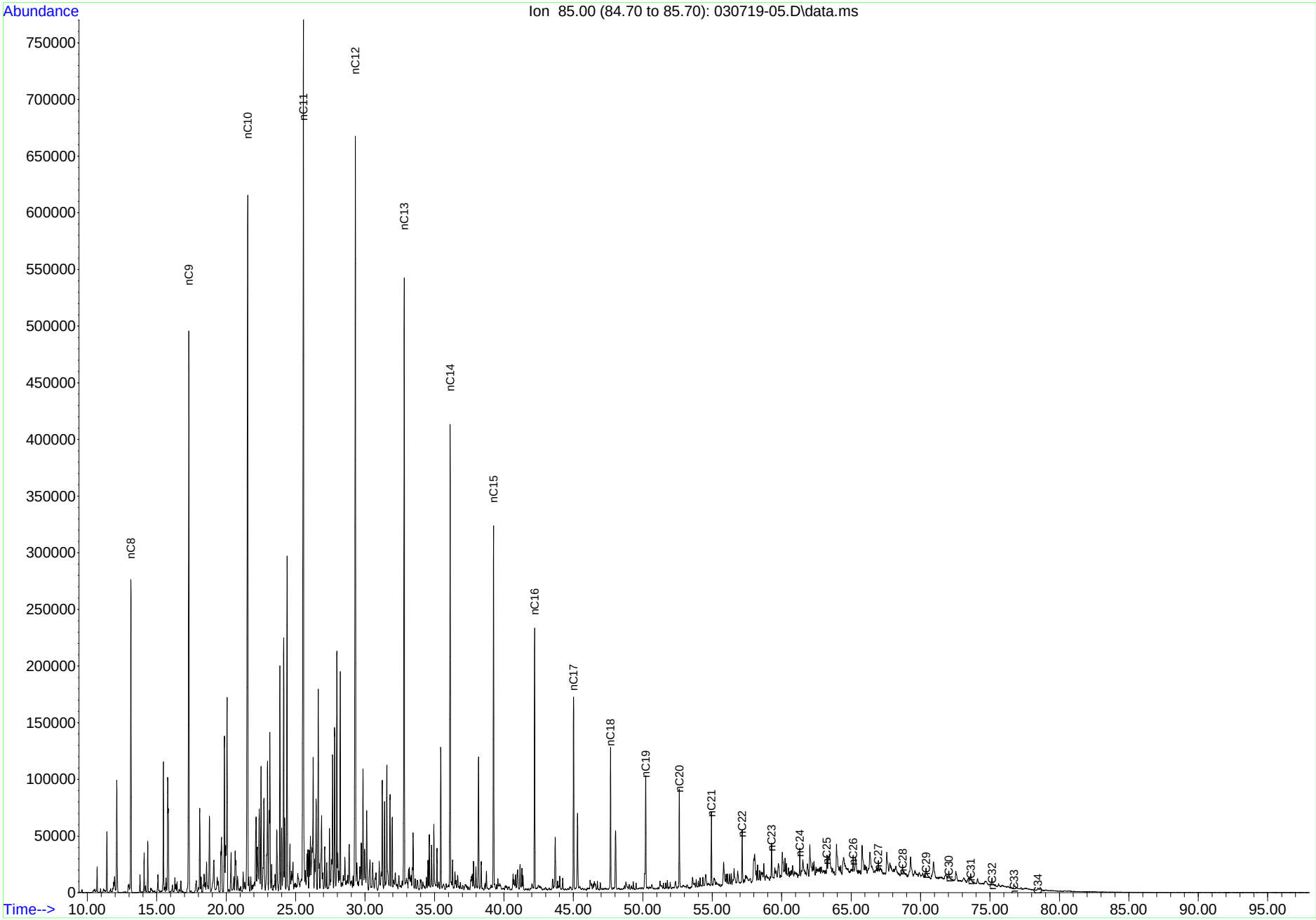
Client ID: P.060866.022619.DT.MW10
Analyzed: 3/7/2019
Q Method: FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (85 m/z)
n-Octane	nC8	85	13.1	276352.0	5.5%
n-Nonane	nC9	85	17.3	495744.0	9.8%
n-Decane	nC10	85	21.6	613779.0	12.2%
n-Undecane	nC11	85	25.6	760628.0	15.1%
n-Dodecane	nC12	85	29.3	662101.0	13.2%
n-Tridecane	nC13	85	32.8	536478.0	10.7%
n-Tetradecane	nC14	85	36.1	408218.0	8.1%
n-Pentadecane	nC15	85	39.3	319254.0	6.3%
n-Hexadecane	nC16	85	42.2	229789.0	4.6%
n-Heptadecane	nC17	85	45.0	170235.0	3.4%
n-Octadecane	nC18	85	47.7	125683.0	2.5%
n-Nonadecane	nC19	85	50.2	99145.0	2.0%
n-icosane	nC20	85	52.6	86790.0	1.7%
n-Henicosane	nC21	85	54.9	65499.0	1.3%
n-Docosane	nC22	85	57.2	46638.0	0.9%
n-Tricosane	nC23	85	59.3	31533.0	0.6%
n-Tetracosane	nC24	85	61.3	25167.0	0.5%
n-Pentacosane	nC25	85	63.3	16504.0	0.3%
n-Hexacosane	nC26	85	65.2	14339.0	0.3%
n-Heptacosane	nC27	85	67.0	9776.0	0.2%
n-Octacosane	nC28	85	68.7	7916.0	0.2%
n-Nonacosane	nC29	85	70.4	7503.0	0.1%
n-Triacontane	nC30	85	72.0	6756.0	0.1%
n-Hentriacontane	nC31	85	73.6	6844.0	0.1%
n-Dotriacontane	nC32	85	75.1	5741.0	0.1%
n-Tritriacontane	nC33	85	76.7	4085.0	0.1%
n-Tetratriacontane	nC34	85	78.5	2094.0	0.0%
n-Pentatriacontane	nC35	85	ND	ND	ND
n-Hexatriacontane	nC36	85	ND	ND	ND
n -Heptatriacontane	nC37	85	ND	ND	ND
n -Octatriacontane	nC38	85	ND	ND	ND
n -Nonatriacontane	nC39	85	ND	ND	ND
n-Tetracontane	nC40	85	ND	ND	ND

0.4252g 321-11-13
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-3 [P.060866.022619.DT.MW10] 1/10
0.4252g 321-11-13



Chromatogram Key & Numerical Results: 113 m/z Isoparaffins

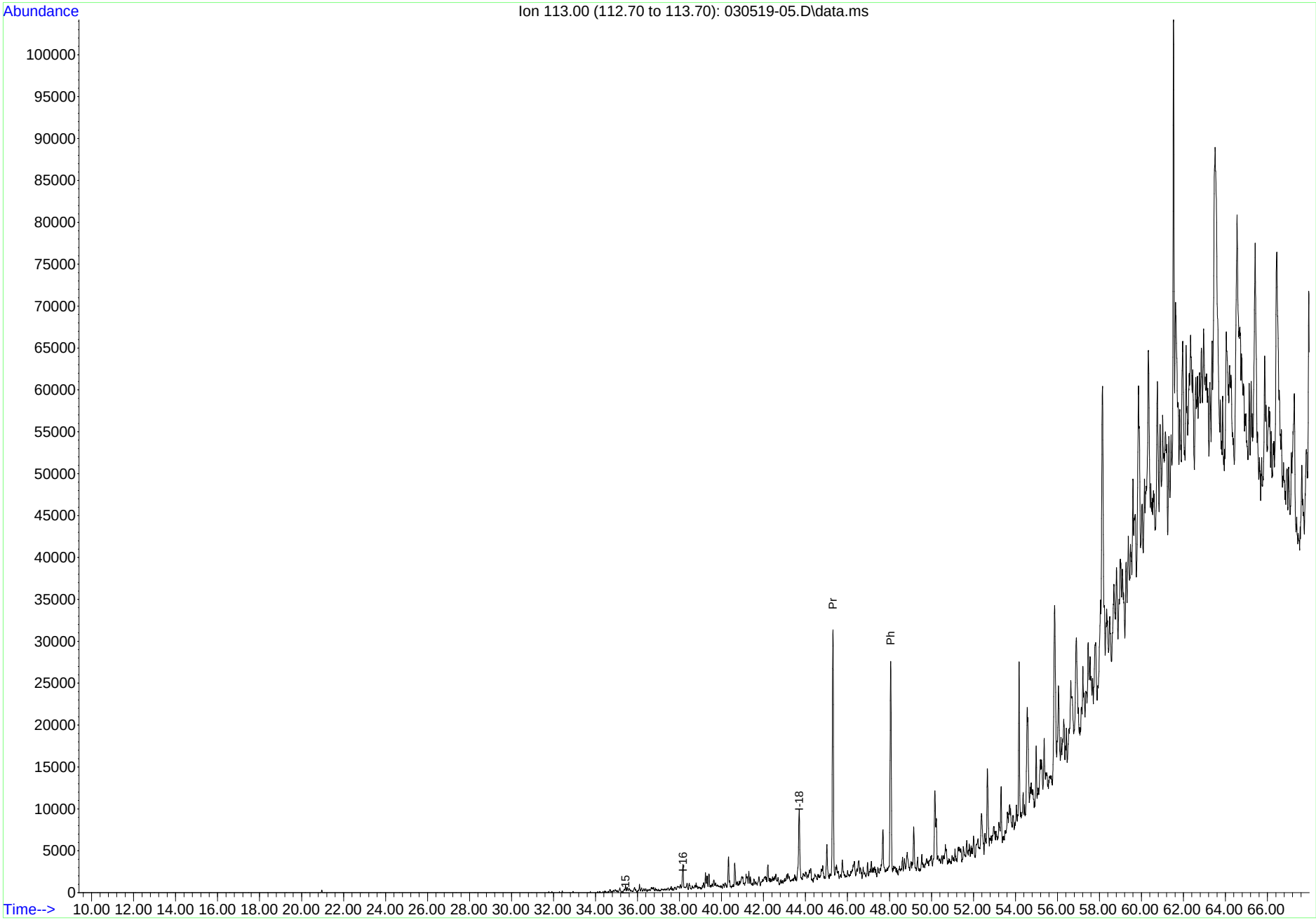
Project Manager:	Brian Peters	Lab ID:	29604-1
Client:	GHD	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.SUMP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (113 m/z)
Iso-alkane w/ 9 Carbon Atoms	I-9	113	ND	ND	ND
Iso-alkane w/ 10 Carbon Atoms	I-10	113	ND	ND	ND
Iso-alkane w/ 11 Carbon Atoms	I-11	113	ND	ND	ND
Iso-alkane w/ 12 Carbon Atoms	I-12	113	ND	ND	ND
Iso-alkane w/ 13 Carbon Atoms	I-13	113	ND	ND	ND
Iso-alkane w/ 14 Carbon Atoms	I-14	113	ND	ND	ND
Farnesane (Isoprenoid - C15)	I-15	113	35.4	828.0	1.2%
Iso-alkane w/ 16 Carbon Atoms	I-16	113	38.2	2844.0	4.3%
Iso-alkane w/ 18 Carbon Atoms	I-18	113	43.7	8583.0	12.9%
Pristane (Isoprenoid - C19)	Pr	113	45.3	29348.0	44.0%
Phytane (Isoprenoid - C20)	Ph	113	48.1	25144.0	37.7%

0.4578g 321-11-11
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-1 [P.060866.022619.DT.SUMP]
0.4578g 321-11-11



Chromatogram Key & Numerical Results: 113 m/z Isoparaffins

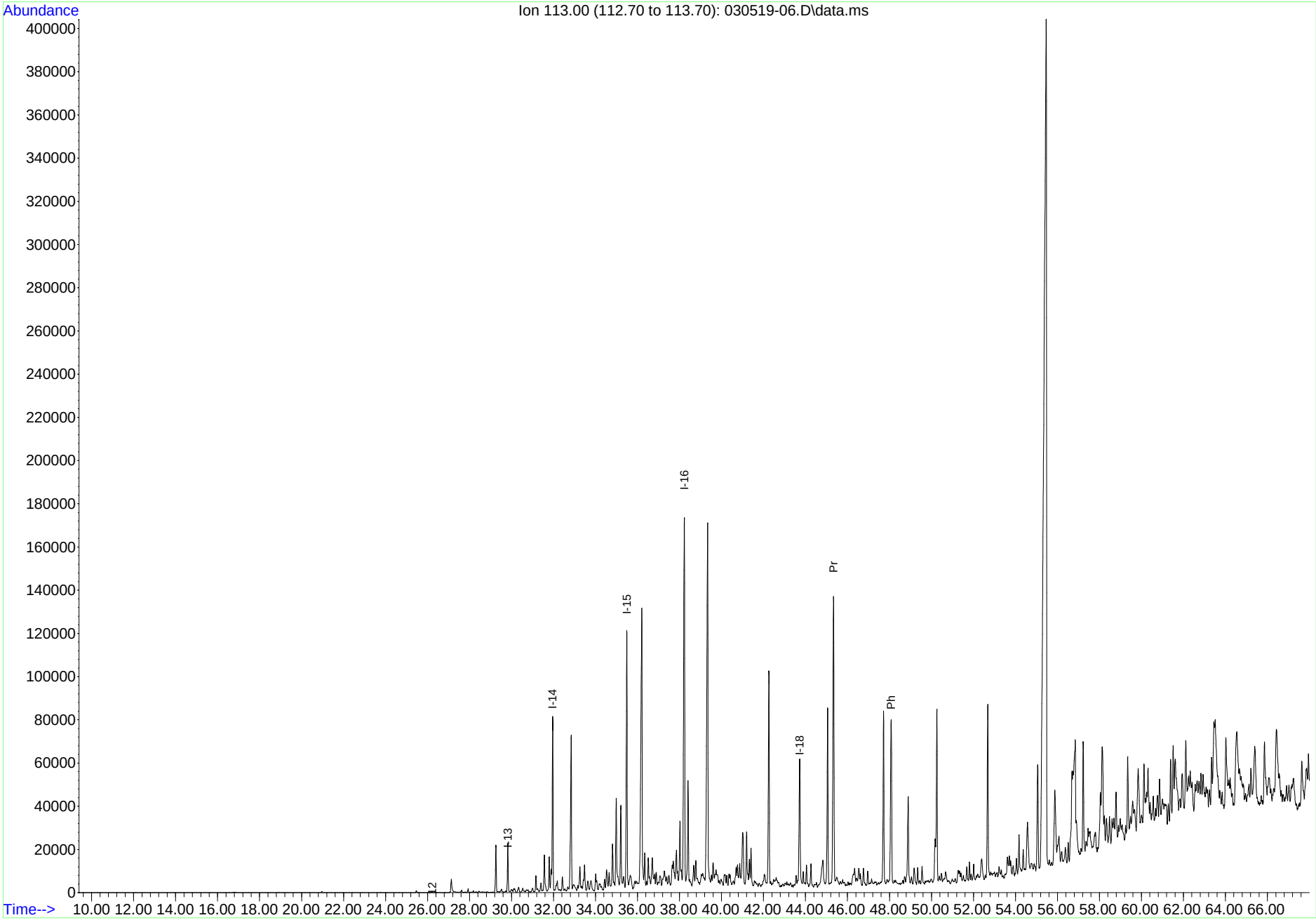
Project Manager:	Brian Peters	Lab ID:	29604-2
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.STAND PIPE
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (113 m/z)
Iso-alkane w/ 9 Carbon Atoms	I-9	113	ND	ND	ND
Iso-alkane w/ 10 Carbon Atoms	I-10	113	ND	ND	ND
Iso-alkane w/ 11 Carbon Atoms	I-11	113	ND	ND	ND
Iso-alkane w/ 12 Carbon Atoms	I-12	113	26.2	323.0	0.0%
Iso-alkane w/ 13 Carbon Atoms	I-13	113	29.8	22707.0	3.5%
Iso-alkane w/ 14 Carbon Atoms	I-14	113	32.0	80519.0	12.3%
Farnesane (Isoprenoid - C15)	I-15	113	35.5	118906.0	18.1%
Iso-alkane w/ 16 Carbon Atoms	I-16	113	38.2	168416.0	25.6%
Iso-alkane w/ 18 Carbon Atoms	I-18	113	43.7	58132.0	8.8%
Pristane (Isoprenoid - C19)	Pr	113	45.3	132489.0	20.2%
Phytane (Isoprenoid - C20)	Ph	113	48.1	75672.0	11.5%

0.4428g 321-11-12
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-2 [P.060866.022619.DT.STAND PIPE]
0.4428g 321-11-12



Chromatogram Key & Numerical Results: 113 m/z Isoparaffins

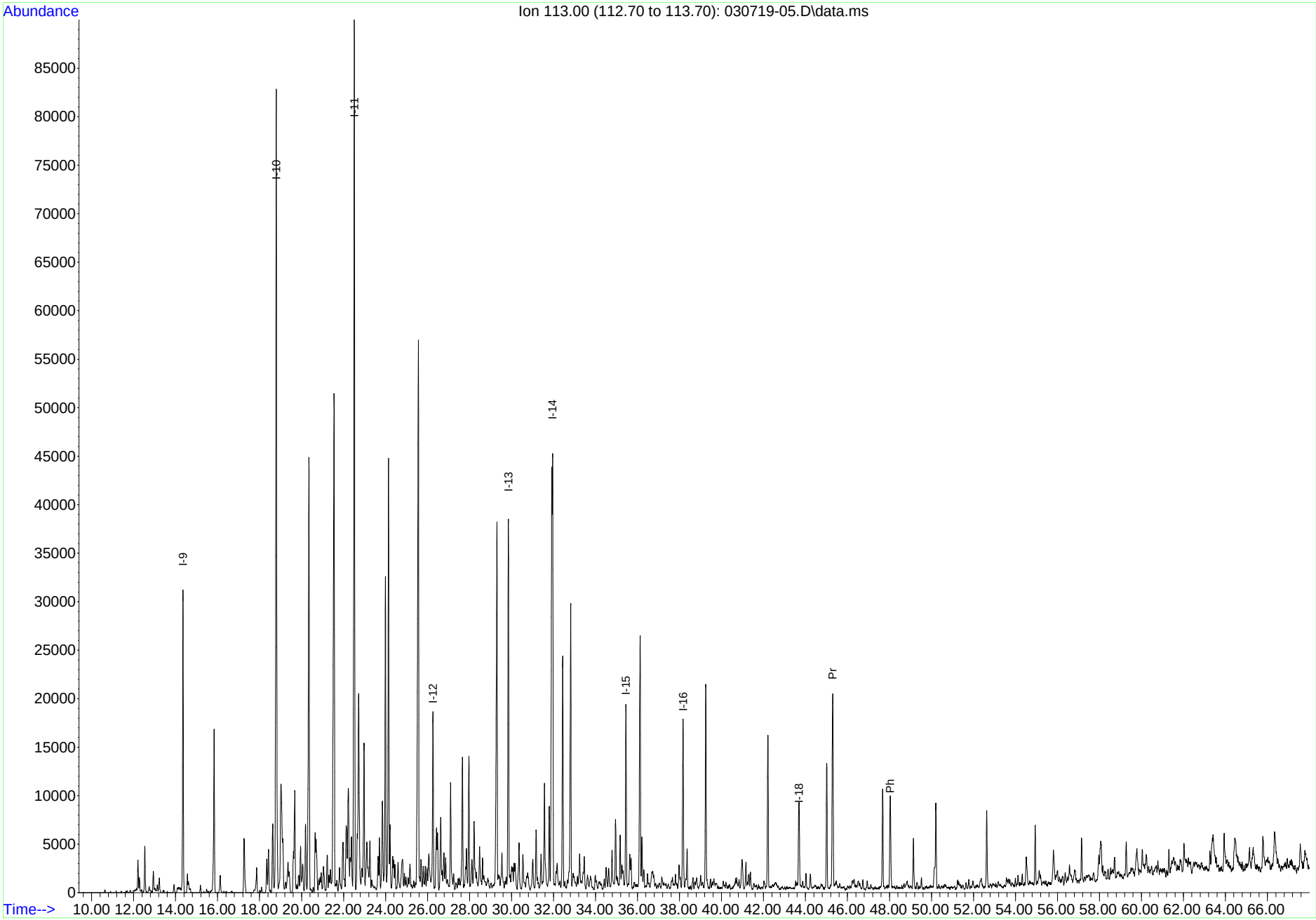
Project Manager:	Brian Peters	Lab ID:	29604-3
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste Lynnwood, WA 98036	Received: Matrix:	3/1/2019 Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.MW10
Project #:	60866	Analyzed:	3/7/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (113 m/z)
Iso-alkane w/ 9 Carbon Atoms	I-9	113	14.4	31240.0	8.3%
Iso-alkane w/ 10 Carbon Atoms	I-10	113	18.8	82442.0	21.8%
Iso-alkane w/ 11 Carbon Atoms	I-11	113	22.5	89692.0	23.7%
Iso-alkane w/ 12 Carbon Atoms	I-12	113	26.3	18258.0	4.8%
Iso-alkane w/ 13 Carbon Atoms	I-13	113	29.9	37651.0	10.0%
Iso-alkane w/ 14 Carbon Atoms	I-14	113	32.0	44302.0	11.7%
Farnesane (Isoprenoid - C15)	I-15	113	35.5	18796.0	5.0%
Iso-alkane w/ 16 Carbon Atoms	I-16	113	38.2	17414.0	4.6%
Iso-alkane w/ 18 Carbon Atoms	I-18	113	43.7	8625.0	2.3%
Pristane (Isoprenoid - C19)	Pr	113	45.3	19926.0	5.3%
Phytane (Isoprenoid - C20)	Ph	113	48.0	9489.0	2.5%

0.4252g 321-11-13
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-3 [P.060866.022619.DT.MW10] 1/10
0.4252g 321-11-13



Chromatogram Key & Numerical Results: 83 m/z Alkylcyclohexanes

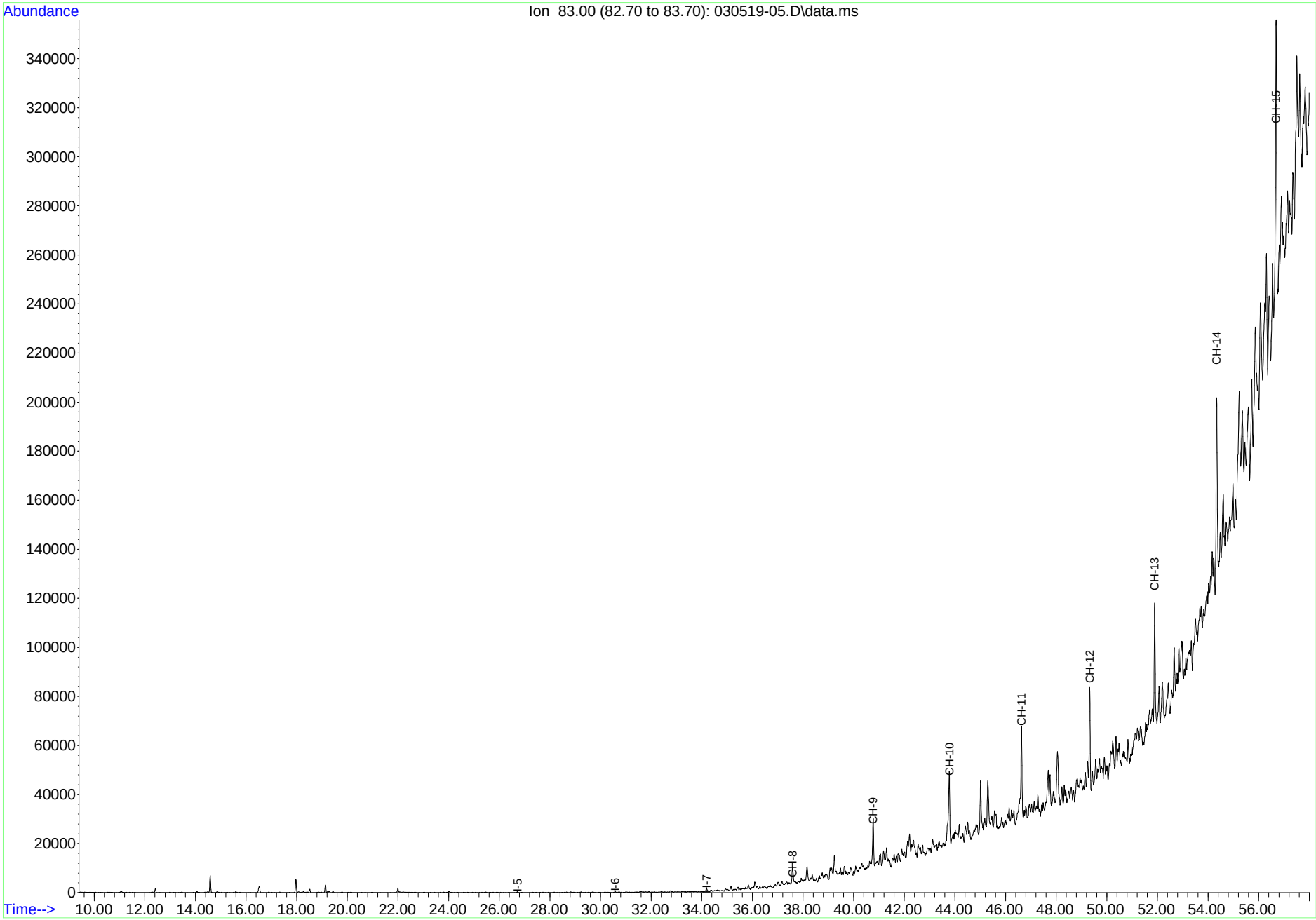
Project Manager:	Brian Peters	Lab ID:	29604-1
Client:	GHD	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.SUMP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (83 m/z)
Methylcyclohexane	CH-1	83	ND	ND	ND
Ethylcyclohexane	CH-2	83	ND	ND	ND
Propylcyclohexane	CH-3	83	ND	ND	ND
Butylcyclohexane	CH-4	83	ND	ND	ND
Pentylcyclohexane	CH-5	83	26.7	252.0	0.1%
Hexylcyclohexane	CH-6	83	30.6	347.0	0.1%
Heptylcyclohexane	CH-7	83	34.2	1214.0	0.5%
Octylcyclohexane	CH-8	83	37.6	6974.0	2.6%
Nonylcyclohexane	CH-9	83	40.8	19452.0	7.3%
Decylcyclohexane	CH-10	83	43.8	29784.0	11.1%
Undecylcyclohexane	CH-11	83	46.6	38635.0	14.4%
Dodecylcyclohexane	CH-12	83	49.3	42056.0	15.7%
Tridecylcyclohexane	CH-13	83	51.9	49104.0	18.3%
Tetradecylcyclohexane	CH-14	83	54.3	80280.0	29.9%

0.4578g 321-11-11
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-1 [P.060866.022619.DT.SUMP]
0.4578g 321-11-11



Chromatogram Key & Numerical Results: 83 m/z Alkylcyclohexanes

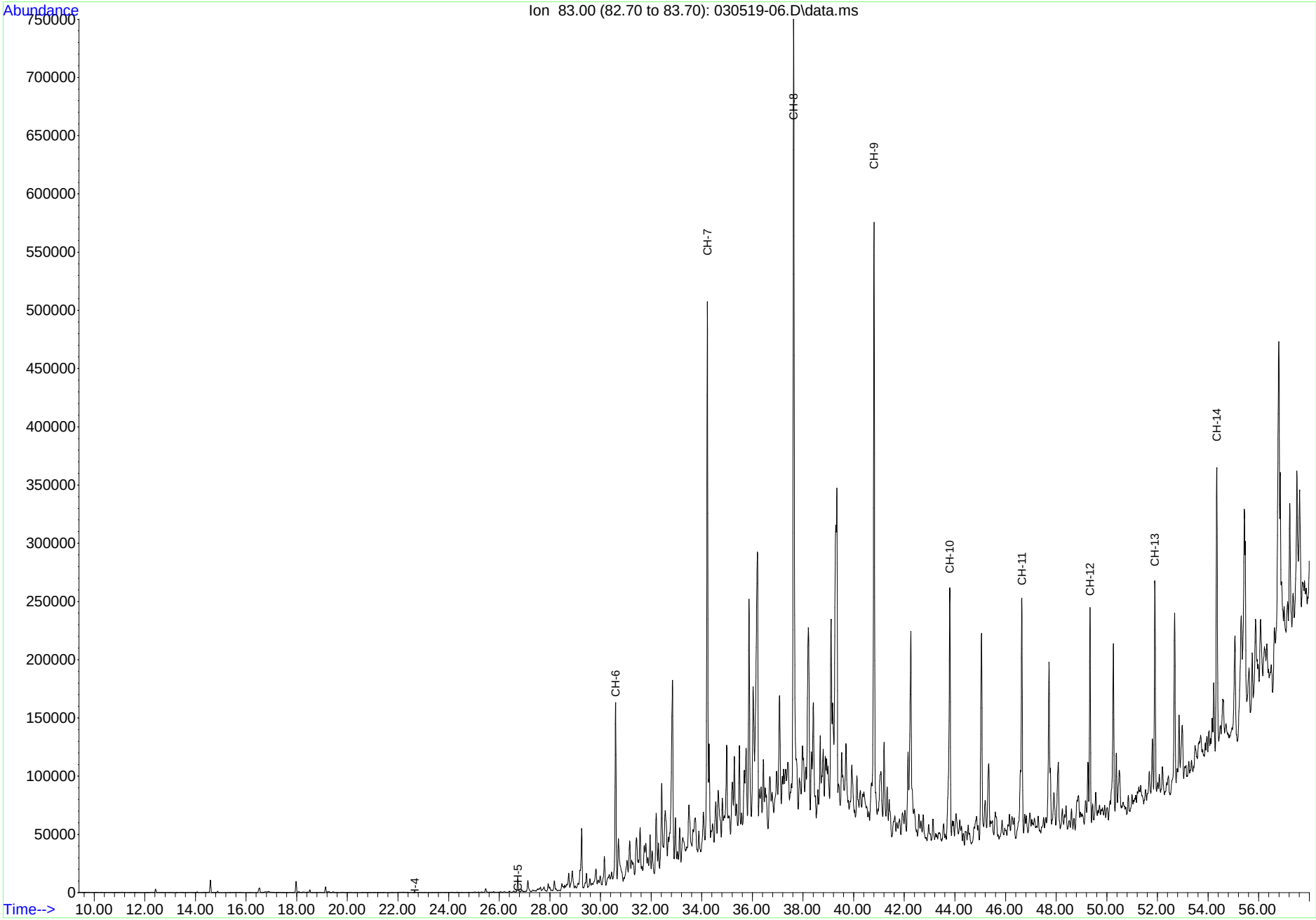
Project Manager:	Brian Peters	Lab ID:	29604-2
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.STAND PIPE
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (83 m/z)
Methylcyclohexane	CH-1	83	ND	ND	ND
Ethylcyclohexane	CH-2	83	ND	ND	ND
Propylcyclohexane	CH-3	83	ND	ND	ND
Butylcyclohexane	CH-4	83	22.7	891.0	0.0%
Pentylcyclohexane	CH-5	83	26.7	10899.0	0.4%
Hexylcyclohexane	CH-6	83	30.6	151466.0	5.3%
Heptylcyclohexane	CH-7	83	34.2	463066.0	16.3%
Octylcyclohexane	CH-8	83	37.6	660024.0	23.3%
Nonylcyclohexane	CH-9	83	40.8	509255.0	18.0%
Decylcyclohexane	CH-10	83	43.8	216383.0	7.6%
Undecylcyclohexane	CH-11	83	46.6	206536.0	7.3%
Dodecylcyclohexane	CH-12	83	49.3	184528.0	6.5%
Tridecylcyclohexane	CH-13	83	51.9	187337.0	6.6%
Tetradecylcyclohexane	CH-14	83	54.3	243592.0	8.6%

0.4428g 321-11-12
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-2 [P.060866.022619.DT.STAND PIPE]
0.4428g 321-11-12



Chromatogram Key & Numerical Results: 83 m/z Alkylcyclohexanes

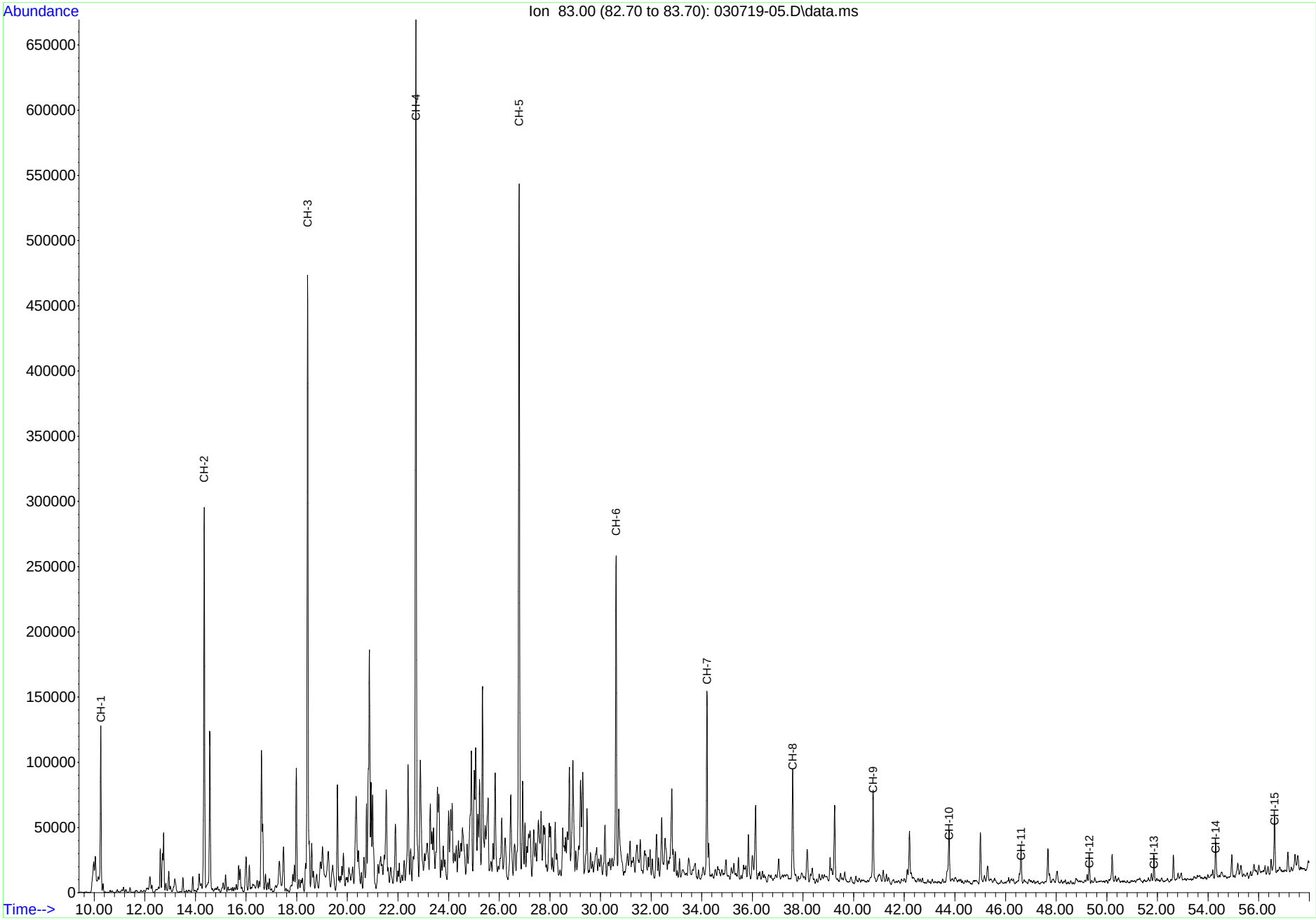
Project Manager:	Brian Peters	Lab ID:	29604-3
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.MW10
Project #:	60866	Analyzed:	3/7/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (83 m/z)
Methylcyclohexane	CH-1	83	10.3	126211.0	4.6%
Ethylcyclohexane	CH-2	83	14.4	292253.0	10.7%
Propylcyclohexane	CH-3	83	18.4	454800.0	16.7%
Butylcyclohexane	CH-4	83	22.7	657113.0	24.1%
Pentylcyclohexane	CH-5	83	26.8	526688.0	19.3%
Hexylcyclohexane	CH-6	83	30.6	241313.0	8.8%
Heptylcyclohexane	CH-7	83	34.2	142389.0	5.2%
Octylcyclohexane	CH-8	83	37.6	84487.0	3.1%
Nonylcyclohexane	CH-9	83	40.8	70179.0	2.6%
Decylcyclohexane	CH-10	83	43.8	40251.0	1.5%
Undecylcyclohexane	CH-11	83	46.6	26656.0	1.0%
Dodecylcyclohexane	CH-12	83	49.3	21646.0	0.8%
Tridecylcyclohexane	CH-13	83	51.9	19545.0	0.7%
Tetradecylcyclohexane	CH-14	83	54.3	27794.0	1.0%

0.4252g 321-11-13
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-3 [P.060866.022619.DT.MW10] 1/10
0.4252g 321-11-13



Chromatogram Key & Numerical Results: 134 m/z C3-C4 Monoaromatics

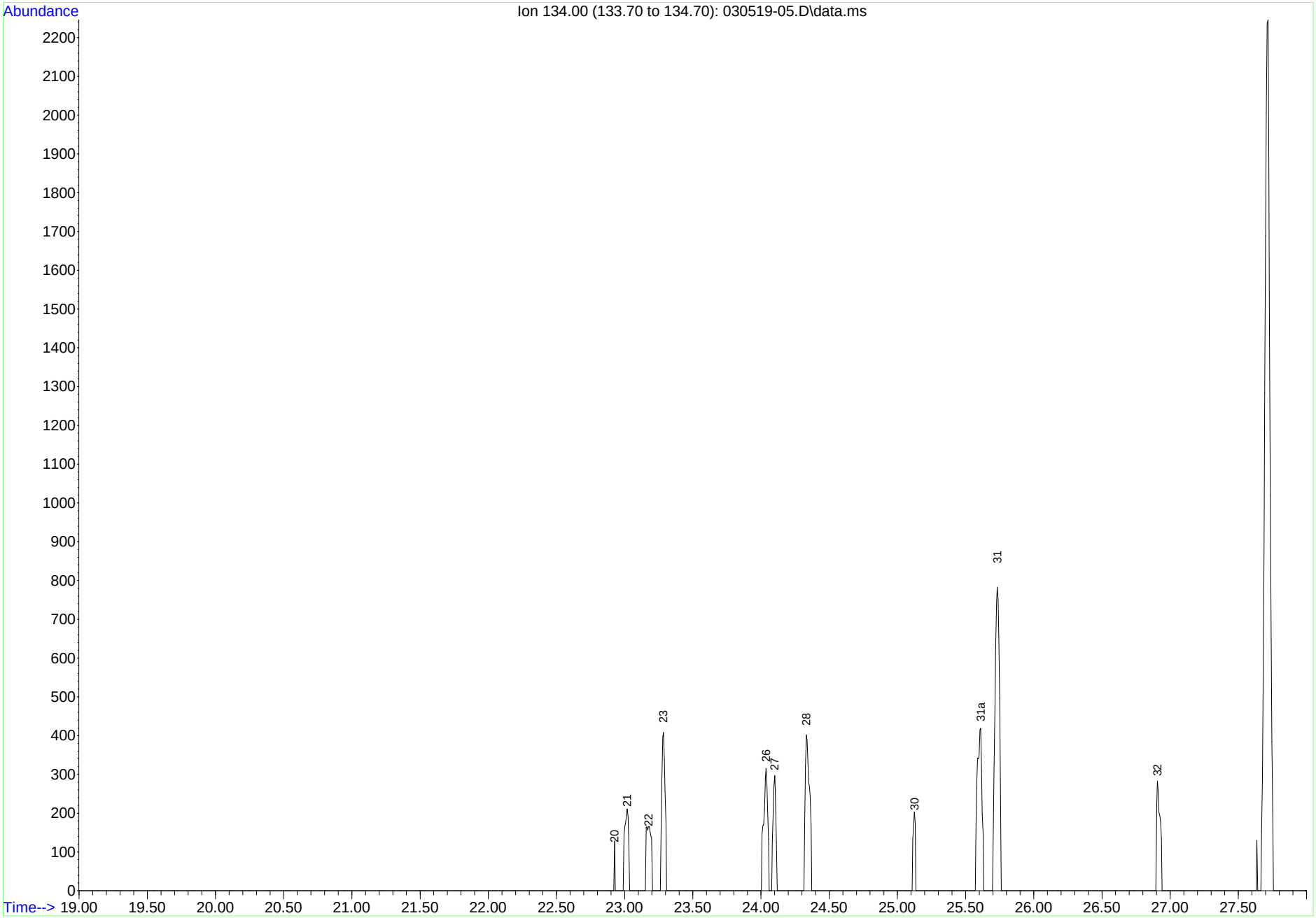
Project Manager:	Brian Peters	Lab ID:	29604-1
Client:	GHD	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.SUMP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (134 m/z)
Sec-Butylbenzene	16	134	ND	ND	ND
1-Methyl-3-Isopropylbenzene	17	134	ND	ND	ND
1-Methyl-4-Isopropylbenzene	18	134	ND	ND	ND
1-Methyl-2-Isopropylbenzene	19	134	ND	ND	ND
1,3-Diethylbenzene	20	134	22.9	128.0	3.5%
1-Methyl-3-Propylbenzene	21	134	23.0	211.0	5.8%
Butylbenzene	22	134	23.2	166.0	4.6%
1,3-Diethyl-5-Ethylbenzene	23	134	23.3	408.0	11.3%
1,2-Diethylbenzene	24	134	ND	ND	ND
1-Methyl-2-Propylbenzene	25	134	ND	ND	ND
1,4-Dimethyl-2-Ethylbenzene	26	134	24.0	316.0	8.7%
1,3-Dimethyl-4-Ethylbenzene	27	134	24.1	297.0	8.2%
1,2-Dimethyl-4-Ethylbenzene	28	134	24.3	402.0	11.1%
1,3-Dimethyl-2-Ethylbenzene	29	134	ND	ND	ND
1,2-Dimethyl-3-Ethylbenzene	30	134	25.1	203.0	5.6%
1,2,4,5-Tetramethylbenzene	31a	134	25.6	419.0	11.6%
1,2,3,5-Tetramethylbenzene	31	134	25.7	783.0	21.7%
1,2,3,4-Tetramethylbenzene	32	134	26.9	283.0	7.8%

0.4578g 321-11-11
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-1 [P.060866.022619.DT.SUMP]
0.4578g 321-11-11



Chromatogram Key & Numerical Results: 134 m/z C3-C4 Monoaromatics

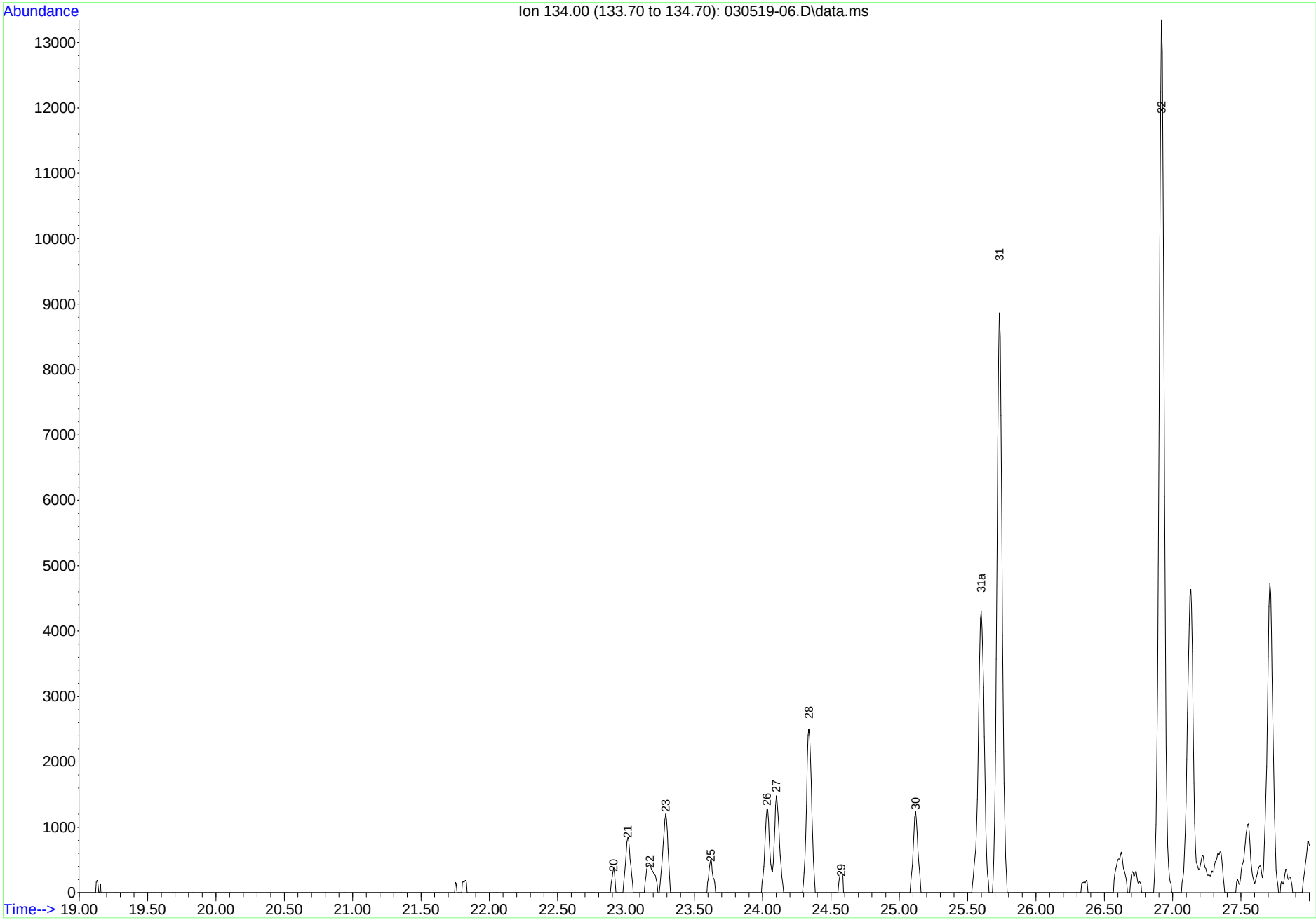
Project Manager:	Brian Peters	Lab ID:	29604-2
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.STAND PIPI
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (134 m/z)
Sec-Butylbenzene	16	134	ND	ND	ND
1-Methyl-3-Isopropylbenzene	17	134	ND	ND	ND
1-Methyl-4-Isopropylbenzene	18	134	ND	ND	ND
1-Methyl-2-Isopropylbenzene	19	134	ND	ND	ND
1,3-Diethylbenzene	20	134	22.9	376.0	1.0%
1-Methyl-3-Propylbenzene	21	134	23.0	844.0	2.3%
Butylbenzene	22	134	23.2	429.0	1.2%
1,3-Diethyl-5-Ethylbenzene	23	134	23.3	1207.0	3.3%
1,2-Diethylbenzene	24	134	ND	ND	ND
1-Methyl-2-Propylbenzene	25	134	23.6	518.0	1.4%
1,4-Dimethyl-2-Ethylbenzene	26	134	24.0	1292.0	3.5%
1,3-Dimethyl-4-Ethylbenzene	27	134	24.1	1481.0	4.0%
1,2-Dimethyl-4-Ethylbenzene	28	134	24.3	2503.0	6.8%
1,3-Dimethyl-2-Ethylbenzene	29	134	24.6	311.0	0.8%
1,2-Dimethyl-3-Ethylbenzene	30	134	25.1	1238.0	3.4%
1,2,4,5-Tetramethylbenzene	31a	134	25.6	4304.0	11.7%
1,2,3,5-Tetramethylbenzene	31	134	25.7	8868.0	24.2%
1,2,3,4-Tetramethylbenzene	32	134	26.9	13348.0	36.4%

0.4428g 321-11-12
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-2 [P.060866.022619.DT.STAND PIPE]
0.4428g 321-11-12



Chromatogram Key & Numerical Results: 134 m/z C3-C4 Monoaromatics

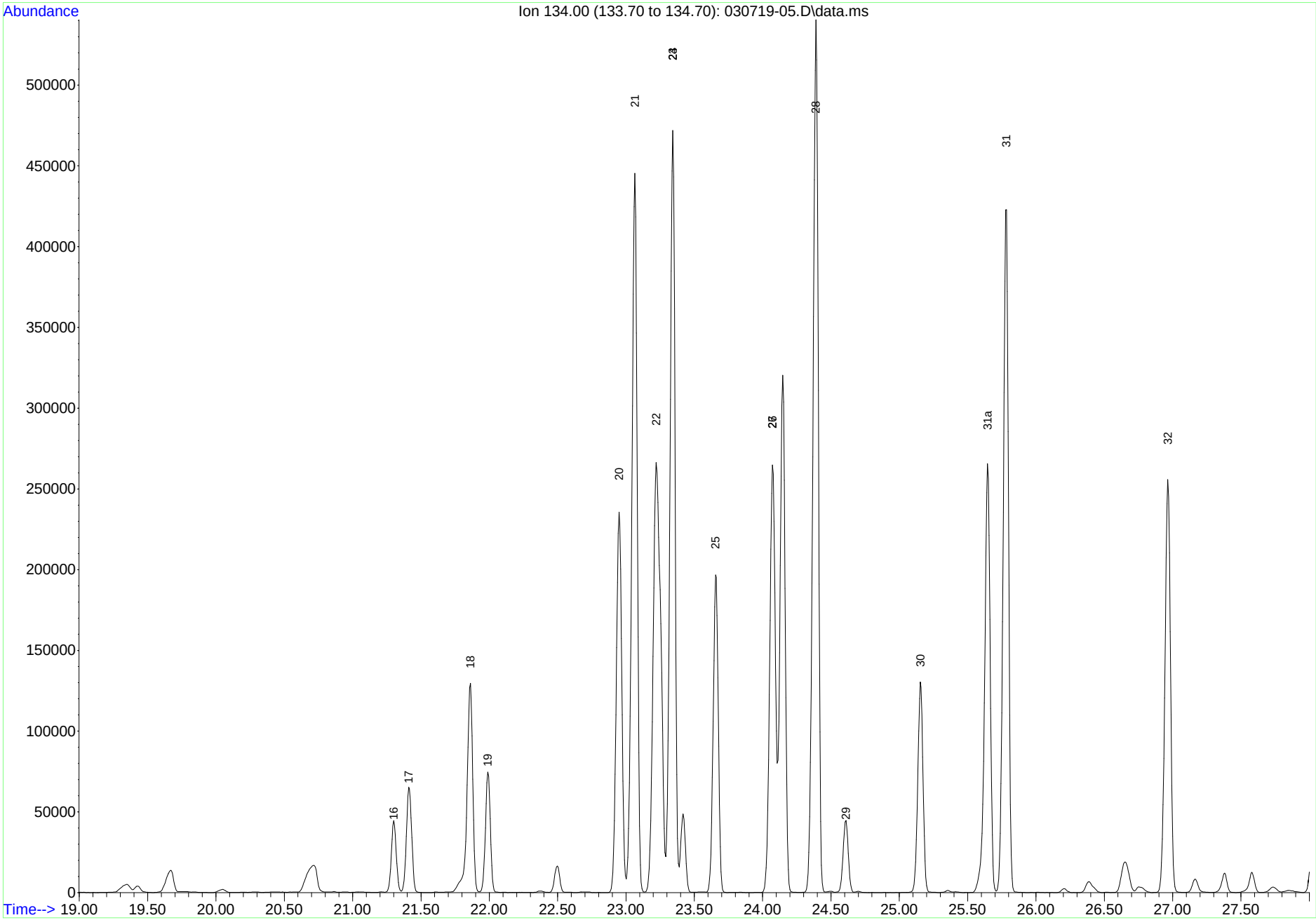
Project Manager:	Brian Peters	Lab ID:	29604-3
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.MW10
Project #:	60866	Analyzed:	3/7/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (134 m/z)
Sec-Butylbenzene	16	134	21.3	44245.0	1.0%
1-Methyl-3-Isopropylbenzene	17	134	21.4	65288.0	1.4%
1-Methyl-4-Isopropylbenzene	18	134	21.9	129261.0	2.8%
1-Methyl-2-Isopropylbenzene	19	134	22.0	74515.0	1.6%
1,3-Diethylbenzene	20	134	23.0	235584.0	5.1%
1-Methyl-3-Propylbenzene	21	134	23.1	445140.0	9.7%
Butylbenzene	22	134	23.2	266147.0	5.8%
1,3-Diethyl-5-Ethylbenzene	23	134	23.3	470003.0	10.2%
1,2-Diethylbenzene	24	134	23.3	471644.0	10.3%
1-Methyl-2-Propylbenzene	25	134	23.7	196736.0	4.3%
1,4-Dimethyl-2-Ethylbenzene	26	134	24.1	264832.0	5.8%
1,3-Dimethyl-4-Ethylbenzene	27	134	24.1	264832.0	5.8%
1,2-Dimethyl-4-Ethylbenzene	28	134	24.4	540303.0	11.8%
1,3-Dimethyl-2-Ethylbenzene	29	134	24.6	44441.0	1.0%
1,2-Dimethyl-3-Ethylbenzene	30	134	25.2	130456.0	2.8%
1,2,4,5-Tetramethylbenzene	31a	134	25.7	265664.0	5.8%
1,2,3,5-Tetramethylbenzene	31	134	25.8	422780.0	9.2%
1,2,3,4-Tetramethylbenzene	32	134	27.0	255744.0	5.6%

0.4252g 321-11-13
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-3 [P.060866.022619.DT.MW10] 1/10
0.4252g 321-11-13



Chromatogram Key & Numerical Results: 123 m/z Bicyclanes

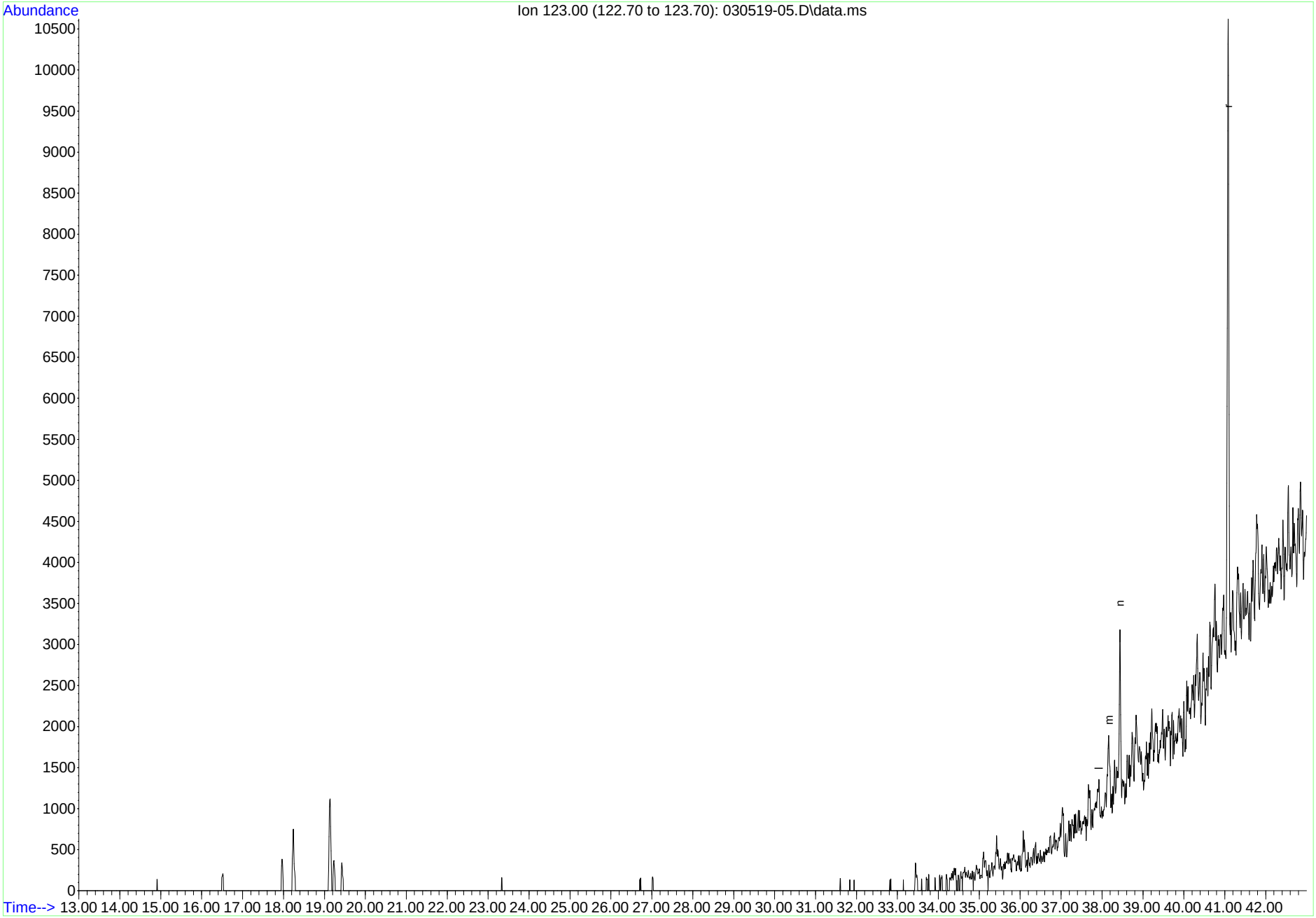
Project Manager:	Brian Peters	Lab ID:	29604-1
Client:	GHD	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.SUMP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (123 m/z)
2,2,3-Trimethylbicycloheptane	a	123	ND	ND	ND
C_{10} bicycloalkane	b	123	ND	ND	ND
3,3,7-Trimethylbicycloheptane	c	123	ND	ND	ND
C_{11} Decalin	d	123	ND	ND	ND
Nordrimane	f	123	ND	ND	ND
Nordrimane	g	123	ND	ND	ND
Rearranged drimane	h	123	ND	ND	ND
Rearranged drimane	j	123	ND	ND	ND
Isomer of Eudesmane	k	123	ND	ND	ND
4β (H) Eudesmane	l	123	37.9	455.0	4.1%
C_{15} Bicyclic Sesquiterpane	m	123	38.2	883.0	7.9%
8β (H) Drimane	n	123	38.4	2080.0	18.5%
C_{15} Bicyclic Sesquiterpane	o	123	ND	ND	ND
C_{16} Bicyclic Sesquiterpane	p	123	ND	ND	ND
C_{16} Bicyclic Sesquiterpane	q	123	ND	ND	ND
8β (H) Homodrimane	r	123	41.1	7796.0	69.5%

0.4578g 321-11-11
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-1 [P.060866.022619.DT.SUMP]
0.4578g 321-11-11



Chromatogram Key & Numerical Results: 123 m/z Bicyclanes

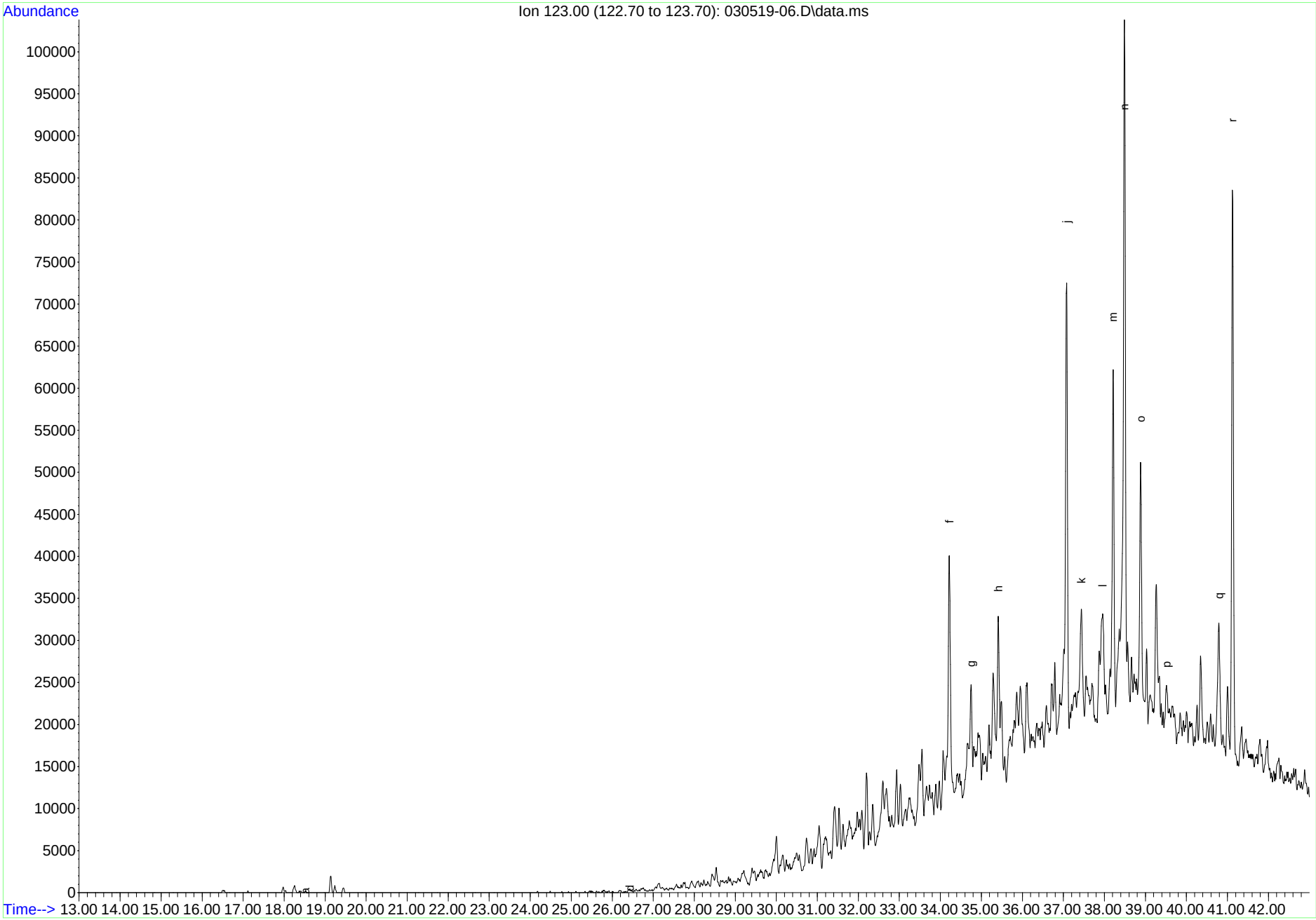
Project Manager:	Brian Peters	Lab ID:	29604-2
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.STAND PIF
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (123 m/z)
2,2,3-Trimethylbicycloheptane	a	123	18.5	179.0	0.0%
C_{10} bicycloalkane	b	123	ND	ND	ND
3,3,7-Trimethylbicycloheptane	c	123	ND	ND	ND
C_{11} Decalin	d	123	26.4	249.0	0.1%
Nordrimane	f	123	34.2	28489.0	7.7%
Nordrimane	g	123	34.8	9773.0	2.6%
Rearranged drimane	h	123	35.4	16520.0	4.5%
Rearranged drimane	j	123	37.1	53016.0	14.3%
Isomer of Eudesmane	k	123	37.4	12720.0	3.4%
4β (H) Eudesmane	l	123	38.0	12509.0	3.4%
C_{15} Bicyclic Sesquiterpane	m	123	38.2	40112.0	10.8%
8β (H) Drimane	n	123	38.5	80318.0	21.7%
C_{15} Bicyclic Sesquiterpane	o	123	38.9	28516.0	7.7%
C_{16} Bicyclic Sesquiterpane	p	123	39.5	5040.0	1.4%
C_{16} Bicyclic Sesquiterpane	q	123	40.8	14656.0	4.0%
8β (H) Homodrimane	r	123	41.1	68443.0	18.5%

0.4428g 321-11-12
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-2 [P.060866.022619.DT.STAND PIPE]
0.4428g 321-11-12



Chromatogram Key & Numerical Results: 123 m/z Bicyclanes

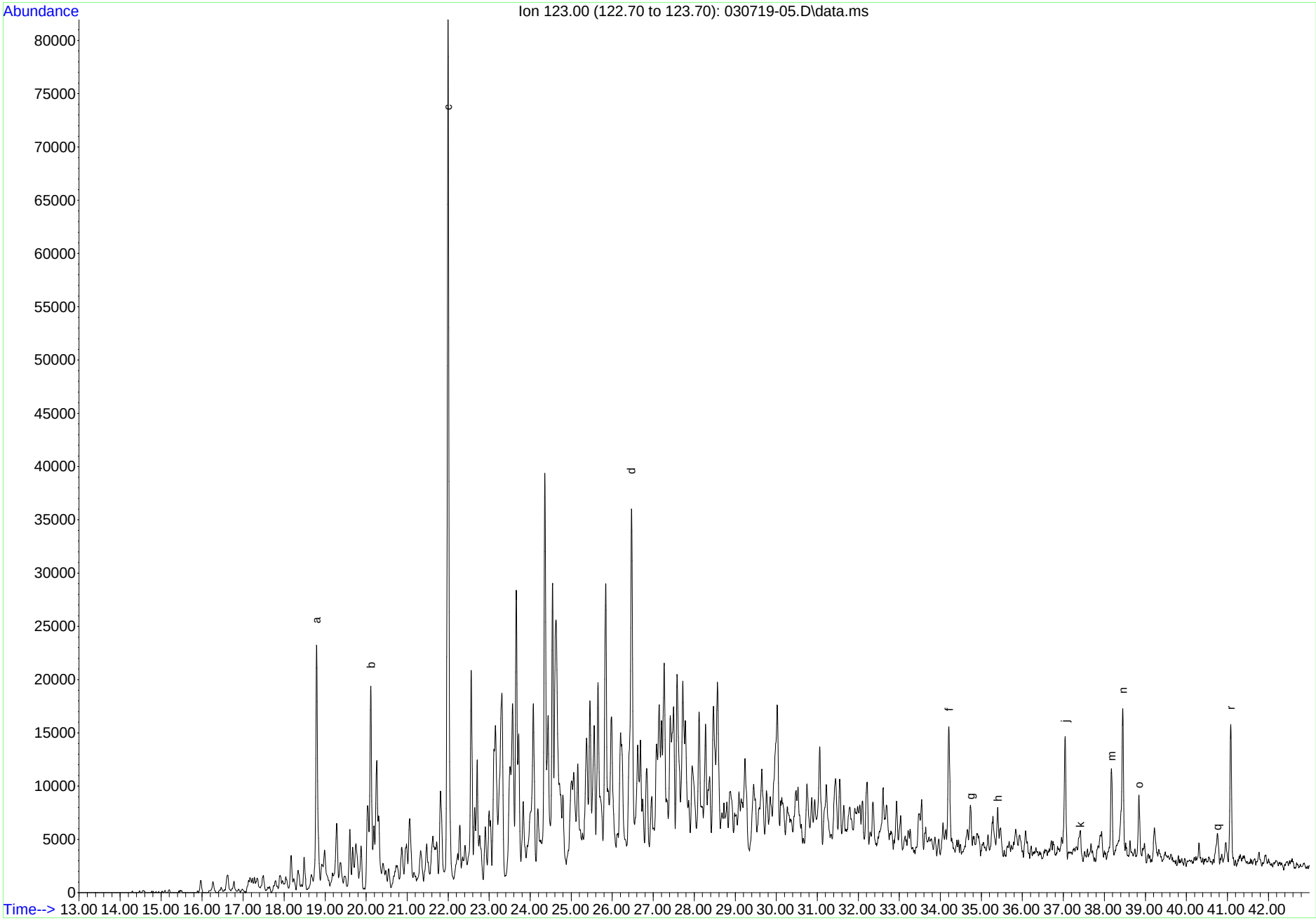
Project Manager:	Brian Peters	Lab ID:	29604-3
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.MW10
Project #:	60866	Analyzed:	3/7/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (123 m/z)
2,2,3-Trimethylbicycloheptane	a	123	18.8	22762.0	9.9%
C_{10} bicycloalkane	b	123	20.1	19079.0	8.3%
3,3,7-Trimethylbicycloheptane	c	123	22.0	80690.0	34.9%
C_{11} Decalin	d	123	26.5	31661.0	13.7%
Nordrimane	f	123	34.2	10825.0	4.7%
Nordrimane	g	123	34.7	3779.0	1.6%
Rearranged drimane	h	123	35.4	3868.0	1.7%
Rearranged drimane	j	123	37.0	11523.0	5.0%
Isomer of Eudesmane	k	123	37.4	2927.0	1.3%
4β (H) Eudesmane	l	123	ND	ND	ND
C_{15} Bicyclic Sesquiterpane	m	123	38.2	8550.0	3.7%
8β (H) Drimane	n	123	38.5	13745.0	6.0%
C_{15} Bicyclic Sesquiterpane	o	123	38.8	5766.0	2.5%
C_{16} Bicyclic Sesquiterpane	p	123	ND	ND	ND
C_{16} Bicyclic Sesquiterpane	q	123	40.8	2887.0	1.2%
8β (H) Homodrimane	r	123	41.1	12908.0	5.6%

0.4252g 321-11-13
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-3 [P.060866.022619.DT.MW10] 1/10
0.4252g 321-11-13



Chromatogram Key & Numerical Results: 191 m/z Terpanes

Pace Analytical® Energy Services™

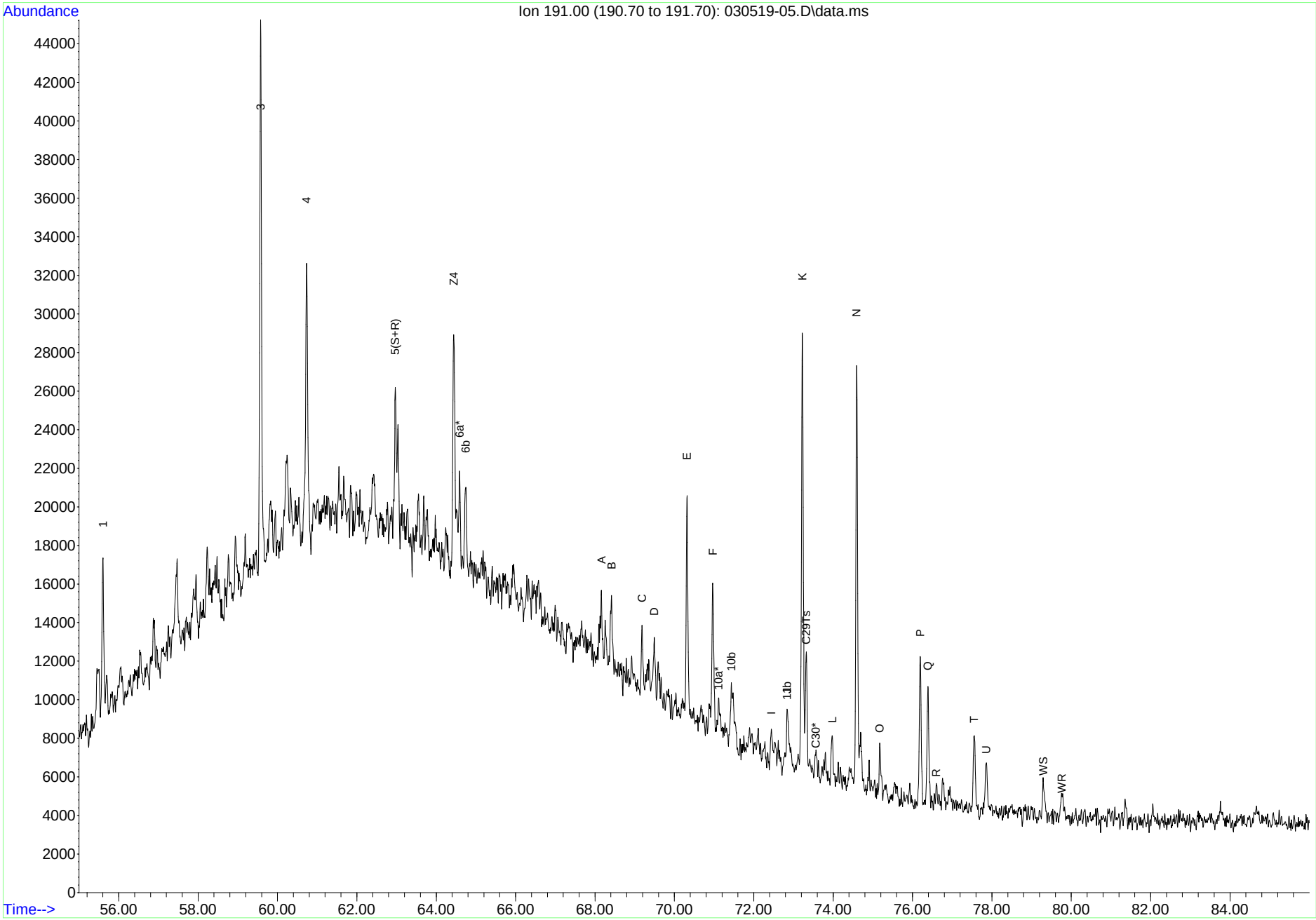
Project Manager:	Brian Peters	Lab ID:	29604-1
Client:	GHD	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste Lynnwood, WA 98036	Received: Matrix:	3/1/2019 Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.SUMP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (191 m/z)
C_{21}-Tricyclic Terpane	1	191	55.6	8270.0	3.0%
C_{22}-Tricyclic Terpane	2	191	ND	ND	ND
C_{23}-Tricyclic Terpane	3	191	59.6	98058.0	35.0%
C_{24}-Tricyclic Terpane	4	191	60.7	15096.0	5.4%
C_{25}-Tricyclic Terpane	5(S+R)	191	63.0	8451.0	3.0%
C_{24}-Tetracyclic Terpane	Z4	191	64.4	12106.0	4.3%
C_{26}-Tricyclic Terpane	6a*	191	64.6	6454.0	2.3%
C_{26}-Tricyclic Terpane	6b	191	64.7	4814.0	1.7%
C_{28}-Tricyclic Terpane #1	A	191	68.2	2723.0	1.0%
C_{28}-Tricyclic Terpane #2	B	191	68.4	4132.0	1.5%
C_{29}-Tricyclic Terpane #1	C	191	69.2	3745.0	1.3%
C_{29}-Tricyclic Terpane #2	D	191	69.5	3203.0	1.1%
18 α-22,29,30-Trisnorneohopane (Ts)	E	191	70.3	11496.0	4.1%
17 α-22,29,30-Trisnorhopane (Tm)	F	191	71.0	7709.0	2.8%
C_{30}-Tricyclic Terpane #1	10a*	191	71.1	1730.0	0.6%
C_{30}-Tricyclic Terpane #2	10b	191	71.4	3308.0	1.2%
17 α-28,30 Bisnorhopane	I	191	72.4	2102.0	0.8%
C_{31}-Tricyclic Terpane #1	11a*	191	ND	ND	ND
17α-25-Norhopane	J	191	72.8	2680.0	1.0%
C_{31}-Tricyclic Terpane #2	11b	191	72.8	2907.0	1.0%
17 α,21β-30-Norhopane	K	191	73.2	22759.0	8.1%
18α-30-Norneohopane	C29Ts	191	73.3	5826.0	2.1%
17α-Diahopane	C30*	191	73.6	1495.0	0.5%
17β-21α-30-Normoretane	L	191	74.0	2579.0	0.9%
18α+18β-Oleanane	Ma+Mb	191	ND	ND	ND
17α-21β-Hopane	N	191	74.6	21662.0	7.7%
17β-21α-Moretane	O	191	75.2	2974.0	1.1%
22S-17α,21β-30-Homohopane	P	191	76.2	7818.0	2.8%
22R-17α,21β-30-Homohopane	Q	191	76.4	6301.0	2.2%
Gammacerane	R	191	76.6	1060.0	0.4%
22S-17α,21β-30-Bishomohopane	T	191	77.6	3964.0	1.4%
22R-17α,21β-30-Bishomohopane	U	191	77.9	2445.0	0.9%
22S-17α,21β-30-Bishomohopane	WS	191	79.3	2360.0	0.8%
22R-17α,21β-Trishomohopane	WR	191	79.8	1554.0	0.6%
22S-17α,21β-Tetrahomohopane	XS	191	ND	ND	ND
22R-17α,21β-Tetrahomohopane	XR	191	ND	ND	ND
22S-17α,21β-Pentahomohopane	YS	191	ND	ND	ND
22R-17α,21β-Pentahomohopane	YR	191	ND	ND	ND

0.4578g 321-11-11
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-1 [P.060866.022619.DT.SUMP]
0.4578g 321-11-11



Chromatogram Key & Numerical Results: 191 m/z Terpanes

Pace Analytical® Energy Services™

Project Manager:	Brian Peters	Lab ID:	29604-2
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.STAND PII
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (191 m/z)
C_{21}-Tricyclic Terpane	1	191	55.6	11338.0	2.8%
C_{22}-Tricyclic Terpane	2	191	ND	ND	ND
C_{23}-Tricyclic Terpane	3	191	59.6	107422.0	26.8%
C_{24}-Tricyclic Terpane	4	191	60.7	17514.0	4.4%
C_{25}-Tricyclic Terpane	5(S+R)	191	63.0	8123.0	2.0%
C_{24}-Tetracyclic Terpane	Z4	191	64.4	9874.0	2.5%
C_{26}-Tricyclic Terpane	6a*	191	64.6	6715.0	1.7%
C_{26}-Tricyclic Terpane	6b	191	64.7	5623.0	1.4%
C_{28}-Tricyclic Terpane #1	A	191	68.2	6738.0	1.7%
C_{28}-Tricyclic Terpane #2	B	191	68.4	6413.0	1.6%
C_{29}-Tricyclic Terpane #1	C	191	69.2	5950.0	1.5%
C_{29}-Tricyclic Terpane #2	D	191	69.5	4298.0	1.1%
18 α-22,29,30-Trisnorneohopane (Ts)	E	191	70.3	13039.0	3.3%
17 α-22,29,30-Trisnorhopane (Tm)	F	191	71.0	10523.0	2.6%
C_{30}-Tricyclic Terpane #1	10a*	191	71.1	4845.0	1.2%
C_{30}-Tricyclic Terpane #2	10b	191	71.4	5198.0	1.3%
17 α-28,30 Bisnorhopane	I	191	ND	ND	ND
C_{31}-Tricyclic Terpane #1	11a*	191	ND	ND	ND
17α-25-Norhopane	J	191	72.9	4783.0	1.2%
C_{31}-Tricyclic Terpane #2	11b	191	72.9	4979.0	1.2%
17 α,21β-30-Norhopane	K	191	73.2	38769.0	9.7%
18α-30-Norneohopane	C29Ts	191	73.3	12489.0	3.1%
17α-Diahopane	C30*	191	73.6	3669.0	0.9%
17β-21α-30-Normoretane	L	191	74.0	4711.0	1.2%
18α+18β-Oleanane	Ma+Mb	191	74.4	3108.0	0.8%
17α-21β-Hopane	N	191	74.6	46658.0	11.6%
17β-21α-Moretane	O	191	75.2	4459.0	1.1%
22S-17α,21β-30-Homohopane	P	191	76.2	18465.0	4.6%
22R-17α,21β-30-Homohopane	Q	191	76.4	12838.0	3.2%
Gammacerane	R	191	76.6	1960.0	0.5%
22S-17α,21β-30-Bishomohopane	T	191	77.6	9238.0	2.3%
22R-17α,21β-30-Bishomohopane	U	191	77.9	6166.0	1.5%
22S-17α,21β-30-Bishomohopane	WS	191	79.3	4620.0	1.2%
22R-17α,21β-Trishomohopane	WR	191	79.8	3142.0	0.8%
22S-17α,21β-Tetrahomohopane	XS	191	ND	ND	ND
22R-17α,21β-Tetrahomohopane	XR	191	ND	ND	ND
22S-17α,21β-Pentahomohopane	YS	191	ND	ND	ND
22R-17α,21β-Pentahomohopane	YR	191	ND	ND	ND

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29604-2 [P.060866.022619.DT.STAND PIPE]
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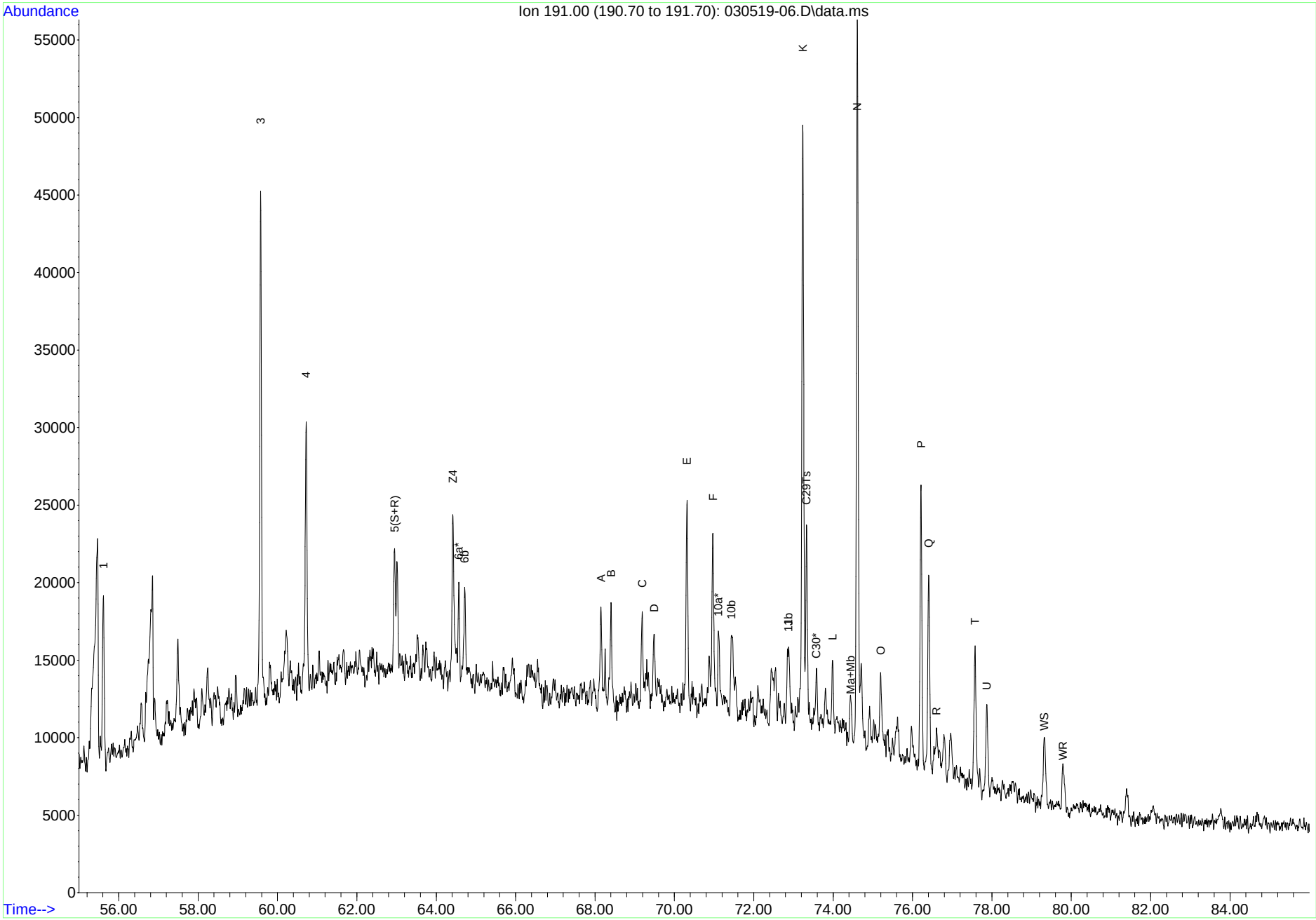

Chromatogram Key & Numerical Results: 191 m/z Terpanes

Project Manager:	Brian Peters	Lab ID:	29604-3
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.MW10
Project #:	60866	Analyzed:	3/7/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (191 m/z)
C_{21}-Tricyclic Terpane	1	191	55.6	1779.0	4.2%
C_{22}-Tricyclic Terpane	2	191	ND	ND	ND
C_{23}-Tricyclic Terpane	3	191	59.5	12264.0	29.2%
C_{24}-Tricyclic Terpane	4	191	60.6	2360.0	5.6%
C_{25}-Tricyclic Terpane	5(S+R)	191	62.9	1396.0	3.3%
C_{24}-Tetracyclic Terpane	Z4	191	64.3	1262.0	3.0%
C_{26}-Tricyclic Terpane	6a*	191	64.5	1227.0	2.9%
C_{26}-Tricyclic Terpane	6b	191	64.6	1025.0	2.4%
C_{28}-Tricyclic Terpane #1	A	191	68.1	1189.0	2.8%
C_{28}-Tricyclic Terpane #2	B	191	68.3	1254.0	3.0%
C_{29}-Tricyclic Terpane #1	C	191	69.1	1397.0	3.3%
C_{29}-Tricyclic Terpane #2	D	191	69.4	848.0	2.0%
18 α-22,29,30-Trisnorneohopane (Ts)	E	191	70.2	1794.0	4.3%
17 α-22,29,30-Trisnorhopane (Tm)	F	191	70.9	1403.0	3.3%
C_{30}-Tricyclic Terpane #1	10a*	191	71.0	544.0	1.3%
C_{30}-Tricyclic Terpane #2	10b	191	71.4	818.0	1.9%
17 α-28,30 Bisnorhopane	I	191	72.4	937.0	2.2%
C_{31}-Tricyclic Terpane #1	11a*	191	ND	ND	ND
17α-25-Norhopane	J	191	ND	ND	ND
C_{31}-Tricyclic Terpane #2	11b	191	ND	ND	ND
17 α,21β-30-Norhopane	K	191	73.2	3756.0	8.9%
18α-30-Norneohopane	C29Ts	191	73.3	1216.0	2.9%
17α-Diahopane	C30*	191	73.5	522.0	1.2%
17β-21α-30-Normoretane	L	191	ND	ND	ND
18α+18β-Oleanane	Ma+Mb	191	ND	ND	ND
17α-21β-Hopane	N	191	74.5	5064.0	12.0%
17β-21α-Moretane	O	191	ND	ND	ND
22S-17α,21β-30-Homohopane	P	191	ND	ND	ND
22R-17α,21β-30-Homohopane	Q	191	ND	ND	ND
Gammacerane	R	191	ND	ND	ND
22S-17α,21β-30-Bishomohopane	T	191	ND	ND	ND
22R-17α,21β-30-Bishomohopane	U	191	ND	ND	ND
22S-17α,21β-30-Bishomohopane	WS	191	ND	ND	ND
22R-17α,21β-Trishomohopane	WR	191	ND	ND	ND
22S-17α,21β-Tetrahomohopane	XS	191	ND	ND	ND
22R-17α,21β-Tetrahomohopane	XR	191	ND	ND	ND
22S-17α,21β-Pentahomohopane	YS	191	ND	ND	ND
22R-17α,21β-Pentahomohopane	YR	191	ND	ND	ND

0.4252g 321-11-13
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29604-3 [P.060866.022619.DT.MW10] 1/10
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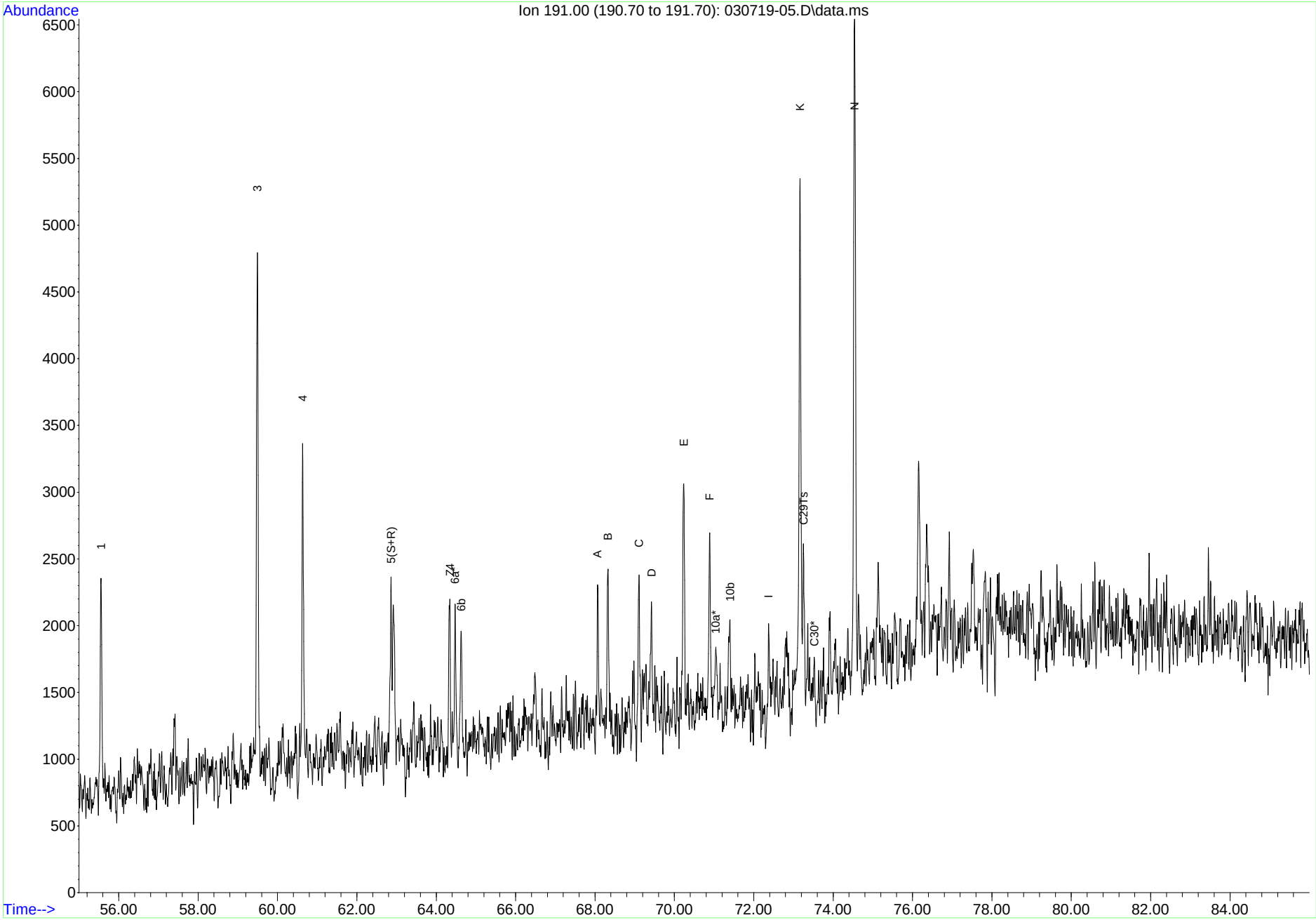

Chromatogram Key & Numerical Results: 217 m/z Steranes

Project Manager:	Brian Peters	Lab ID:	29604-1
Client:	GHD	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.SUMP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (217 m/z)
13β, 17α-Diacholestane (20S)	1	217	66.3	9428.0	13.7%
13β, 17α-Diacholestane (20R)	2	217	67.0	5836.0	8.5%
13α, 17β-Diacholestane (20S)	3	217	67.5	2732.0	4.0%
13α, 17β-Diacholestane (20R)	4	217	67.8	2698.0	3.9%
24-methyl-13β,17α-Diacholestane (20S)	5	217	67.9	3214.0	4.7%
24-methyl-13β,17α-Diacholestane (20S)	6	217	68.7	1442.0	2.1%
24-methyl-13α,17β-Diacholestane (20S)	7D	217	ND	ND	ND
14α,17α-Cholestane (20S)	7	217	ND	ND	ND
24-ethyl-13β, 17α-Diacholestane (20S)+	8+8D	217			
14β,17β-Cholestane (20R)			69.3	6158.0	9.0%
14β,17β-Cholestane (20S)	9	217	69.4	3905.0	5.7%
24-methyl-13α,17β-Diacholestane (20R)	9D	217	ND	ND	ND
14α,17α-Cholestane (20R)	10	217	69.9	4133.0	6.0%
24-ethyl-13β, 17α-Diacholestane (20R)	11	217	70.0	3307.0	4.8%
24-ethyl-13α, 17β-Diacholestane (20S)	12	217	70.4	2315.0	3.4%
24-ethyl-13α, 17α-Diacholestane (20S)	13	217	70.8	1599.0	2.3%
24-methyl-14β, 17β-Cholestane (20R)	14	217	71.0	2336.0	3.4%
24-methyl-14β, 17β-Cholestane (20S)	15	217	71.2	3655.0	5.3%
24-methyl-14α, 17α-Cholestane (20R)	16	217	71.7	2172.0	3.2%
24-ethyl-14α-Cholestane (20S)	17	217	72.2	2609.0	3.8%
24-ethyl-14β, 17β-Cholestane (20R)	18	217	72.4	4322.0	6.3%
24-ethyl-14β, 17β-Cholestane (20S)	19	217	72.5	4066.0	5.9%
24-ethyl-14α, 17α-Cholestane (20R)	20	217	73.1	2711.0	3.9%

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29604-1 [P.060866.022619.DT.SUMP]
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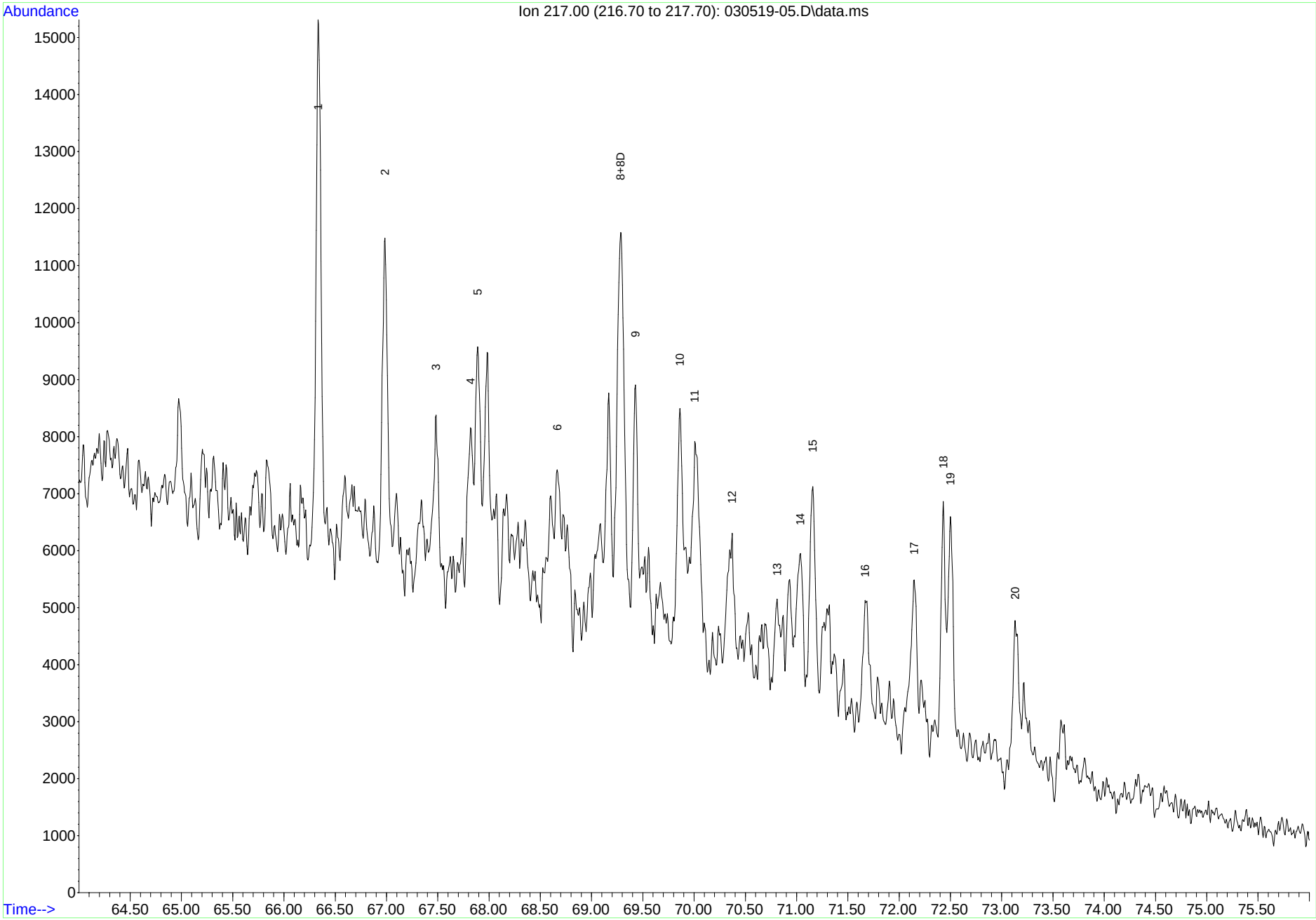

Chromatogram Key & Numerical Results: 217 m/z Steranes

Project Manager:	Brian Peters	Lab ID:	29604-2
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received: Matrix:	3/1/2019 Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.STAND PIP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (217 m/z)
13β, 17α-Diacholestane (20S)	1	217	66.3	16032.0	11.5%
13β, 17α-Diacholestane (20R)	2	217	67.0	10334.0	7.4%
13α, 17β-Diacholestane (20S)	3	217	67.5	4091.0	2.9%
13α, 17β-Diacholestane (20R)	4	217	67.8	4863.0	3.5%
24-methyl-13β,17α-Diacholestane (20S)	5	217	67.9	5828.0	4.2%
24-methyl-13β,17α-Diacholestane (20S)	6	217	68.7	2178.0	1.6%
24-methyl-13α,17β-Diacholestane (20S)	7D	217	69.0	2075.0	1.5%
14α,17α-Cholestane (20S)	7	217	69.1	2997.0	2.1%
24-ethyl-13β, 17α-Diacholestane (20S)+	8+8D	217			
14β,17β-Cholestane (20R)			69.3	14837.0	10.6%
14β,17β-Cholestane (20S)	9	217	69.4	6861.0	4.9%
24-methyl-13α,17β-Diacholestane (20R)	9D	217	69.5	1707.0	1.2%
14α,17α-Cholestane (20R)	10	217	69.9	7585.0	5.4%
24-ethyl-13β, 17α-Diacholestane (20R)	11	217	70.0	7828.0	5.6%
24-ethyl-13α, 17β-Diacholestane (20S)	12	217	70.4	3845.0	2.8%
24-ethyl-13α, 17α-Diacholestane (20S)	13	217	70.8	2277.0	1.6%
24-methyl-14β, 17β-Cholestane (20R)	14	217	71.0	5288.0	3.8%
24-methyl-14β, 17β-Cholestane (20S)	15	217	71.2	7112.0	5.1%
24-methyl-14α, 17α-Cholestane (20R)	16	217	71.7	4263.0	3.1%
24-ethyl-14α-Cholestane (20S)	17	217	72.2	5447.0	3.9%
24-ethyl-14β, 17β-Cholestane (20R)	18	217	72.4	8374.0	6.0%
24-ethyl-14β, 17β-Cholestane (20S)	19	217	72.5	8808.0	6.3%
24-ethyl-14α, 17α-Cholestane (20R)	20	217	73.2	7004.0	5.0%

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29604-2 [P.060866.022619.DT.STAND PIPE]
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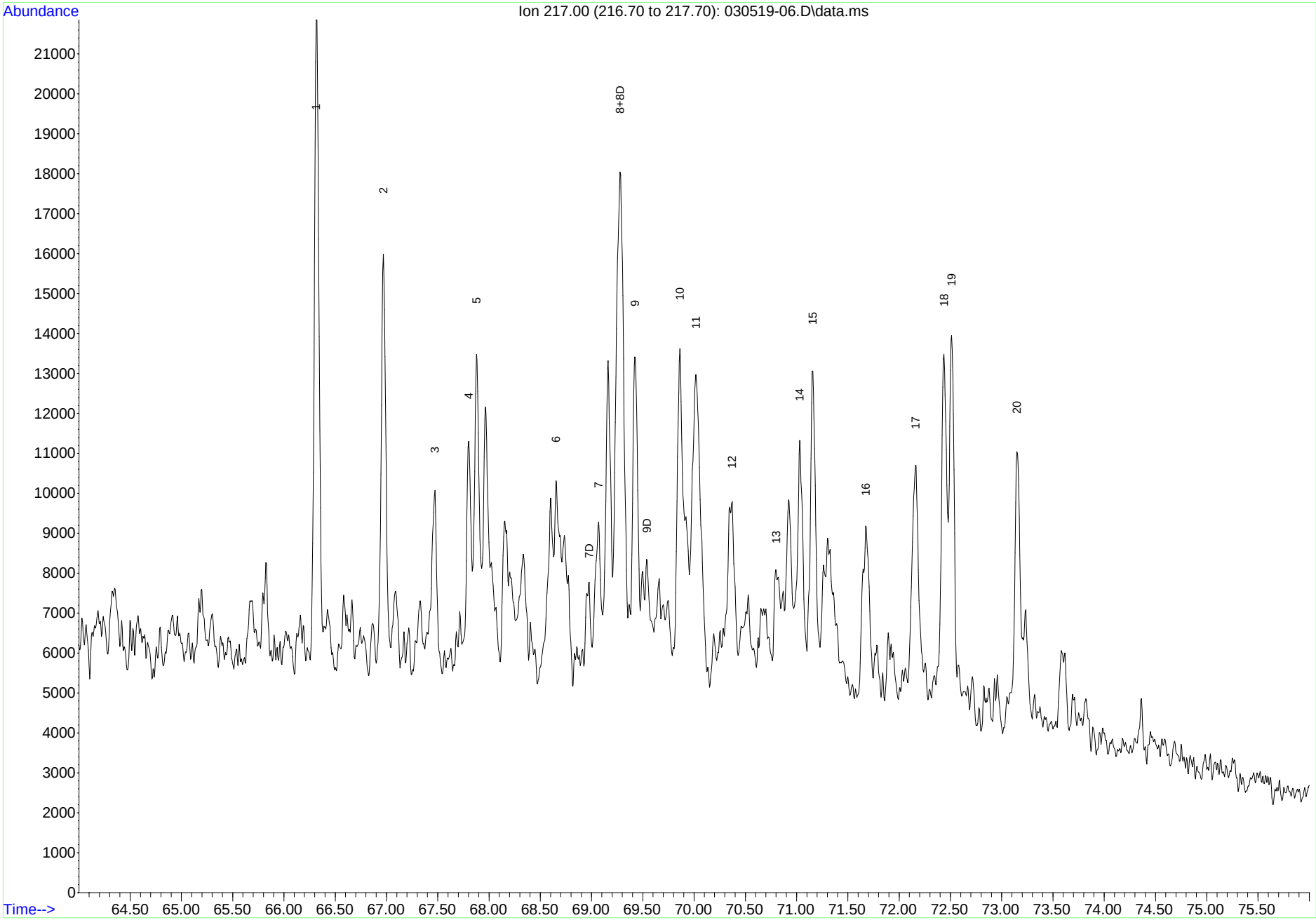

Chromatogram Key & Numerical Results: 217 m/z Steranes

Project Manager:	Brian Peters	Lab ID:	29604-3
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received: Matrix:	3/1/2019 Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.MW10
Project #:	60866	Analyzed:	3/7/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (217 m/z)
13β, 17α-Diacholestane (20S)	1	217	66.2	2473.0	13.4%
13β, 17α-Diacholestane (20R)	2	217	66.9	1263.0	6.8%
13α, 17β-Diacholestane (20S)	3	217	67.4	863.0	4.7%
13α, 17β-Diacholestane (20R)	4	217	67.7	901.0	4.9%
24-methyl-13β,17α-Diacholestane (20S)	5	217	67.8	1071.0	5.8%
24-methyl-13β,17α-Diacholestane (20S)	6	217	68.6	333.0	1.8%
24-methyl-13α,17β-Diacholestane (20S)	7D	217	ND	ND	ND
14α,17α-Cholestane (20S)	7	217	69.0	406.0	2.2%
24-ethyl-13β, 17α-Diacholestane (20S)+	8+8D	217			
14β,17β-Cholestane (20R)			69.2	2066.0	11.2%
14β,17β-Cholestane (20S)	9	217	69.4	1026.0	5.5%
24-methyl-13α,17β-Diacholestane (20R)	9D	217	69.5	512.0	2.8%
14α,17α-Cholestane (20R)	10	217	69.8	870.0	4.7%
24-ethyl-13β, 17α-Diacholestane (20R)	11	217	70.0	552.0	3.0%
24-ethyl-13α, 17β-Diacholestane (20S)	12	217	70.3	585.0	3.2%
24-ethyl-13α, 17α-Diacholestane (20S)	13	217	ND	ND	ND
24-methyl-14β, 17β-Cholestane (20R)	14	217	71.1	899.0	4.9%
24-methyl-14β, 17β-Cholestane (20S)	15	217	71.1	910.0	4.9%
24-methyl-14α, 17α-Cholestane (20R)	16	217	71.6	646.0	3.5%
24-ethyl-14α-Cholestane (20S)	17	217	72.1	519.0	2.8%
24-ethyl-14β, 17β-Cholestane (20R)	18	217	72.4	879.0	4.8%
24-ethyl-14β, 17β-Cholestane (20S)	19	217	72.5	1070.0	5.8%
24-ethyl-14α, 17α-Cholestane (20R)	20	217	73.1	646.0	3.5%

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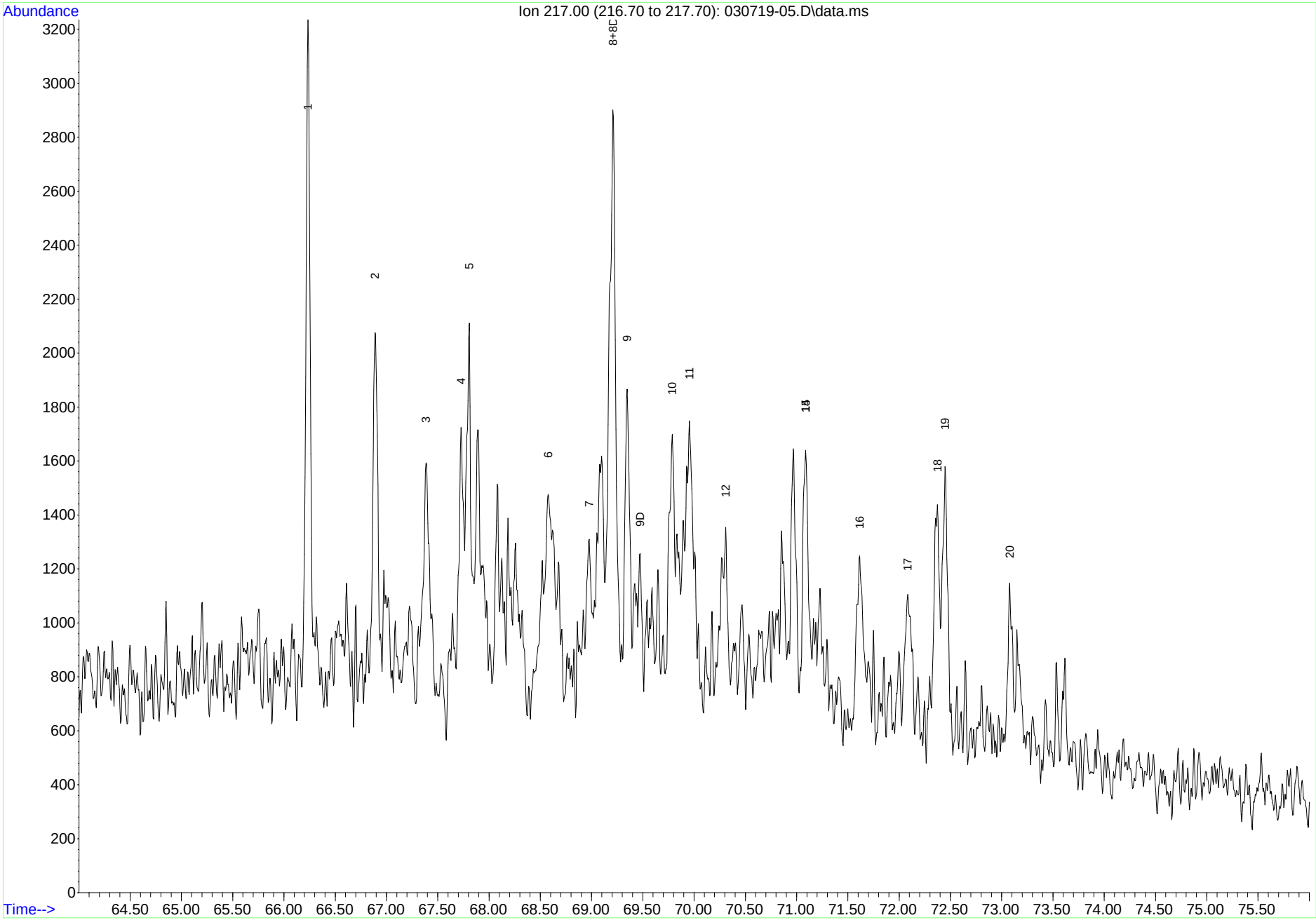

Chromatogram Key & Numerical Results: 253 m/z Monoaromatic Steranes

Project Manager:	Brian Peters	Lab ID:	29604-1
Client:	GHD	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste Lynnwood, WA 98036	Received: Matrix:	3/1/2019 Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.SUMP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (253 m/z)
20S, 5β C27-MAS	a	253	65.1	2343.0	7.3%
20S, dia C27-MAS	b	253	65.2	3188.0	9.9%
20R, 5β C27-MAS + 20R C27 dia MAS	c	253	66.3	3220.0	10.0%
20S, 5α C27-MAS	d	253	66.4	1755.0	5.5%
20R, 5β C28-MAS + 20S C28 dia MAS	e	253	66.7	5220.0	16.2%
20R, 5α C27-MAS	f	253	67.6	1494.0	4.6%
20S, 5α C28-MAS	g	253	67.8	1732.0	5.4%
20R, 5β C28-MAS + 20R C28 dia MAS	h	253	67.9	3673.0	11.4%
20S, 5β C29-MAS + 20S C29 dia MAS	i	253	68.0	4112.0	12.8%
20S, 5α C29-MAS	J lower case	253	69.0	998.0	3.1%
20R, 5α C28-MAS	k	253	69.2	1336.0	4.2%
20R, 5β C29-MAS + 20R C29 dia MAS	L lower case	253	69.3	2241.0	7.0%
20R, 5α C29-MAS	m	253	70.5	849.0	2.6%

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Pace Energy Services, LLC

29604-1 [P.060866.022619.DT.SUMP]
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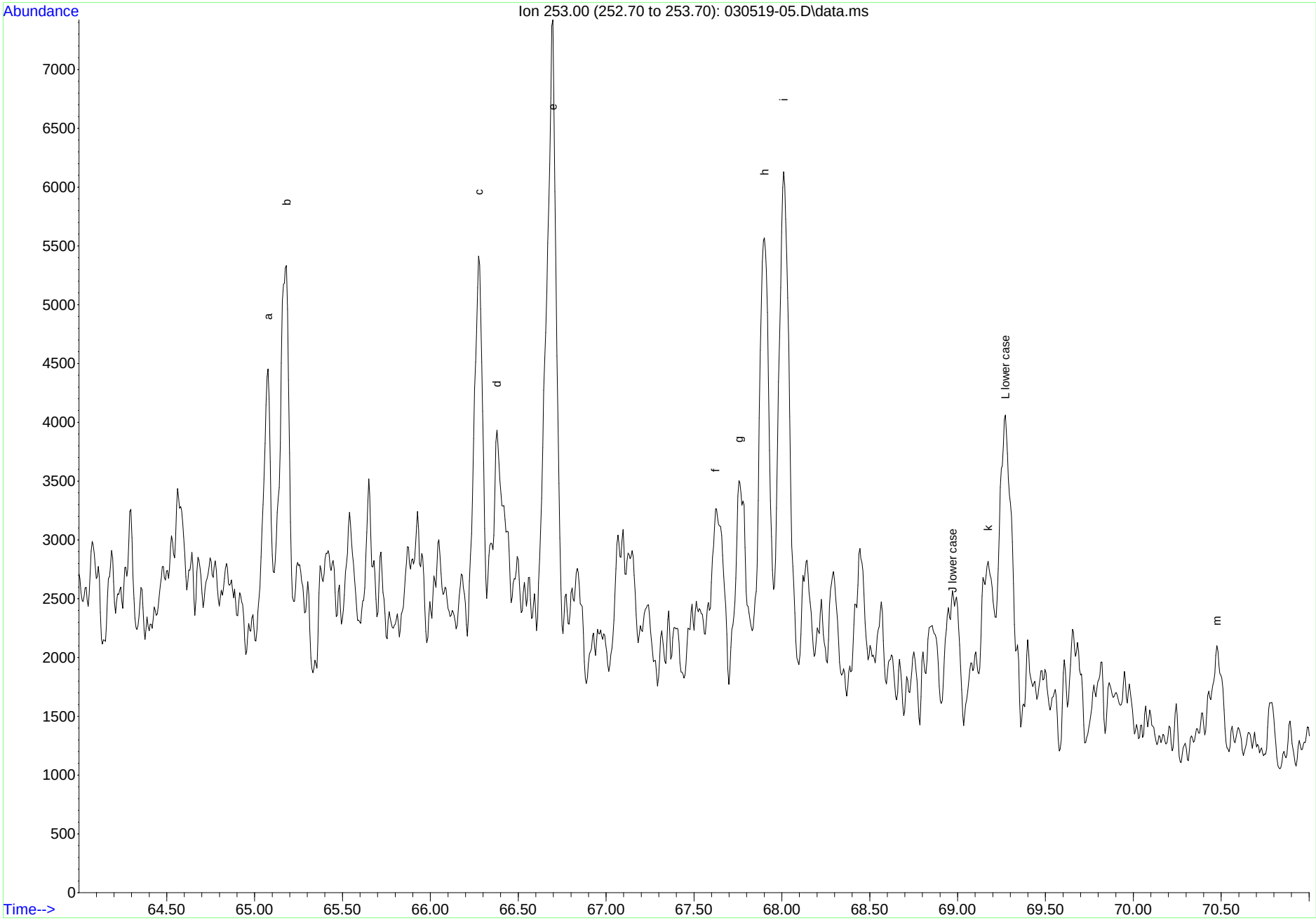

Chromatogram Key & Numerical Results: 253 m/z Monoaromatic Steranes

Project Manager:	Brian Peters	Lab ID:	29604-2
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.STAND PIPE
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (253 m/z)
20S, 5β C27-MAS	a	253	65.1	2956.0	6.4%
20S, dia C27-MAS	b	253	65.2	5074.0	11.0%
20R, 5β C27-MAS + 20R C27 dia MAS	c	253	66.3	4263.0	9.2%
20S, 5α C27-MAS	d	253	66.4	1958.0	4.2%
20R, 5β C28-MAS + 20S C28 dia MAS	e	253	66.7	6998.0	15.2%
20R, 5α C27-MAS	f	253	67.6	2069.0	4.5%
20S, 5α C28-MAS	g	253	67.8	2419.0	5.2%
20R, 5β C28-MAS + 20R C28 dia MAS	h	253	67.9	5578.0	12.1%
20S, 5β C29-MAS + 20S C29 dia MAS	i	253	68.0	6109.0	13.2%
20S, 5α C29-MAS	J lower case	253	69.0	1760.0	3.8%
20R, 5α C28-MAS	k	253	69.2	2131.0	4.6%
20R, 5β C29-MAS + 20R C29 dia MAS	L lower case	253	69.3	3922.0	8.5%
20R, 5α C29-MAS	m	253	70.5	950.0	2.1%

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29604-2 [P.060866.022619.DT.STAND PIPE]
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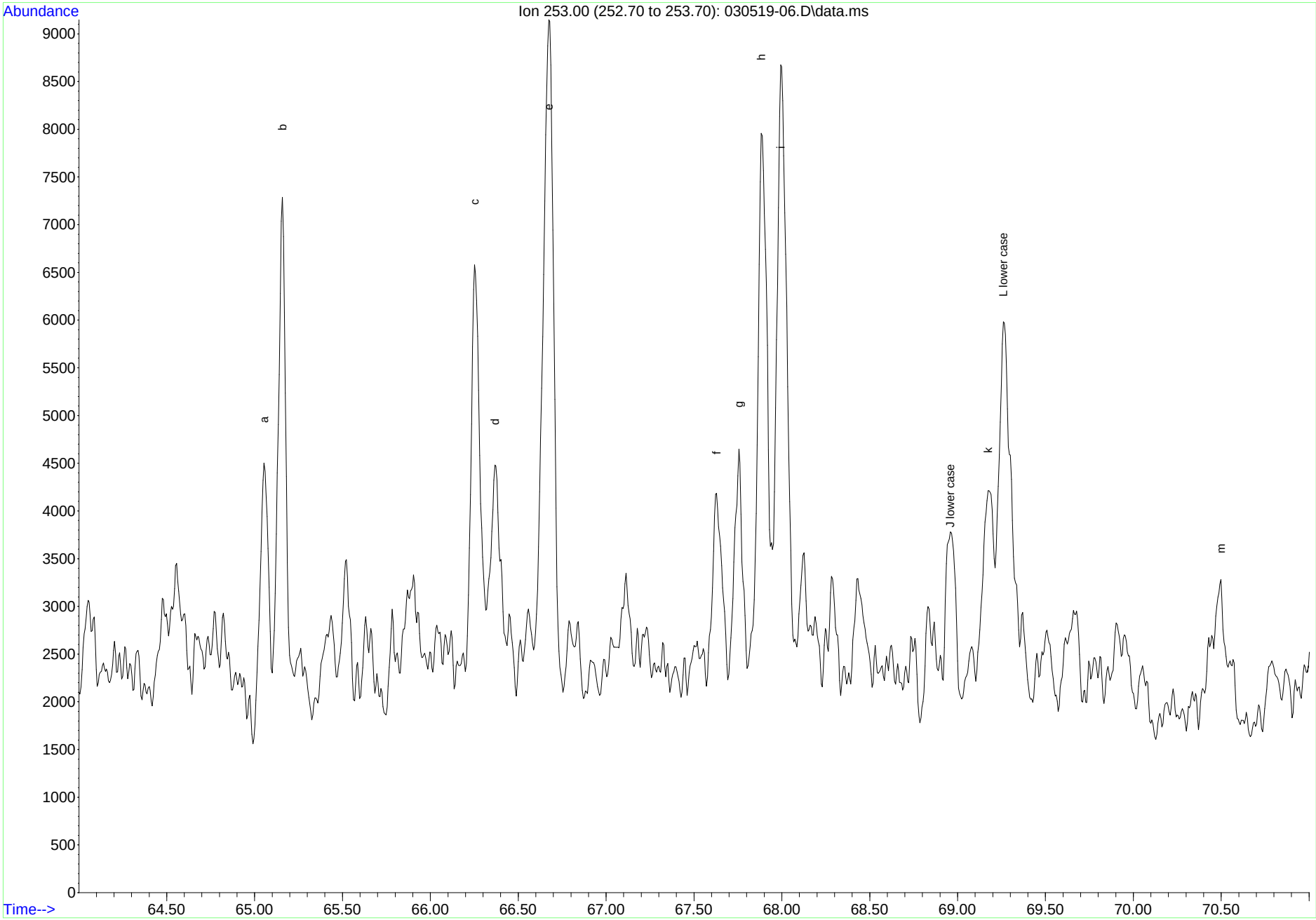


Chromatogram Key & Numerical Results: 253 m/z Monoaromatic Steranes

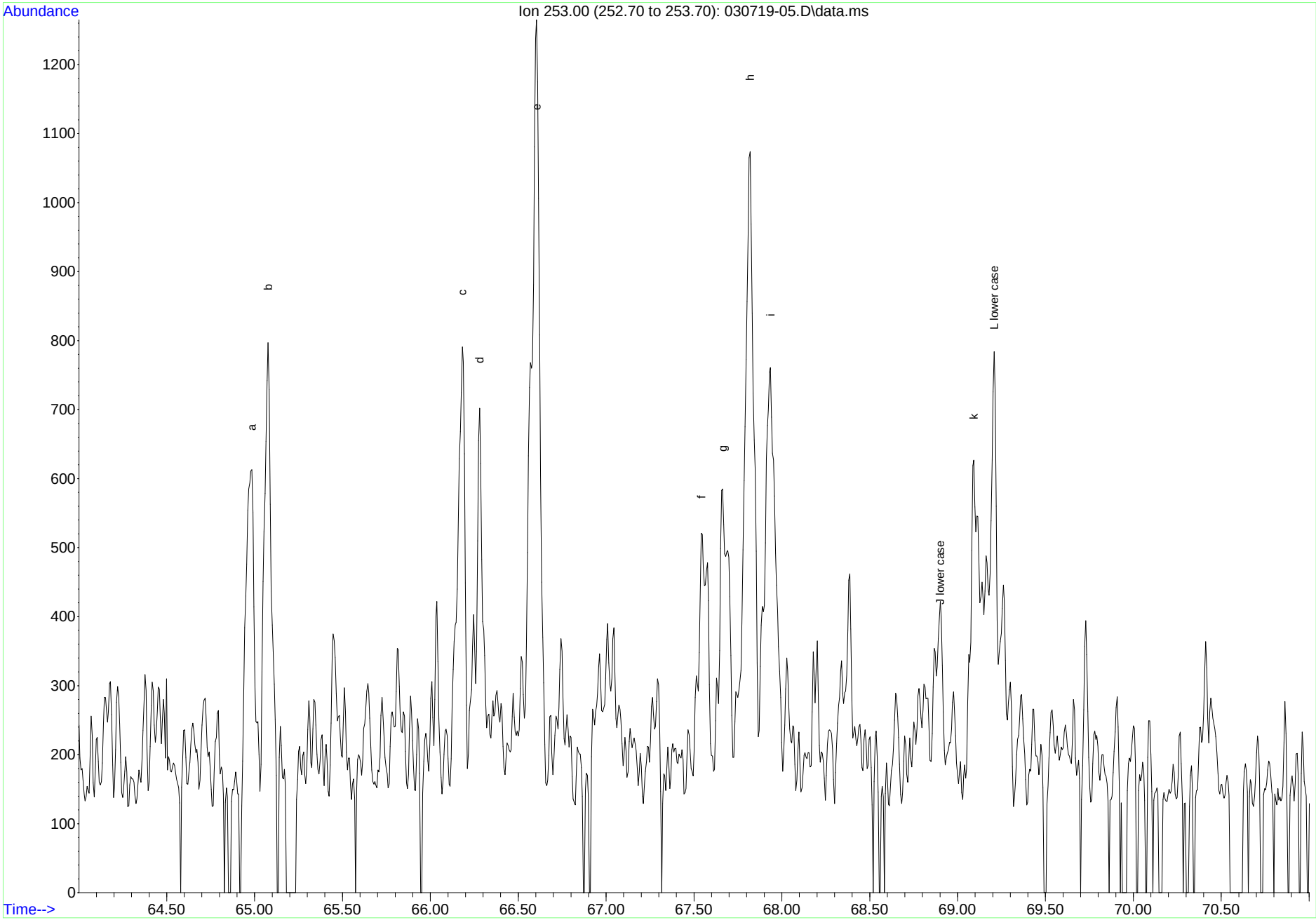
Project Manager:	Brian Peters	Lab ID:	29604-3
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.MW10
Project #:	60866	Analyzed:	3/7/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (253 m/z)
20S, 5β C27-MAS	a	253	65.0	613.0	8.7%
20S, dia C27-MAS	b	253	65.1	797.0	11.3%
20R, 5β C27-MAS + 20R C27 dia MAS	c	253	66.2	637.0	9.0%
20S, 5α C27-MAS	d	253	66.3	485.0	6.9%
20R, 5β C28-MAS + 20S C28 dia MAS	e	253	66.6	1110.0	15.7%
20R, 5α C27-MAS	f	253	67.5	355.0	5.0%
20S, 5α C28-MAS	g	253	67.7	413.0	5.8%
20R, 5β C28-MAS + 20R C28 dia MAS	h	253	67.8	878.0	12.4%
20S, 5β C29-MAS + 20S C29 dia MAS	i	253	67.9	585.0	8.3%
20S, 5α C29-MAS	J lower case	253	68.9	243.0	3.4%
20R, 5α C28-MAS	k	253	69.1	492.0	7.0%
20R, 5β C29-MAS + 20R C29 dia MAS	L lower case	253	69.2	453.0	6.4%
20R, 5α C29-MAS	m	253	ND	ND	ND

0.4252g 321-11-13
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-3 [P.060866.022619.DT.MW10] 1/10
0.4252g 321-11-13



Chromatogram Key & Numerical Results: 231 m/z Triaromatic Steranes

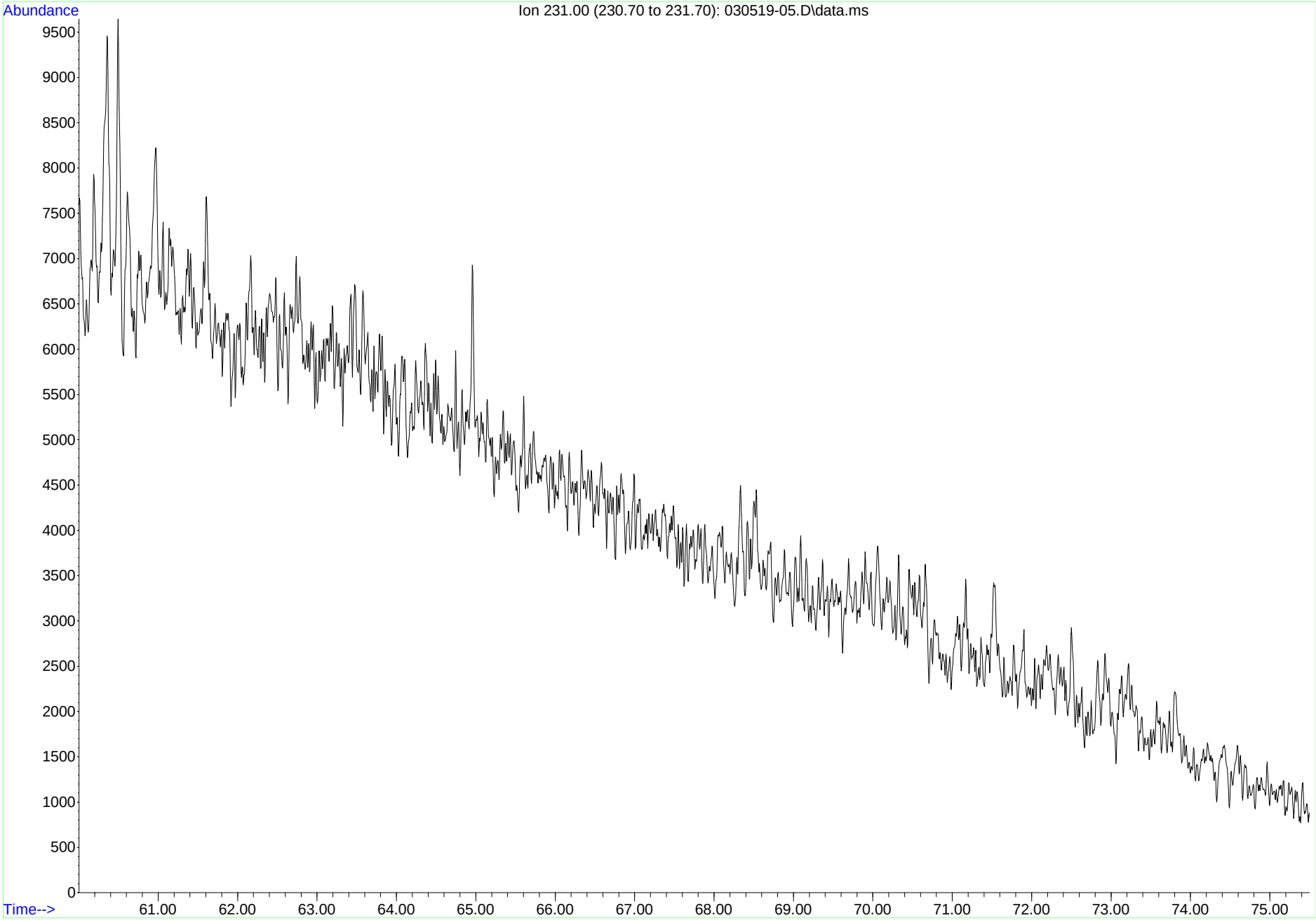
Project Manager:	Brian Peters	Lab ID:	29604-1
Client:	GHD	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.SUMP
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (231 m/z)
C_{20} Triaromatic Sterane	T1	231	ND	ND	ND
C_{21} Triaromatic Sterane	T2	231	ND	ND	ND
20S C_{26} Triaromatic Sterane	T3	231	ND	ND	ND
20R C_{26} + 20S C_{27} Triaromatic Steranes	T4	231	ND	ND	ND
20S C_{28} Triaromatic Sterane	T5	231	ND	ND	ND
20R C_{27} Triaromatic Sterane	T6	231	ND	ND	ND
20R C_{28} Triaromatic Sterane	T7	231	ND	ND	ND

0.4578g 321-11-11
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-1 [P.060866.022619.DT.SUMP]
0.4578g 321-11-11



Chromatogram Key & Numerical Results: 231 m/z Triaromatic Steranes

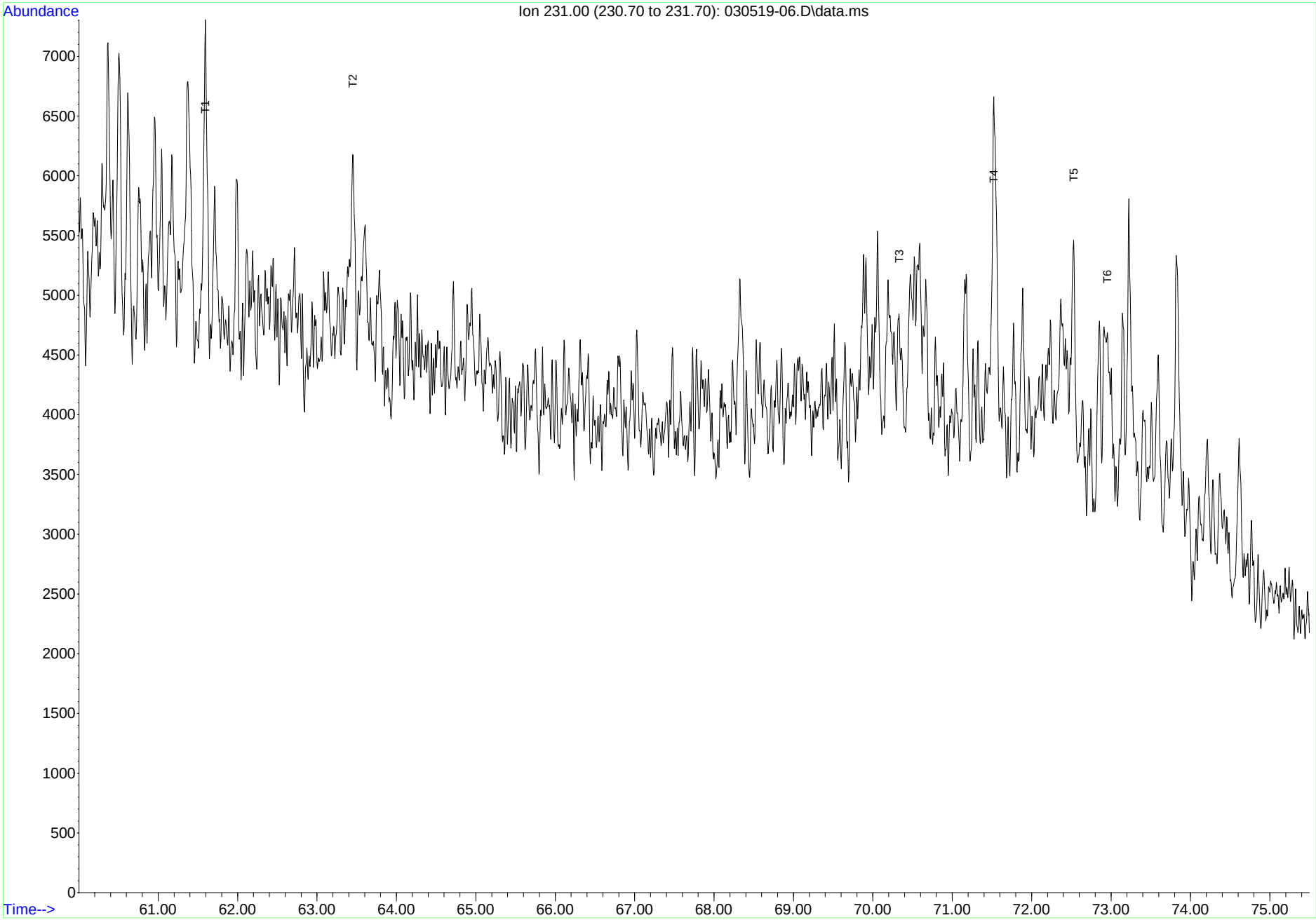
Project Manager:	Brian Peters	Lab ID:	29604-2
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.STAND PIPE
Project #:	60866	Analyzed:	3/5/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (231 m/z)
C_{20} Triaromatic Sterane	T1	231	61.6	2844.0	23.4%
C_{21} Triaromatic Sterane	T2	231	63.5	1816.0	15.0%
20S C_{26} Triaromatic Sterane	T3	231	70.3	829.0	6.8%
20R C_{26} + 20S C_{27} Triaromatic Steranes	T4	231	71.5	2717.0	22.4%
20S C_{28} Triaromatic Sterane	T5	231	72.5	1843.0	15.2%
20R C_{27} Triaromatic Sterane	T6	231	73.0	1127.0	9.3%
20R C_{28} Triaromatic Sterane	T7	231	74.2	960.0	7.9%

0.4428g 321-11-12
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-2 [P.060866.022619.DT.STAND PIPE]
0.4428g 321-11-12



Chromatogram Key & Numerical Results: 231 m/z Triaromatic Steranes

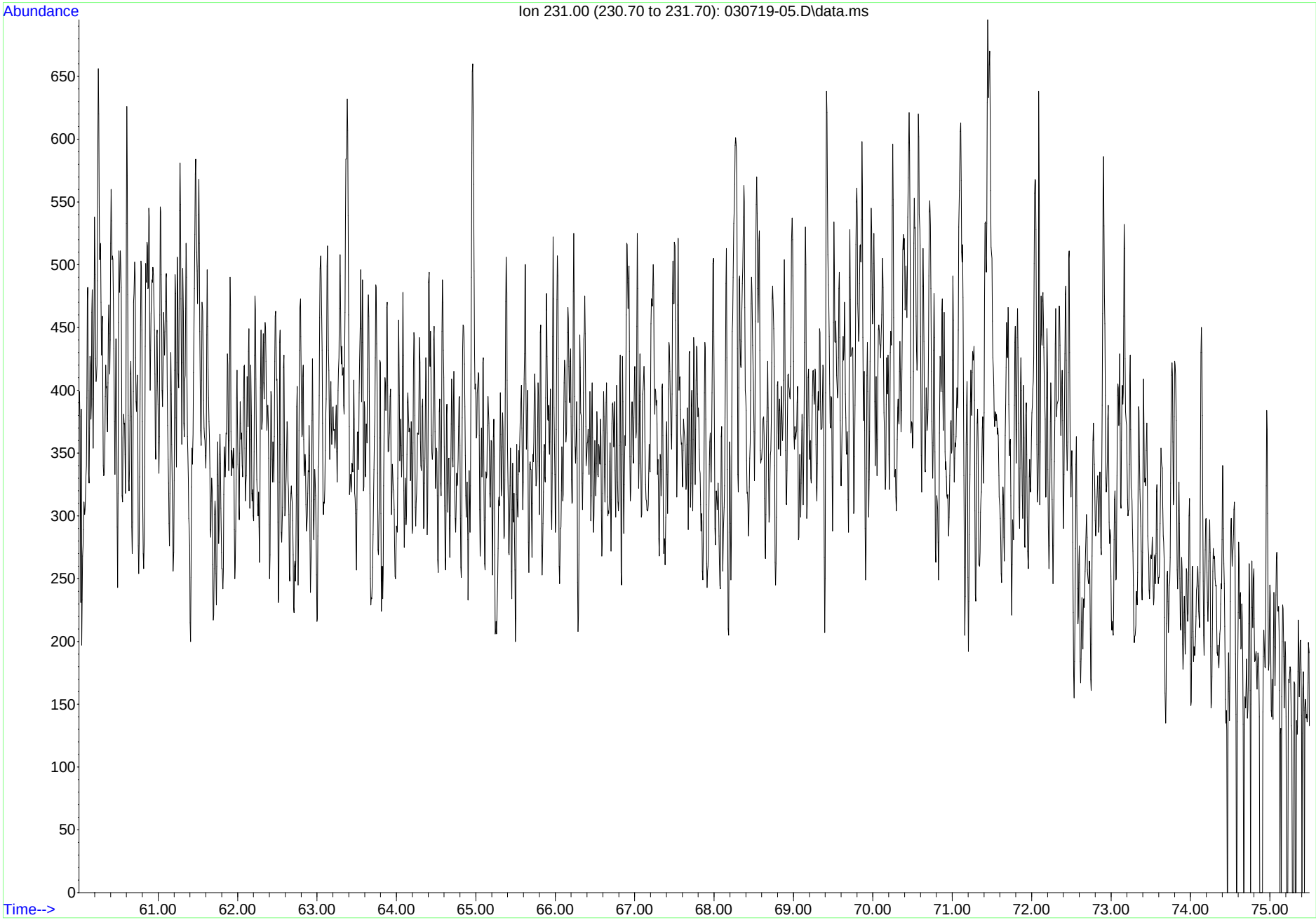
Project Manager:	Brian Peters	Lab ID:	29604-3
Client:	GHD Inc	Collected:	2/26/2019
Address:	20818 44th Ave W, Ste 190 Lynnwood, WA 98036	Received:	3/1/2019
		Matrix:	Product
Project:	Shell Woodland	Client ID:	P.060866.022619.DT.MW10
Project #:	60866	Analyzed:	3/7/2019
Collected by:	D.Trudeau	Q Method:	FSRTL030519.M

Identity	Symbol	Ion (m/z)	Retention Time	Peak Height	Rel. Height % (231 m/z)
C_{20} Triaromatic Sterane	T1	231	ND	ND	ND
C_{21} Triaromatic Sterane	T2	231	ND	ND	ND
20S C_{26} Triaromatic Sterane	T3	231	ND	ND	ND
20R C_{26} + 20S C_{27} Triaromatic Steranes	T4	231	ND	ND	ND
20S C_{28} Triaromatic Sterane	T5	231	ND	ND	ND
20R C_{27} Triaromatic Sterane	T6	231	ND	ND	ND
20R C_{28} Triaromatic Sterane	T7	231	ND	ND	ND

0.4252g 321-11-13
FOREN4LA_RTL.M

Submitted by,
Pace Energy Services, LLC

29604-3 [P.060866.022619.DT.MW10] 1/10
0.4252g 321-11-13



Pace Analytical® Energy Services™

Key for Identifying Aromatic Hydrocarbons

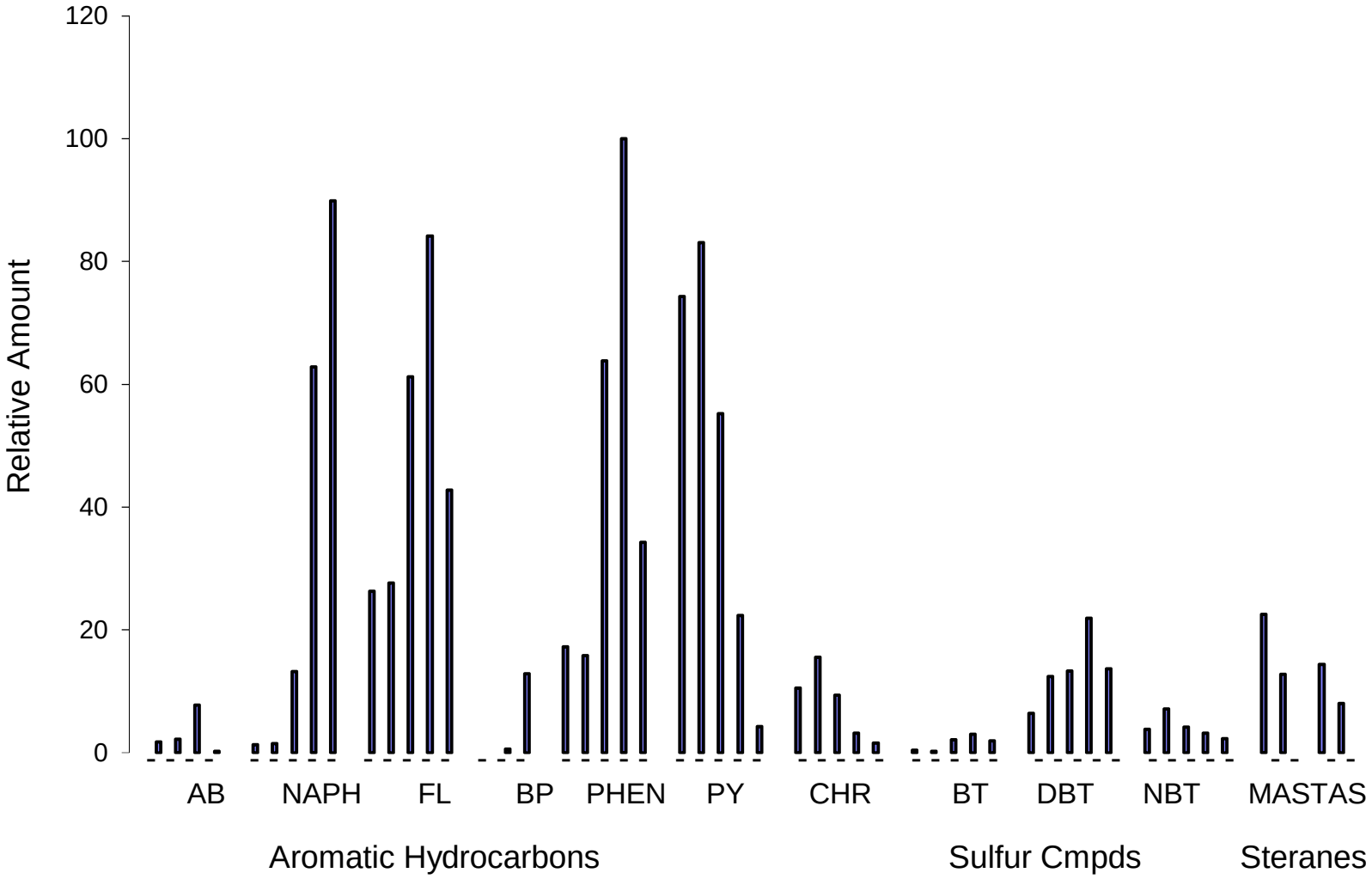
No	m/z	Abbreviation	Compound
1	120	AB	C_3-alkylbenzenes
2	134		C_4-alkylbenzenes
3	148		C_5-alkylbenzenes
4	162		C_6-alkylbenzenes
5	128	NAPH	C_0-naphthalene
6	142		C_1-naphthalenes
7	156		C_2-naphthalenes
8	170		C_3-naphthalenes
9	184		C_4-naphthalenes
10	166	FL	C_0-fluorene
11	180		C_1-fluorenes
12	194		C_2-fluorenes
13	208		C_3-fluorenes
14	222		C_4-fluorenes
15	154	BP	C_0-biphenyl
16	168		C_1-biphenyls + dibenzofuran
17	182		C_2-biphenyls + C1 Dibenzofuran
18	178	PHEN	C_0-phenanthrene
19	192		C_1-phenanthrenes
20	206		C_2-phenanthrenes
21	220		C_3-phenanthrenes
22	234		C_4-phenanthrenes
23	202	PY	C_0-pyrene/fluoranthene
24	216		C_1-pyrenes/fluoranthenes
25	230		C_2-pyrenes/fluoranthenes
26	244		C_3-pyrenes/fluoranthenes
27	258		C_4-pyrenes/fluoranthenes
28	228	CHR	C_0-chrysene
29	242		C_1-chrysenes
30	256		C_2-chrysenes
31	270		C_3-chrysenes
32	284		C_4-chrysenes
33	148	BT	C_1-benzothiophenes
34	162		C_2-benzothiophenes
35	176		C_3-benzothiophenes
36	190		C_4-benzothiophenes
37	204		C_5-benzothiophenes

Key for Identifying Aromatic Hydrocarbons – Cont.

No	m/z	Abbreviation	Compound
38	184	DBT	C_0-dibenzothiophene
39	198		C_1-dibenzothiophenes
40	212		C_2-dibenzothiophenes
41	226		C_3-dibenzothiophenes
42	240		C_4-dibenzothiophenes
43	234	NBT	C_0-naphthobenzthiophene
44	248		C_1-naphthobenzthiophenes
45	262		C_2-naphthobenzthiophenes
46	276		C_3-naphthobenzthiophenes
47	290		C_4-naphthobenzthiophenes
48	253	MAS	Monoaromatic steranes
49	267		Monoaromatic steranes
50	239		Monoaromatic steranes
51	231	TAS	Triaromatic steranes
52	245		Triaromatic steranes

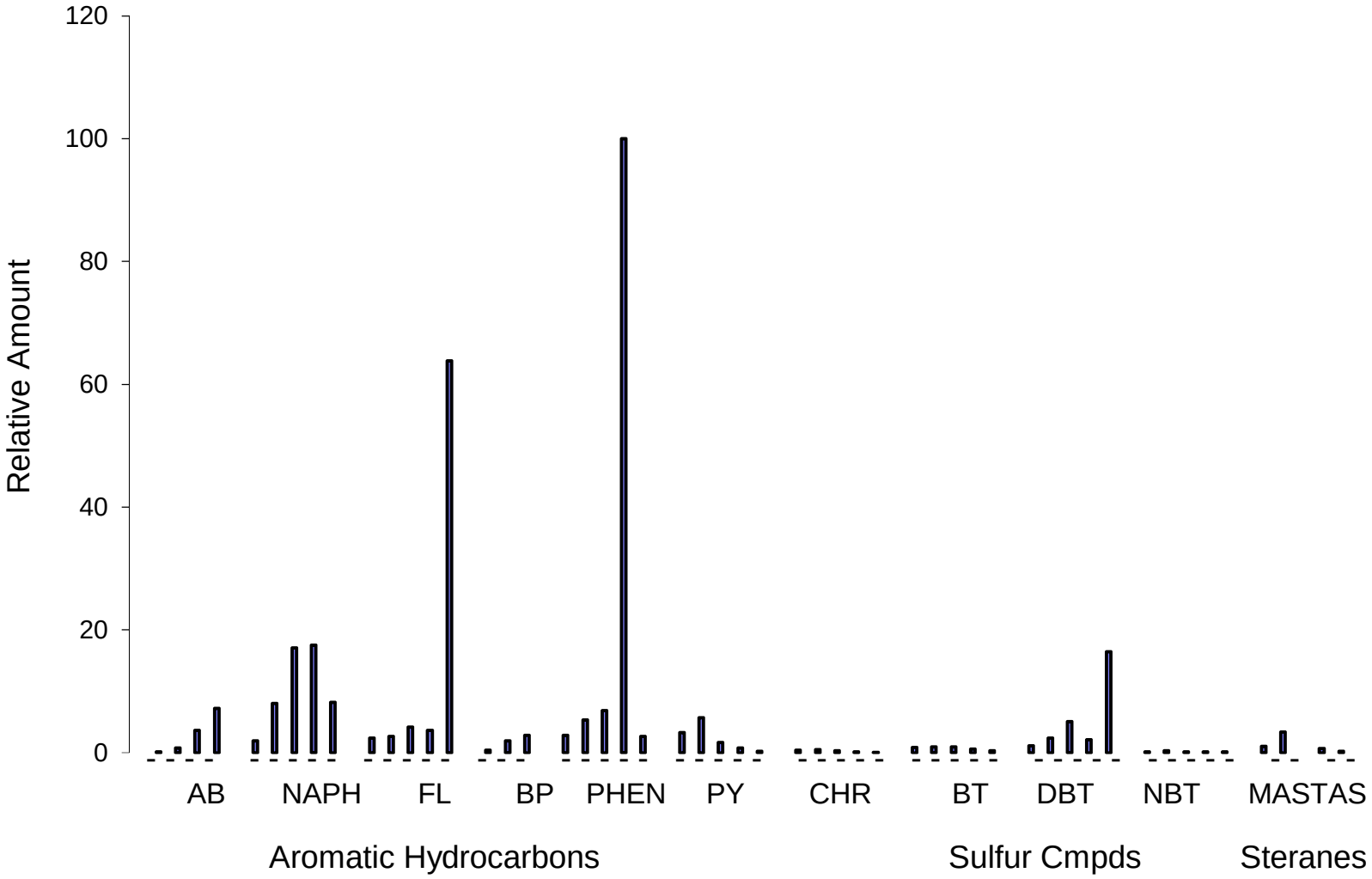
Aromatic Hydrocarbon Distribution

29604-1 [P.060866.022619.DT.SUMP]



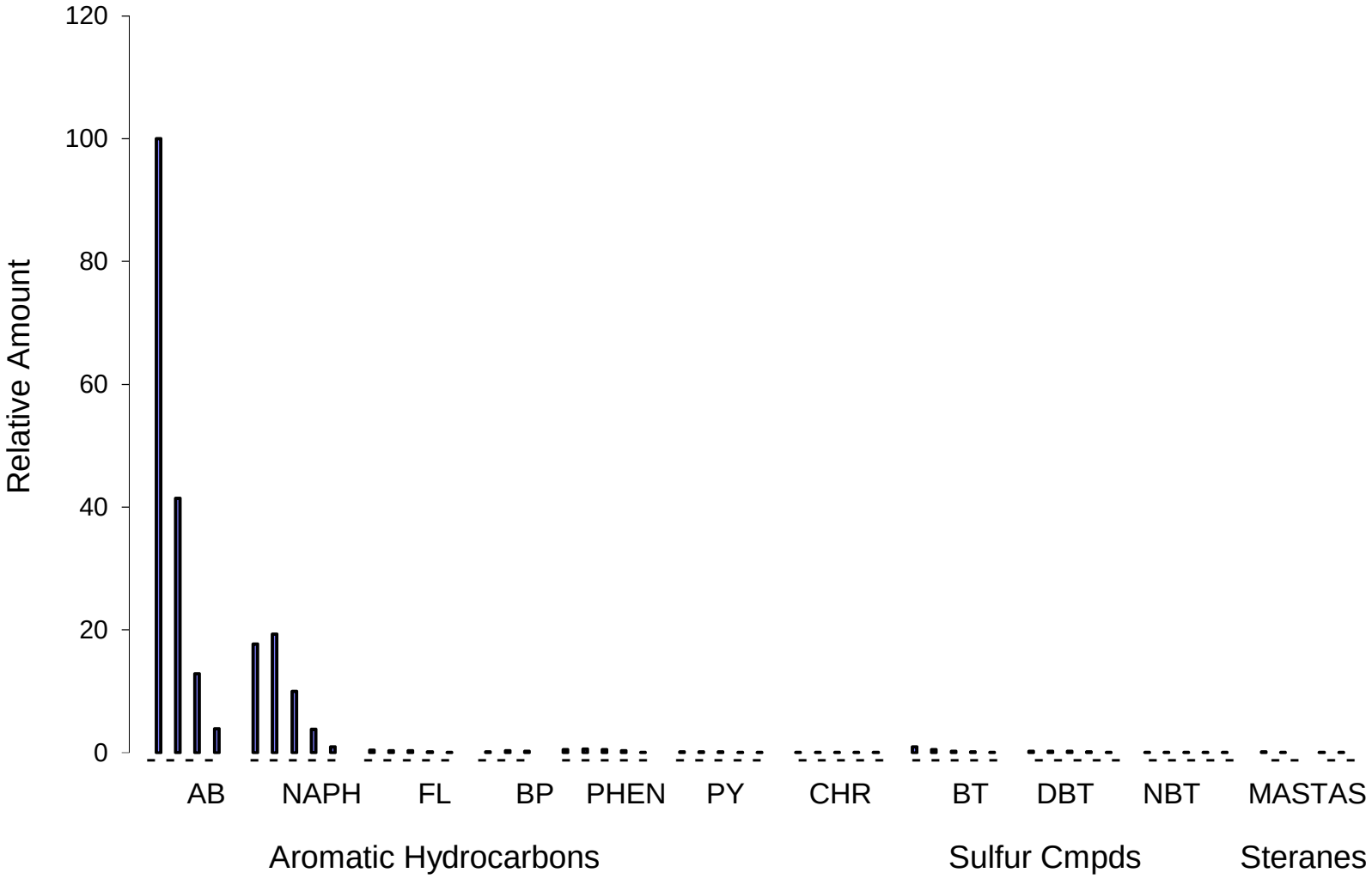
Aromatic Hydrocarbon Distribution

29604-2 [P.060866.022619.DT.STAND PIPE]



Aromatic Hydrocarbon Distribution

29604-3 [P.060866.022619.DT.MW10] 1/10



Organic Lead Speciation
by GC/ECD

EDB, TML, TMEL, DMDEL, MTEL, TEL

Brian Peters
GHD
20818 44th Ave W, Suite 190
Lynnwood WA 98036

Lab ID: **29604-1**
Collected: **2/26/19**
Received: **3/1/19**
Matrix: **Product**

Project: **Shell Woodland**

Client ID: **P.060866.022619.DT SUMP**

Project #: **060866-2019-03**
Collected b **D. Trydeau**

Analyzed: **3/8/2019**
Q Method: **GC/ECD**

Constituents	ssRL mg/kg	PQL mg/kg	Result mg/kg	Blank mg/L
Ethylene Dibromide	0.6	1.8	< 0.6	<0.1
Tetramethyl Lead	6.1	18.3	U	<1.0
Trimethylethyl Lead	6.1	18.3	U	<1.0
Dimethyldiethyl Lead	6.1	18.3	U	<1.0
Methyltriethyl Lead	6.1	18.3	< 6.1	<1.0
Tetraethyl Lead	6.1	18.3	U	<1.0
Methylcyclopentadienyl Manganese Tricarbonyl	6.1	18.3	U	<1.0

ssRL - Sample Specific Reporting Limit
U: Not detected
J: value greater than the ssRL but less than the PQL (3xssRL)

29604-1e.xls
PSB

Brian Peters
GHD
20818 44th Ave W, Suite 190
Lynnwood WA 98036

Project: **Shell Woodland**

Project #: **060866-2019-03**
Collected b **D. Trydeau**

Lab ID: **29604-1D**
Collected: **2/26/19**
Received: **3/1/19**
Matrix: **Product**

Client ID: **P.060866.022619.DT SUMP**

Analyzed: **3/8/2019**
Q Method: **GC/ECD**

Constituents	ssRL mg/kg	PQL mg/kg	Result mg/kg	Blank mg/L
Ethylene Dibromide	0.6	1.9	< 0.6	<0.1
Tetramethyl Lead	6.3	18.8	U	<1.0
Trimethylethyl Lead	6.3	18.8	U	<1.0
Dimethyldiethyl Lead	6.3	18.8	U	<1.0
Methyltriethyl Lead	6.3	18.8	< 6.3	<1.0
Tetraethyl Lead	6.3	18.8	U	<1.0
Methylcyclopentadienyl Manganese Tricarbonyl	6.3	18.8	U	<1.0

ssRL - Sample Specific Reporting Limit
U: Not detected
J: value greater than the ssRL but less than the PQL (3xssRL)

29604-1De.xls
PSB

Brian Peters
GHD
20818 44th Ave W, Suite 190
Lynnwood WA 98036

Lab ID: **29604-2**
Collected: **2/26/19**
Received: **3/1/19**
Matrix: **Product**

Project: **Shell Woodland**

Client ID: **P.060866.022619.DT Stand Pipe**

Project #: **060866-2019-03**
Collected b **D. Trydeau**

Analyzed: **3/8/2019**
Q Method: **GC/ECD**

Constituents	ssRL mg/kg	PQL mg/kg	Result mg/kg	Blank mg/L
Ethylene Dibromide	0.6	1.8	< 0.6	<0.1
Tetramethyl Lead	6.1	18.2	U	<1.0
Trimethylethyl Lead	6.1	18.2	U	<1.0
Dimethyldiethyl Lead	6.1	18.2	U	<1.0
Methyltriethyl Lead	6.1	18.2	U	<1.0
Tetraethyl Lead	6.1	18.2	U	<1.0
Methylcyclopentadienyl Manganese Tricarbonyl	6.1	18.2	U	<1.0

ssRL - Sample Specific Reporting Limit
U: Not detected
J: value greater than the ssRL but less than the PQL (3xssRL)

29604-2e.xls
PSB

Brian Peters
GHD
20818 44th Ave W, Suite 190
Lynnwood WA 98036

Lab ID: **29604-3**
Collected: **2/26/19**
Received: **3/1/19**
Matrix: **Product**

Project: **Shell Woodland**

Client ID: **P.060866.022619.DT MW10**

Project #: **060866-2019-03**
Collected b **D. Trydeau**

Analyzed: **3/8/2019**
Q Method: **GC/ECD**

Constituents	ssRL mg/kg	PQL mg/kg	Result mg/kg	Blank mg/L
Ethylene Dibromide	0.5	1.5	U	<0.1
Tetramethyl Lead	5.2	15.5	62.8	<1.0
Trimethylethyl Lead	5.2	15.5	U	<1.0
Dimethyldiethyl Lead	5.2	15.5	U	<1.0
Methyltriethyl Lead	5.2	15.5	U	<1.0
Tetraethyl Lead	5.2	15.5	U	<1.0
Methylcyclopentadienyl Manganese Tricarbonyl	5.2	15.5	U	<1.0

ssRL - Sample Specific Reporting Limit
U: Not detected
J: value greater than the ssRL but less than the PQL (3xssRL)

29604-3e.xls
PSB

QUALITY ASSURANCE REPORT

Brian Peters
GHD
20818 44th Ave W, Suite 190
Lynnwood WA 98036

Project # **060866-2019-03**
Analyzed: **3/8/2019**
Method: **GC/ECD**

QA DATA FOR EDB and TEL

ANALYTES	RRF	RRF_D	RPD	ACCEPTANCE LIMIT %
Ethylene Dibromide	0.6191667	0.53015	14.38	±15
Tetraethyl Lead	0.0291667	0.0267033	8.45	±15

RRF = Mean relative response factor from 6 point calibration
RRF_D= Daily calibration standard relative response factor
RPD = Relative Percent Difference
QPB011519.M

29604-3e.xls
PSB

CHAIN OF CUSTODY RECORD

COC NO.: 56520

Address: 20818 44th Ave W, Ste 190, Lynnwood, WA PAGE 1 OF 1
Phone: 425 563 6523 Fax:

Project No/ Phase/Task Code: 060866	Laboratory Name: Pace Energy	Lab Location: 200 William Pitt Way Pittsburgh, PA 15238	SSOW ID: 060866-2019-03
Project Name: Shell Bozarth	Lab Contact: Rum Welsh		Cooler No:
Project Location: Woodland, WA			Carrier: Fedex
GHD Chemistry Contact: Jeffrey Cloud.			Airbill No:
Sampler(s): D. Trudeau			Total # of Containers:

Item	Sample Identification (Containers for each sample may be combined on one line)	Date (mm/dd//yy)	Time (hh:mm)	Matrix Code (see back of COC)	Grab (G) or Comp (C)	Filtered (Y/N)	Analysis Requested (See Back of COC for Definitions): Full Scan	PIANO	Organic Lead	Total Containers/sample	MS/MSD Request	Comments/ Special Instructions:
	PRESERVATION - (SEE BACK OF COC FOR ABBREVIATIONS)											
1	P.060866.022619.DT.Sump	2/26/19	1045	P	G	N	X	X	X			
2	P.060866.022619.DT.Stand Pipe	2/26/19	1125	P	G	N	X	X	X			
3	P.060866.022619.DT.MW10	2/26/19	1310	P	G	N	X	X	X			
4												
5												
6												
7												
8												
9												
10												
11												
12												

TAT Required in business days (use separate COCs for different TATs): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 1 Week ☒ 2 Week ☐ Other: 10 day STD

Notes/ Special Requirements: Seperated Product, Not water

Relinquished By	Company	Date	Time	Received By	Company	Date	Time
1. D. Trudeau	GHD	2/28/19	1200	1.			
2.				2.			
3.				3.			

THE CHAIN OF CUSTODY IS A LEGAL DOCUMENT – ALL FIELDS MUST BE COMPLETED ACCURATELY

Distribution: WHITE – Fully Executed Copy (CRA) YELLOW – Receiving Laboratory Copy PINK – Shipper GOLDENROD – Sampling Crew

Cooler Receipt Form

Client Name: _____ **Project:** _____ **Lab Work Order:** _____

A. **Shipping/Container Information** (circle appropriate response)

Courier: FedEx UPS USPS Client Other:_____ **Air bill Present:** Yes No

Tracking Number:_____

Custody Seal on Cooler/Box Present: Yes No **Seals Intact:** Yes No

Cooler/Box Packing Material: Bubble Wrap Absorbent Foam Other:_____

Type of Ice: Wet Blue None **Ice Intact:** Yes Melted

Cooler Temperature:_____ **Radiation Screened:** Yes No **Chain of Custody Present:** Yes No

Comments:_____

B. **Laboratory Assignment/Log-in** (check appropriate response)

	YES	NO	N/A	Comment Reference non-Conformance
Chain of Custody properly filled out				
Chain of Custody relinquished				
Sampler Name & Signature on COC				
Containers intact				
Were samples in separate bags				
Sample container labels match COC Sample name/date and time collected				
Sufficient volume provided				
PAES containers used				
Are containers properly preserved for the requested testing? (as labeled)				
If an unknown preservation state, were containers checked? Exception: VOA's coliform				If yes, see pH form.
Was volume for dissolved testing field filtered, as noted on the COC? Was volume received in a preserved container?				
Headspace present?				

Comments:_____

_____

Cooler contents examined/received by :_____ **Date:**_____

Project Manager Review : ERG **Date:** 3/1/19

Shell Woodland

Report Prepared for:

GHD, Inc.
20818 44th Ave. West
Suite 190
Lynnwood, WA 21076

Report Prepared By:

Mark Jonathan Cejas

Pace Analytical Energy Services, LLC

220 William Pitt Way

Pittsburgh, PA 15238

15 April 2019

Table of Contents

Introduction

Pace Analytical Energy Services, LLC is pleased to provide this report that focuses on the chemical fingerprinting results conducted on behalf of GHD, Inc. The interpretive report was carried out three product sample. The objective of this interpretive report is to characterize the petroleum type(s) in the samples and age constrain if at all possible.

Client ID	Lab ID	Date Collected	Date Received	C3-C12 GC/MS Volatile Range Fingerprinting	C8-C36+ SVOC Fingerprinting by GC/MS	Organic Lead Isomers
P 060866 022619 DT SUMP	29604-1	2/26/2019	3/1/2019	X	X	X
P 060866 022619 Stand Pipe	29604-2	2/26/2019	3/1/2019	X	X	X
P 060866 022619 MW10	29604-3	2/26/2019	3/1/2019	X	X	X

Supporting chemical and general site information was provided by GHD for this interpretive report. The sample was submitted to PACE Energy Forensics Laboratory (Pittsburgh, PA) and analyzed with the following analytical methods:

1) C3-C12 PIANO w/ Oxygenates and additives quantification and fingerprinting by GC/MS – full scan mode (EPA 8260 Modified)
2) C8-C40 qualitative fingerprinting by GC/MS – full scan mode
3) EDB, MMT, and alkyl lead concentrations by GC/ECD

Sample Characterization

Multiple visualizations of diagnostic attributes of petroleum in the three samples are provided in Figures 1, 2, and 3. Multiple lines of evidence suggest that the petroleum present in the samples are not related. All of the samples contain different petroleum products.

Sample P 060866 022619 DT SUMP (29604-1) contained residual range petroleum that has a lubricating oil type quality. The lubricating oil character is evident in the shape and location of the residual range unresolved complex mixture (UCM) "hump," that is evident in the total ion chromatogram (TIC). Detailed biomarker fingerprints of the oil are also shown in Figure 1. Time of release estimation is not possible for a residual range product on chemistry lines of evidence alone. Although the depletion of lower alkylate PAH series (2-3 ring PAHs) and enrichment of C0 and C1 fluoranthenes and pyrenes suggest that the oil may be a used lubricating oil (ULO) that has experienced residence time in the environment.

Sample P 060866 022619 Stand Pipe (29604-2) contained a three-part mixture of 1) #1 diesel-like boiling range product, 2) residual range petroleum product, 3) the enrichment of two organic acid compounds suggests a non-petroleum product source as well. The #1 diesel like signature is notable in the shape and boiling range locations of n-paraffins (85 m/z), and alkylcyclohexanes (83 m/z) in Figure 2. Detailed biomarker fingerprints of the residual range oil are also shown in Figure 2. Time of release estimation is not possible for this mixture of an unknown light distillate type of petroleum and residual range product on chemistry lines of evidence alone. The enrichment of C0 and C1 fluoranthenes and pyrenes suggest that the oil may be a used form. Also, the depletion of lower alkylate PAH series of 2-3 ring PAHs suggest that the petroleum has experienced residence time in the environment.

Sample P 060866 022619 MW-10 (29604-3) contained predominantly a light distillate petroleum product that resembled a Naphtha feedstock more so than any other light distillate fuel product. This naphtha-like characterization was predicated on the shape and boiling range locations of n-paraffins (85 m/z), and alkylcyclohexanes (83 m/z) in Figure 2. In contrast to the petroleum signatures that are evident in the other project samples, the enrichment of C0-C1 two to three ringed PAHs, and the generally non-depleted state of n-paraffins (85 m/z) in the sample invites the interpretation that the product may be somewhat "fresher." Assuming a moderate subsurface weathering regime on-Site, it is plausible that the petroleum may have experienced a residence time in the environment of 0-8 years[1]

[1] Oudijk, Gil. "Age dating heating-oil releases, Part 2: Assessing weathering and release time frames through chemistry, geology and site history." *Environmental Forensics* 10.2 (2009): 120-131.

Conclusion

Chemical source type relationships were not evident in the project samples. All of the samples exhibited different petroleum products. Sample P 060866 022619 DT SUMP (29604-1) contained residual range petroleum that has a lubricating oil type quality. Sample P 060866 022619 Stand Pipe (29604-2) contained a three-part mixture of 1) #1 diesel-like boiling range product, 2) residual range petroleum product, 3) the enrichment of two organic acid compounds suggests a non-petroleum product source as well. Sample P 060866 022619 MW-10 (29604-3) contained predominantly a light distillate petroleum product that resembled a Naphtha feedstock more so than any other light distillate fuel product. Please review the body of the text for details concerning weathering and time of release estimations.

Please call the lab at 412-826-5245, or you may email any questions or concerns to mark.cejas@pacelabs.com regarding any analytical data reports or interpretations.

Respectfully submitted,

Mark Jonathan Cejas

Technical Director of Petroleum Forensics

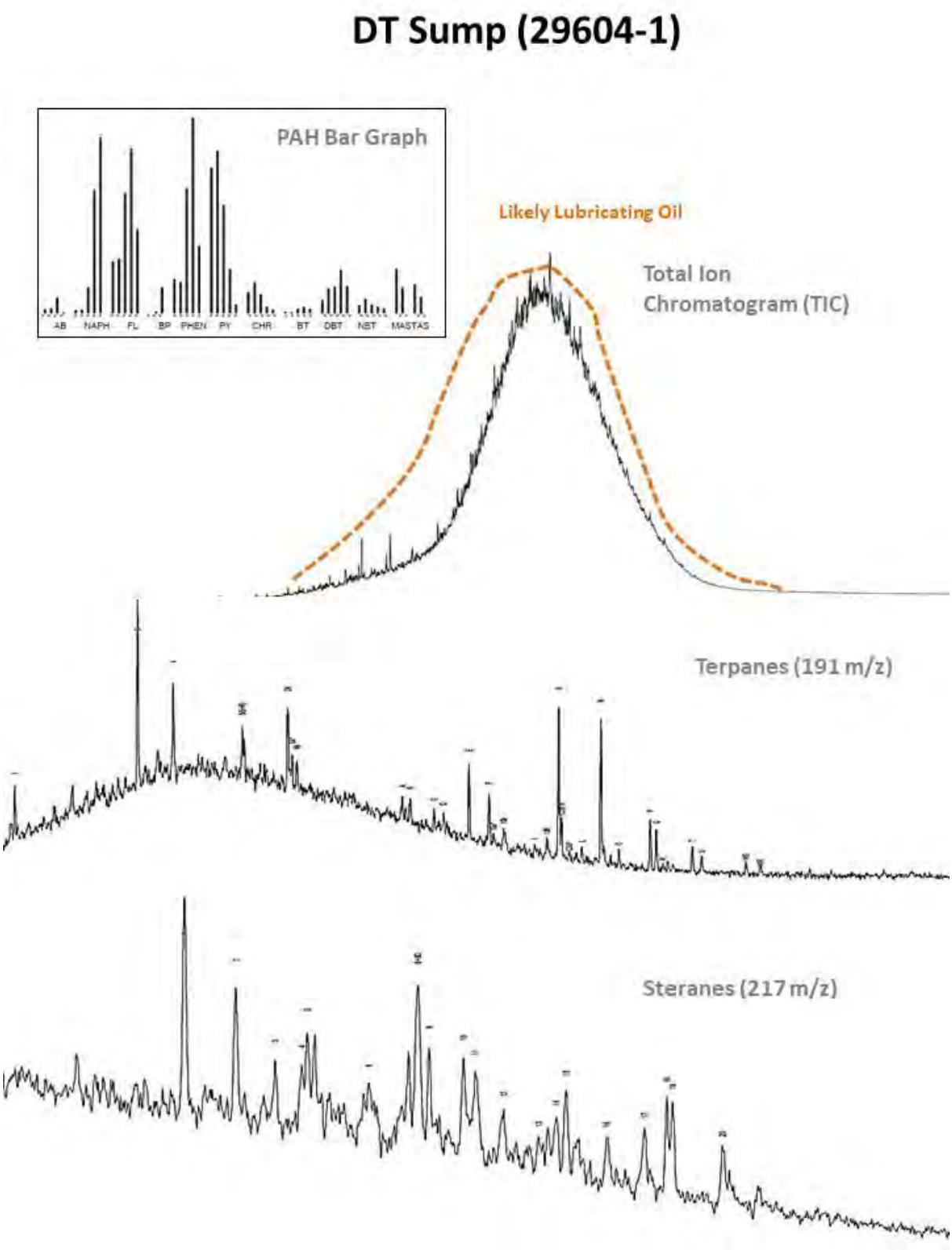


Figure 1. Diagnostic petroleum attributes of DT Sump.

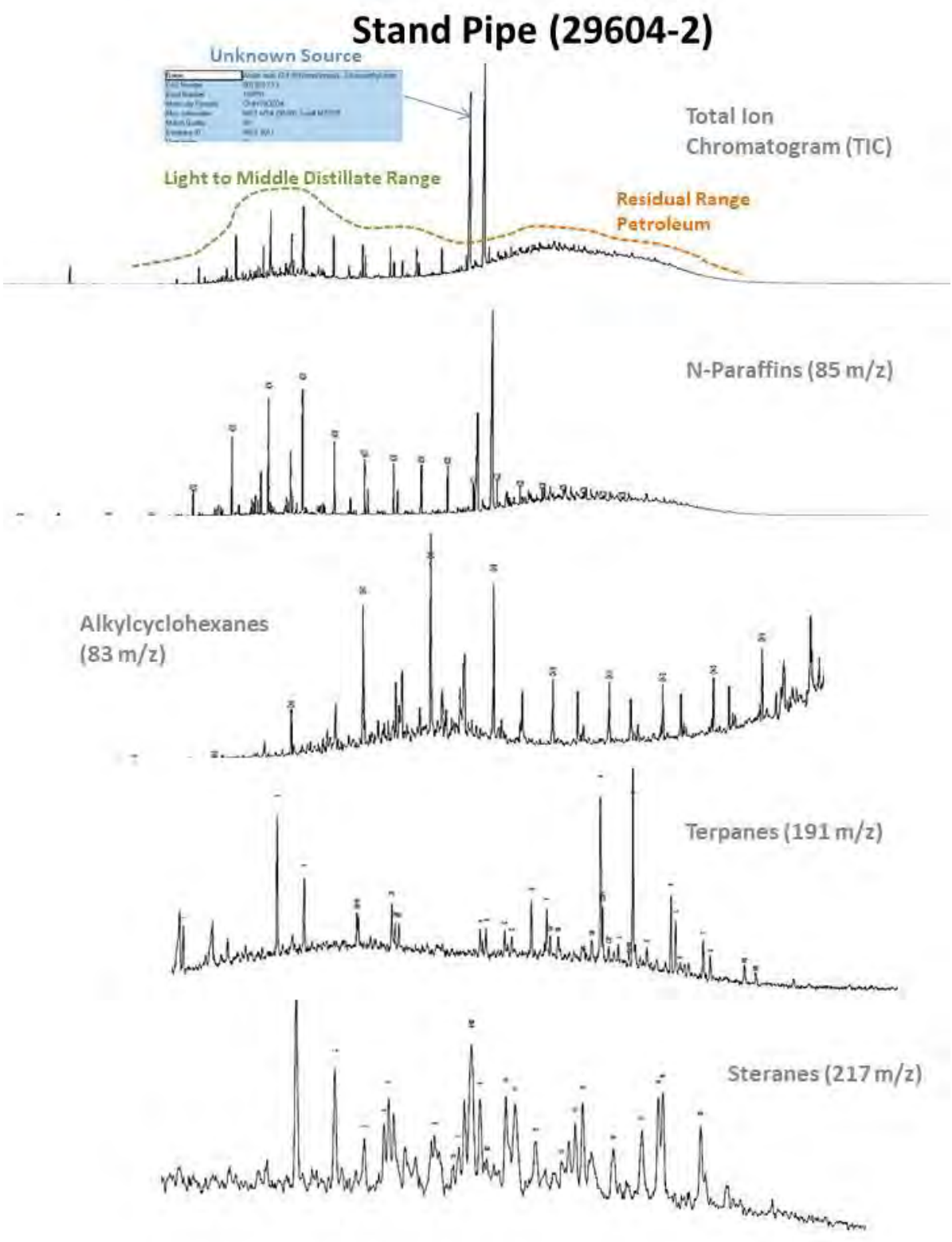


Figure 2 Diagnostic petroleum attributes of Stand Pipe.

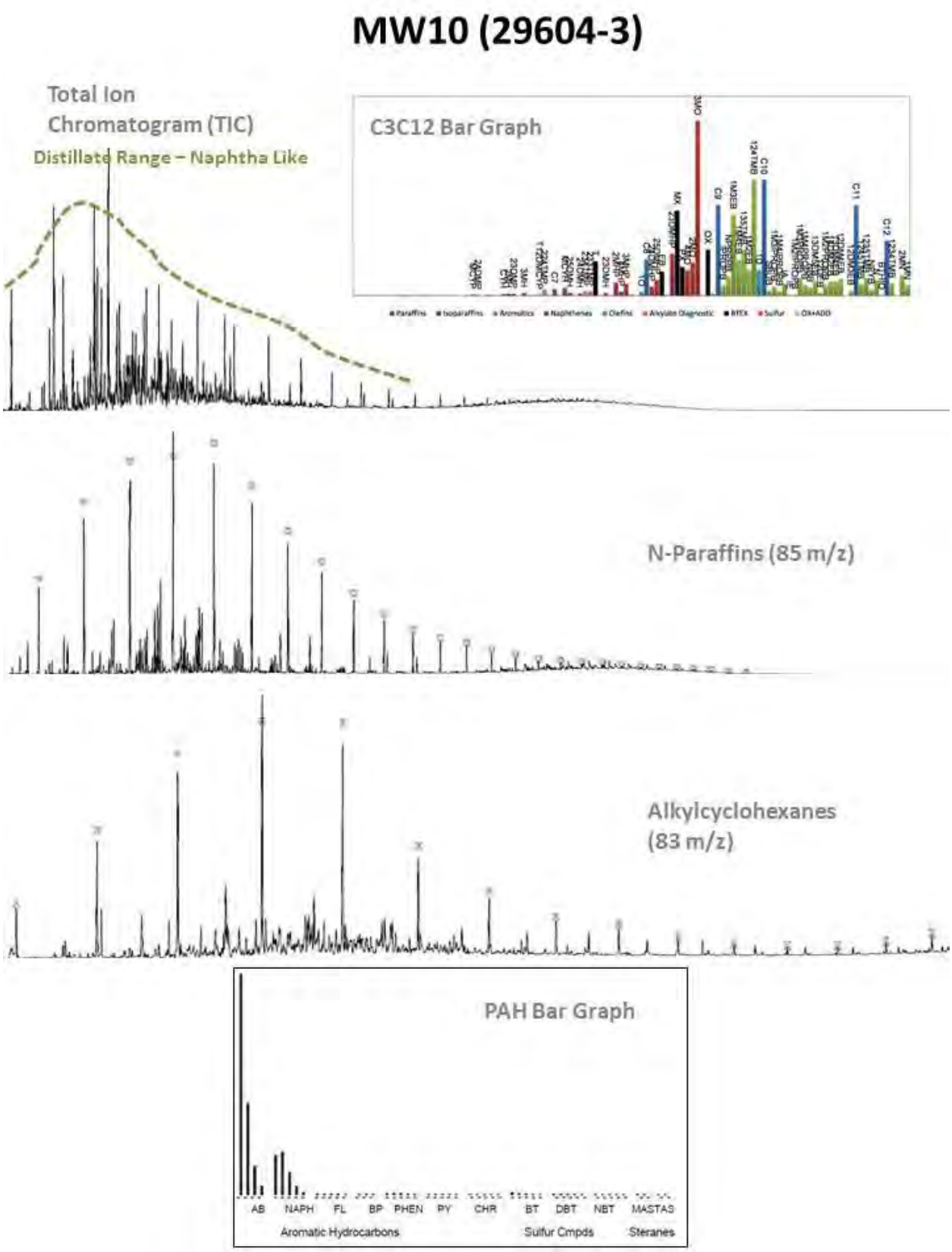


Figure 3. Diagnostic petroleum attributes of MW10.

DATA VALIDATION REPORT

GHD Services, Inc.

Shell - Woodland

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October 1, 2018

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PROJECT NARRATIVE

Basis for the Data Validation

This report summarizes the results of the full level validation (EPA Stage 4) performed on soil and ground water samples and the associated laboratory and field quality control samples for the Shell Woodland Sampling project. A complete list of samples is provided in the Sample Index.

Samples were analyzed by TestAmerica, Inc., Nashville, Tennessee. The analytical methods and EcoChem project chemists are listed in the following table:

ANALYSIS	METHOD OF ANALYSIS	PRIMARY REVIEW	SECONDARY REVIEW
Volatile Organic Compounds (VOC)	SW8260B	A. Bodkin	C. Frans
Total Petroleum Hydrocarbons – Diesel Range	NWTPH-Dx		
Total Petroleum Hydrocarbons – Gasoline Range	NWTPH-Gx		

The data were reviewed using guidance and quality control criteria documented in the analytical methods and *USEPA National Functional Guidelines for Organic Data Review* (EPA, 1999 & 2008).

EcoChem's goal in assigning data assessment qualifiers is to assist in proper data interpretation. If values are estimated (J or UJ), data may be used for site evaluation and risk assessment purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an R, the data are to be rejected and should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet the data quality objectives as stated in the documents and methods referenced above.

Data qualifier definitions, reason codes, and validation criteria are included as Appendix A. A Qualified Data Summary Table is included in Appendix B. Data Validation Worksheets will be kept on file at EcoChem, Inc. A qualified laboratory electronic data deliverable (EDD) is also submitted with this report.

Sample Index
Shell Woodland

SDG	Sample ID	Lab Sample ID	NWTPH-Gx	NWTPH-Dx	BETX	BETX + Naphthalene	VOCs
J157307-1	S-060866-8818-DT-A 5.0	4901573071	✓	✓	✓		
	S-060866-8818-DT-A 10.0	4901573072	✓	✓	✓		
	S-060866-8818-DT-A 15.0	4901573073	✓	✓	✓		
	S-060866-8818-DT-B 5.0	4901573074	✓	✓	✓		
	S-060866-8818-DT-B 10.0	4901573075	✓	✓	✓		
	S-060866-8818-DT-B 15.0	4901573076	✓	✓	✓		
	S-060866-8818-DT-C 5.0	4901573077	✓	✓	✓		
	S-060866-8818-DT-C 10.0	4901573078	✓	✓	✓		
	S-060866-8818-DT-C 15.0	4901573079	✓	✓	✓		
	S-060866-8918-DT-D 5.0	49015730710	✓	✓	✓		
	S-060866-8918-DT-D 10.0	49015730711	✓	✓	✓		✓
	S-060866-8918-DT-D 15.0'	49015730712	✓	✓	✓		✓
	S-060866-8918-DT-E 5.0	49015730713	✓	✓	✓		
	S-060866-8918-DT-E 10.0	49015730714	✓	✓	✓		✓
	S-060866-8918-DT-E 15.0	49015730715	✓	✓	✓		✓
	S-060866-8918-DT-F 5.0	49015730716	✓	✓	✓		
	S-060866-8918-DT-F 10.0	49015730717	✓	✓	✓		
	S-060866-8918-DT-F 15.0	49015730718	✓	✓	✓		
	S-060866-8918-DT-G 5.0	49015730719	✓	✓	✓		
	S-060866-8918-DT-G 10.0	49015730720	✓	✓	✓		
	S-060866-8918-DT-G 15.0	49015730721	✓	✓	✓		
	S-060866-8818-DT-H 5.0	49015730722	✓	✓	✓		
	S-060866-8818-DT-H 10.0	49015730723	✓	✓	✓		
	S-060866-8818-DT-H 15.0	49015730724	✓	✓	✓		
	S-060866-8918-DT-I 5.0	49015730725	✓	✓	✓		
	S-060866-8918-DT-I 10.0	49015730726	✓	✓	✓		
	S-060866-8918-DT-I 15.0	49015730727	✓	✓	✓		
	GW-060866-8918-DT-I	49015730728	✓	✓	✓		✓
	Trip Blanks	49015730729			✓		✓
J157729-1	GW-060866-081518-LB-MW-1	4901577291	✓	✓		✓	
	GW-060866-081518-LB-MW-2	4901577292	✓	✓		✓	✓
	GW-060866-081418-LB-MW-3	4901577293	✓	✓		✓	
	GW-060866-081418-LB-MW-4	4901577294	✓	✓		✓	
	GW-060866-081418-LB-MW-5	4901577295	✓	✓		✓	✓
	GW-060866-081418-LB-MW-6	4901577296	✓	✓		✓	
	GW-060866-081518-LB-MW-7	4901577297	✓	✓		✓	
	GW-060866-081418-LB-MW-8	4901577298	✓	✓		✓	
	GW-060866-081518-LB-MW-9	4901577299	✓	✓		✓	
	GW-060866-081418-LB-MW-11	49015772910	✓			✓	✓

Sample Index
Shell Woodland

SDG	Sample ID	Lab Sample ID	NWTPH-Gx	NWTPH-Dx	BETX	BETX + Naphthalene	VOCs
J157729-1	GW-060866-081418-LB-MW-12	49015772911	✓	✓		✓	✓
	GW-060866-081518-LB-MW-13	49015772912	✓	✓		✓	✓
	GW-060866-081518-LB-MW-14	49015772913	✓	✓		✓	✓
	GW-060866-081518-LB-MW-15	49015772914	✓	✓		✓	
	GW-060866-081518-LB-DUP-1	49015772915	✓	✓		✓	
	GW-060866-081418-LB-TB	49015772916	✓			✓	

DATA VALIDATION REPORT
GHD Services, Inc. – Shell Woodland
Volatile Organic Compounds - Method SW8260B

This report documents the review of analytical data from the analyses of soil and groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by TestAmerica, Inc., Nashville, Tennessee. Refer to the Sample Index for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
J157307-1	27 Soil - 1 Groundwater - 1 Trip Blank	Stage 4
J157729-1	14 Groundwater - 1 Field Duplicate - 1 Trip Blank	Stage 4

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

All sample IDs and results reported in the electronic data deliverable (EDD) were verified (10% verification) by comparing the EDD to the laboratory data package. Ten percent (10%) of the laboratory QC results were also verified.

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
✓	GC/MS Instrument Performance	1	Field Duplicates
✓	Initial Calibration (ICAL)	✓	Target Analyte List
✓	Continuing Calibration (CCAL)	✓	Internal Standards
✓	Laboratory Blanks	1	Reporting Limits
1	Field Blanks	✓	Reported Results
2	Surrogate Compounds	✓	Compound Identification
✓	Laboratory Control Samples (LCS/LCSD)	✓	Calculation Verification

✓ Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
1 Quality control results are discussed below, but no data were qualified.
2 Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

SDG J157307-1: The sample receipt form indicated that one trip blank (laboratory ID 157307-30) was received empty. The other trip blank (laboratory ID 157307-29) was acceptable. No action was taken.

SDG J157729-1: The container label for one sample (GW-060866-081418-LB-MW-11) did not match the ID listed on the COC (GW-060866-081518-LB-MW-11). The sample was collected on 8/14/18 so the container label was used in the data package.

Laboratory Blanks

A method blank was analyzed at the required frequency of one per batch of 20 or fewer samples. With the following exception, target analytes were not detected in the laboratory blanks.

SDG J157307-1: One of 11 method blanks had a positive result for carbon disulfide. This analyte was not detected in the associated sample. No action was required.

Field Blanks

SDG J157307-1: One trip blank (Trip Blanks) was submitted with these samples. Target analytes were not detected in the trip blank.

SDG J157729-1: One trip blank (GW-060866-081418-LB-TB) was submitted with these samples. Target analytes were not detected in the trip blank.

Surrogates

The surrogate compounds 4-bromofluorobenzene (BFB), dibromofluoromethane (DBFM), 1,2-dichloroethane-d4 (DCA), and toluene-d8 (TOL) were added to all field and batch QC samples. When two or more surrogate %R values are below the control limits and indicate a potential low bias, associated results are estimated (J/UJ-13L). When two or more surrogate %R values are greater than the control limit and indicate a potential high bias, only the positive results for a sample are estimated (J-13H). If there is one surrogate outlier that is less than 10% recovery, the reporting limits are rejected (R-13L) and the detections are estimated (J-13L). With the exception of the following samples, all surrogate spike recoveries were within the laboratory control limits of 70% to 130%.

SDG	Sample	Analysis Date	Surrogate	%R	Associated analytes	Qualifier
J157307-1	S-060866-8918-DT-D 5.0	8/14/18 @ 14:56	BFB	1062	Toluene Xylene	J-13H
			DBFM	179		
			DCA	194		
			TOL	556		

SDG	SAMPLE	ANALYSIS DATE	SURROGATE	%R	ASSOCIATED ANALYTES	QUALIFIER
J157307-1	S-060866-8918-DT-D 5.0	8/17/18 @ 17:19	BFB	329	Benzene	J-13H
			DBFM	152		
			DCA	131		
			TOL	387		
	S-060866-8918-DT-F 5.0	8/14/18 @ 5:11	BFB	245	Benzene Toluene	J-13H
			TOL	240		
	S-060866-8818-DT-H 15.0	8/14/18 @ 6:35	BFB	283	Benzene	J-13H
			TOL	227		
	S-060866-8918-DT-I 15.0	8/14/18 @ 7:03	BFB	202	Benzene Toluene	J-13H
			TOL	229		

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) samples were analyzed at the appropriate frequency. No action is taken unless both the MS and MSD %R values are outside the control limits for MS/MSD %R outliers. Precision is evaluated using the RPD values calculated between the MS and MSD results. Any RPD values outside the control limits indicate uncertainty in the measured results for the sample. Qualifiers were only issued to the parent sample.

When the MS/MSD %R values indicate a potential low bias, associated results are estimated (J/UJ-8). Only the associated positive results are estimated (J-8) if the %R values indicate a potential high bias. Associated positive results are estimated (J-9) if the RPD values indicate uncertainty.

SDG J157307-1: Three sets of matrix spike samples were analyzed:

- *S-060866-8918-DT-G 10.0* (BTEX only): The percent recovery (%R) and relative percent difference (RPD) values were acceptable.
- *S060866-8818-DT-H 15.0* (BTEX only): The %R and RPD values were acceptable.
- *S-060866-8918-DT-I 10.0* (VOC): There were several %R values outside the control limits. For some analytes, the concentrations in the parent sample were greater than 4X the spike concentration; therefore, no action was required. For the remainder of the outliers, the %R values were greater than the upper control limit and there were no positive results in the associated parent sample; therefore, no qualifiers were required.

Field Duplicates

For water samples, the RPD control limit is 35% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the absolute difference between the sample and replicate must be less than the RL.

SDG J157307-1: No field duplicates were submitted with this data set.

SDG J157729-1: Samples GW-060866-081518-LB-MW-9 and GW-060866-081518-LB-DUP1 were designated as field duplicates. Field precision was acceptable.

Reporting Limits

The target reporting limits for samples were adjusted for sample size and required dilutions. No data were qualified.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, LCS, and MS/MSD recovery values and with the exceptions noted above, precision was also acceptable as demonstrated by the MS/MSD, and laboratory and field duplicate RPD values.

Results were estimated because of surrogate accuracy outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
GHD Services, Inc. – Shell Woodland
Gasoline Range Organics - Method NWTPH-Gx

This report documents the review of analytical data from the analyses of soil groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by TestAmerica, Inc., Nashville, Tennessee. Refer to the Sample Index for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
J157307-1	27 Soil - 1 Groundwater	Stage 4
J157729-1	14 Groundwater - 1 Field Duplicate - 1 Trip Blank	Stage 4

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

All sample IDs and results reported in the electronic data deliverable (EDD) were verified (10% verification) by comparing the EDD to the laboratory data package.

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
✓	GC/MS Instrument Performance	1	Field Duplicates
✓	Initial Calibration (ICAL)	✓	Target Analyte List
✓	Continuing Calibration (CCAL)	✓	Internal Standards
✓	Laboratory Blanks	1	Reporting Limits
1	Field Blanks	✓	Reported Results
✓	Surrogate Compounds	✓	Compound Identification
✓	Laboratory Control Samples (LCS/LCSD)	✓	Calculation Verification

✓ Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
1 Quality control results are discussed below, but no data were qualified.
2 Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

SDG J157729-1: The container label for one sample (GW-060866-081418-LB-MW-11) did not match the ID listed on the COC (GW-060866-081518-LB-MW-11). The sample was collected on 8/14/18 so the container label was used in the data package.

Field Blanks

SDG J157729-1: One trip blank, GW-060866-081418-LB-TB was submitted with this SDG. Gasoline Range Organics were not detected in this blank.

Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike/matrix spike duplicate (MS/MSD) samples were not analyzed with these samples. Accuracy was evaluated using the laboratory control sample and surrogate %R values. Precision is evaluated using the LCS/LCSD and laboratory duplicate RPD values.

Field Duplicates

For water samples, the RPD control limit is 35% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the absolute difference between the sample and replicate must be less than the RL.

SDG J157307-1: No field duplicates were submitted with this data set.

SDG J157729-1: Samples GW-060866-081518-LB-MW-9 and GW-060866-081518-LB-DUP1 were designated as field duplicates. Field precision was acceptable.

Reporting Limits

The target reporting limits for samples were adjusted for sample size and required dilutions. No data were qualified.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate and LCS recovery values. Precision was also acceptable as demonstrated by the LCS/LCSD and laboratory duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
GHD Services, Inc. – Shell Woodland
Diesel Range Organics - Method NWTPH-Dx

This report documents the review of analytical data from the analyses of soil and groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by TestAmerica Inc., Nashville, Tennessee. Refer to the Sample Index for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
J157307-1	27 SOIL – 1 GROUNDWATER	STAGE 4
J157729-1	13 GROUNDWATER – 1 FIELD DUPLICATE	STAGE 4

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

All sample IDs and results reported in the electronic data deliverable (EDD) were verified (10% verification) by comparing the EDD to the laboratory data package.

The original EDD received from the laboratory was missing some sample results. The laboratory was contacted and provided an updated EDD with all sample results present.

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

2	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
✓	GC/MS Instrument Performance	2	Laboratory Duplicates
✓	Initial Calibration (ICAL)	1	Field Duplicates
✓	Continuing Calibration (CCAL)	✓	Target Analyte List
✓	Laboratory Blanks	✓	Internal Standards
1	Field Blanks	1	Reporting Limits
2	Surrogate Compounds	✓	Reported Results
✓	Laboratory Control Samples (LCS/LCSD)	✓	Compound Identification
		✓	Calculation Verification

✓ *Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed*
1 *Quality control outliers are discussed below, but no data were qualified.*
2 *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

Sample Receipt, Preservation, and Holding Times

SDG J157307-1: Sample GW-060866-8918-DT-I was extracted past the 7-day holding time on the 12th day. Results were estimated (J/UJ-1).

SDG J157729-1: The container label for one sample (GW-060866-081418-LB-MW-11) did not match the ID listed on the COC (GW-060866-081518-LB-MW-11). The sample was collected on 8/14/18 so the container label was used in the data package.

Sample GW-060866-081418-LB-MW-11 was extracted past the 7-day holding time on the 10th day. There were no positive results in the sample. Reporting limits were estimated (UJ-1).

Field Blanks

No field blanks were submitted with this sampling event.

Surrogate Compounds

The surrogate compound, o-terphenyl was added to all samples. With the following exceptions, all surrogate recoveries were within the laboratory control limits.

SDG J157307-1: There were several recoveries for the surrogate compound that were outside the control limits. For Sample S-060866-8818-DT-H 15.0 (5x dilution), the %R value for o-terphenyl was less than the lower control limit of 50% at 49%. Results were estimated (J/UJ-13L) to indicate a potential low bias. For all other outliers, the samples were analyzed at dilution factors of 10x to 100x. No qualifiers were assigned for these samples because they were diluted beyond a level of accurate quantitation of the surrogate.

Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike/matrix spike duplicate (MS/MSD) samples were not analyzed with these samples. Accuracy was evaluated using the laboratory control sample and surrogate %R values. Precision is evaluated using the LCS/LCSD and laboratory duplicate RPD values.

Laboratory Duplicates

For soil samples, the relative percent difference (RPD) control limit is 50% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the absolute difference between the sample and replicate must be less than 2x the RL.

For aqueous samples, the relative percent difference (RPD) control limit is 35% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the absolute difference between the sample and replicate must be less than the RL.

All duplicate RPD values were within the laboratory control limits.

SDG J157307-1: Three laboratory duplicates were analyzed. For the laboratory duplicates analyzed on Samples S060866-8818-DT-B 5.0 and S060866-8918-DT-I 5.0, the RPDs were within QC limits. For the duplicate analyzed on Sample S-060866-8918-DT-F 5.0, the RPD value for C10-C24 was greater than the control limit of 50% at 58%. The positive result for C10-C24 was estimated (J-9) in the parent sample.

Field Duplicates

For soil samples, the relative percent difference (RPD) control limit is 50% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the absolute difference between the sample and replicate must be less than 2x the RL.

For aqueous samples, the RPD control limit is 35% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the absolute difference between the sample and replicate must be less than the RL.

SDG J157307-1: No field duplicates were submitted with this data set.

SDG J157729-1: Samples GW-060866-081518-LB-MW-9 and GW-060866-081518-LB-DUP1 were designated as field duplicates. Field precision was acceptable.

Reporting Limits

The target reporting limits for samples were adjusted for sample size and required dilutions. No data were qualified.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted previously, accuracy was acceptable, as demonstrated by the surrogate, LCS, and MS/MSD percent recovery values. Precision was also acceptable as demonstrated by the MS/MSD, and laboratory and field duplicate relative percent difference values.

Results were estimated based on holding time outliers, surrogate accuracy outliers, and laboratory duplicate precision outliers.

All data, as qualified, are acceptable for use.

ECOCHEM
Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS
REASON CODES
AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
Based on National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

Group	Code	Reason for Qualification
Sample Handling	1	Improper Sample Handling or Sample Preservation (i.e., headspace, cooler temperature, pH, summa canister pressure); Exceeded Holding Times
Instrument Performance	24	Instrument Performance (i.e., tune, resolution, retention time window, endrin breakdown, lock-mass)
	5A	Initial Calibration (RF, %RSD, r^2)
	5B	Calibration Verification (CCV, CCAL; RF, %D, %R) Use bias flags (H,L)[1] where appropriate
	5C	Initial Calibration Verification (ICV %D, %R) Use bias flags (H,L)[1] where appropriate
Blank Contamination	6	Field Blank Contamination (Equipment Rinsate, Trip Blank, etc.)
	7	Lab Blank Contamination (i.e., method blank, instrument blank, etc.) Use low bias flag (L)[1] for negative instrument blanks
Precision and Accuracy	8	Matrix Spike (MS and/or MSD) Recoveries Use bias flags (H,L)[1] where appropriate
	9	Precision (all replicates: LCS/LCSD, MS/MSD, Lab Replicate, Field Replicate)
	10	Laboratory Control Sample Recoveries (a.k.a. Blank Spikes) Use bias flags (H,L)[1] where appropriate
	12	Reference Material Use bias flags (H,L)[1] where appropriate
	13	Surrogate Spike Recoveries (a.k.a. labeled compounds, recovery standards) Use bias flags (H,L)[1] where appropriate
Interferences	16	ICP/ICP-MS Serial Dilution Percent Difference
	17	ICP/ICP-MS Interference Check Standard Recovery Use bias flags (H,L)[1] where appropriate
	19	Internal Standard Performance (i.e., area, retention time, recovery)
	22	Elevated Detection Limit due to Interference (i.e., chemical and/or matrix)
	23	Bias from Matrix Interference (i.e. diphenyl ether, PCB/pesticides)
Identification and Quantitation	2	Chromatographic pattern in sample does not match pattern of calibration standard
	3	2nd column confirmation (RPD or %D)
	4	Tentatively Identified Compound (TIC) (associated with NJ only)
	20	Calibration Range or Linear Range Exceeded
	25	Compound Identification (i.e., ion ratio, retention time, relative abundance, etc.)
Miscellaneous	11	A more appropriate result is reported (multiple reported analyses i.e., dilutions, re-extractions, etc. Associated with "R" and "DNR" only)
	14	Other (See DV report for details)
	26	Method QC information not provided

[1] H = high bias indicated
L = low bias indicated

Volatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)
(Based on NFG 1999 & 2008 and SW-846 Method 8260C)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	4°C±2°C Aqueous: HCl to pH < 2 Current SW846 criterion is ≤ 6° C [3]	NFG [1] Method [3]	**If required by project:** J (pos)/UJ (ND) if greater than 6° C	1	Use **PJ** for temp outliers; see **TM20** if pH ≤ 2, reject 2-chloroethyl vinyl ether (R-1) some projects may require methanol preserved soils/seds
Holding Time	**Aqueous:** 14 days preserved 7 Days: unpreserved **Solid:** 14 Days	NFG [1] Method [3]	J (pos)/UJ (ND) if HT exceeded J (pos)/R (ND) if gross exceedance (> 2x HT)	1	Gross exceedance = > 2x HT, as per 1999 NFG
Instrument Performance					
Tuning	BFB Beginning of each 12 hour period Use method or project acceptance criteria	NFG [1] Method [3]	R (pos/ND) all analytes in all samples associated with the tune	24	
Initial Calibration **Sensitivity**	Minimum 5 standards RRF ≥ 0.05 except: RRF ≥ 0.01 poor responders * RRF ≥ 0.005 1,4-dioxane	NFG [1] Method [3]	Use **PJ** to qualify J (pos)/UJ (ND)	5A	**TM-06** EcoChem Policy for the Evaluation and Qualification of GCMS Instrument Performance **PJ** - no action if response is stable (ICAL RSD and CCAL %D acceptable)
Initial Calibration **Stability**	%RSD ≤ 20% except: %RSD ≤ 40% poor responders * %RSD ≤ 50% 1,4-dioxane	NFG [1] Method [3]	J (pos) if %RSD > limit	5A	
Initial Calibration Verification	Second source analyzed immediately after ICAL %R 70% - 130%	Method [3]	J (pos) %R > UCL J (pos)/UJ (ND) %R < LCL	5A (H,L)[4]	QAPP may have overriding accuracy limits.
Continuing Calibration **Sensitivity**	RRF ≥ 0.05 except: RRF ≥ 0.01 poor responders * RRF ≥ 0.005 1,4-dioxane	NFG [1] Method [3]	Use **PJ** to qualify J (pos)/UJ (ND)	5B	see ICAL RRF guidance
Continuing Calibration **Stability**	%D ≤ 25% except: %D ≤ 40% poor responders * %D ≤ 50% 1,4-dioxane	NFG [1] Method [3]	J (pos) - %D > control limit (high bias) J (pos)/UJ (ND) - %D < -control limit (low bias)	5B (H,L)[4]	

Volatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)
(Based on NFG 1999 & 2008 and SW-846 Method 8260C)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch (of ≤ 20 samples) No detected compounds > MDL	NFG (2) Method (3)	U (pos) if result is < 5X or 10X action level	7	10X action level for methylene chloride, acetone, & 2-butanone. 5X for all other target analytes **Hierarchy of blank review:** **#1 - Review MB, qualify as needed** **#2 - Review TB, qualify as needed** **#3 - Review FB, qualify as needed** **Note: Actions as per NFG 1999**
	No TICs present		R (pos) TICs using 10X rule		
Trip Blank (TB)	No detected compounds > MDL	NFG (2) Method (3)	U (pos) if result is < 5X or 10X action level	6	
Field Blank (FB)	No detected compounds > MDL	NFG (2) Method (3)	U (pos) if result is < 5X or 10X action level	6	
Precision and Accuracy					
LCS/LCSD (recovery)	One per matrix per batch (of ≤ 20 samples) LCSD not required by NFG or method Use method acceptance criteria/laboratory limits	Method (3)	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND)%R < 10%	10 (H,L)[4]	No action if only one spike %R is outside criteria when LCSD is analyzed, unless one recovery is <10%. QAPP may have overriding accuracy limits.
LCS/LCSD RPD	If LCSD analyzed RPD < lab limits	Method (3)	J (pos)	9	Qualify all associated samples. QAPP may have overriding precision limits.
Reference Material (RM, SRM, or CRM)	Result ±20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L)[4]	QAPP may have overriding accuracy limits. Some manufacturers may have different RM control limits
Surrogates	Added to all samples Within method/laboratory control limits	NFG (1) Method (3)	J (pos) if %R >UCL J (pos)/UJ (ND) if %R <LCL J (pos)/R (ND) if <10%	13 (H,L)[4]	No action if there are 4+ surrogates and only 1 outlier Qualify all compounds if qualification is required.
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	NFG (1) Method (3)	J (pos) if > 200% J (pos)/UJ (ND) if < 50% J (pos)/R (ND) if < 25% if RT >30 seconds use **PJ**	19	Qualify compounds quantified using particular internal standard

Volatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)
(Based on NFG 1999 & 2008 and SW-846 Method 8260C)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Precision and Accuracy (continued)					
MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG [1] Method [3]	J (pos) %R > UCL J (pos)/UJ (ND) if both %R < LCL J (pos)/R (ND) if both %R < 10% J (pos)/UJ (ND) if one > UCL & one < LCL, with no bias	8 (H,L)[4]	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only.
MS/MSD (RPD)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG [1] Method [3]	J (pos) If RPD > control limit	9	Qualify parent sample only
Field Duplicates	**Solids:** RPD < 50% OR difference < 2X RL (for results < 5X RL) **Aqueous:** RPD < 35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	J (pos)/UJ (ND) Qualify only parent and field duplicate samples	9	Use project limits if specified
Compound Identification and Quantitation					
Retention Time Relative Ion Intensities	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	NFG [1] Method [3]	U (pos) if identification criteria not met	25	
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NFG [1] Method [3]	NJ TIC R (pos) if common laboratory contaminants	4	Common laboratory contaminants: aldol condensation products, solvent preservatives, and reagent contaminants
Calibration Range	Results greater than highest calibration standard	EcoChem standard policy	Qualify J (pos)	20	If result from dilution analysis is not reported.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	**TM-04** EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] National Functional Guidelines for Organic Data Review, June, 2008
[2] National Functional Guidelines for Organic Data Review, Oct, 1999
[3] Method SW846 8260C Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)
[4] NFG 2013 suggests using "+ / -" to indicate bias; EcoChem has chosen "H" = high bias indicated; "L" = low bias indicated.

(pos): Positive Result
(ND): Non-detect

* "Poor responder" compounds: Acetone, 2-butanone, carbon disulfide, chloroethane, chloromethane, cyclohexane, 1,2-dibromoethane, dichlorodifluoromethane, cis-1,2-dichloroethene, 1,2-dichloropropane, 1,2-dibromo-3-chloropropane, 2-hexanone, isopropylbenzene, methyl acetate, methylene chloride, methylcyclohexane, 4-methyl-2-pentanone, methyl tert-butyl ether, trans-1,2-dichloroethene, trichlorofluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane **criterion is 0.010 RRF;** 1,4-dioxane RRF **criterion is 0.005**.

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Gasoline Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Gx, June 1997, Wa DOE & Oregon DEQ)

QC Element	Acceptance Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling				
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6°C	1	
Holding Time	Waters: 14 days preserved 7 days unpreserved Solids: 14 Days	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X	1	Professional Judgement
Instrument Performance				
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $r^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if r^2 <0.990 J(+)/UJ(-) if %RSD > 20%	5A	
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 80% to 120%	Narrate if frequency not met. J(+)/UJ(-) if %R < 80% J(+) if %R >120%	5B	
Blank Contamination				
Method Blank	At least one per batch (≤10 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7	
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7	
Trip Blank (if required by project)	No results >RL	Action is same as method blank for positive results remaining in trip blank after method blank qualifiers are assigned.	18	
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in field blank after method **and** trip blank qualifiers are assigned.	6	

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Gasoline Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Gx, June 1997, Wa DOE & Oregon DEQ)

QC Element	Acceptance Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Precision and Accuracy				
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked.	8	Use Professional Judgement if only one %R outlier
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9	
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10%	10	Professional Judgement
Surrogates	Bromofluorobenzene and/or 1,4-difluorobenzene added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R >UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits.	13	Professional Judgement
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2	
Field Duplicates	Use project control limits, if stated in QAPP **EcoChem default:** water: RPD < 35% solids: RPD < 50%	Narrate outliers **If required by project**, qualify with J(+)/UJ(-)	9	
Compound ID and Calculation				
Two analyses for one sample (e.g., dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported.	11	See EcoChem TM-04

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

QC Element	Acceptance Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling				
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1	
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X	1	Professional Judgement
Instrument Performance				
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $r^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if r^2 <0.990 J(+)/UJ(-) if %RSD > 20%	5A	
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 85% to 115%	Narrate if frequency not met. J(+)/UJ(-) if %R < 85% J(+) if %R >115%	5B	
Blank Contamination				
Method Blank	At least one per batch (≤20 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7	
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7	
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6	

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

QC Element	Acceptance Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Precision and Accuracy				
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked.	8	Use Professional Judgement if only one %R outlier
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9	
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10%	10	Professional Judgement
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits.	13	Professional Judgement
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2	
Field Duplicates	Use project control limits, if stated in QAPP **EcoChem default:** water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9	

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

QC Element	Acceptance Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Compound ID and Calculation				
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported.	11	See EcoChem TM-04

ECOCHEM
Data Quality

APPENDIX B

QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary Table

GHD Services - Shell Woodland

SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
490-157307	S-060866-8918-DT-D 5.0	49015730710	SW8260B	Xylenes, Total	0.566	mg/kg		J	13H
490-157307	S-060866-8918-DT-D 5.0	49015730710	SW8260B	Toluene	0.0449	mg/kg		J	13H
490-157307	S-060866-8918-DT-D 5.0	49015730710	SW8260B	Benzene	0.051	mg/kg		J	13H
490-157307	S-060866-8918-DT-F 5.0	49015730716	SW8260B	Toluene	0.0659	mg/kg		J	13H
490-157307	S-060866-8918-DT-F 5.0	49015730716	SW8260B	Benzene	0.0432	mg/kg		J	13H
490-157307	S-060866-8918-DT-F 5.0	49015730716	NWTPH-Dx	C24-C40	1280	mg/kg		J	9
490-157307	S-060866-8818-DT-H 15.0	49015730724	SW8260B	Benzene	0.11	mg/kg		J	13H
490-157307	S-060866-8818-DT-H 15.0	49015730724	NWTPH-Dx	C24-C40	290	mg/kg		J	13L
490-157307	S-060866-8918-DT-I 15.0	49015730727	SW8260B	Benzene	0.169	mg/kg		J	13H
490-157307	S-060866-8918-DT-I 15.0	49015730727	SW8260B	Toluene	0.233	mg/kg		J	13H
490-157307	GW-060866-8918-DT-I	49015730728	NWTPH-Dx	C10-C24	126	ug/l		J	1
490-157729	GW-060866-081418-LB-MW-11	49015772910	NWTPH-Dx	C24-C40		ug/l	U	UJ	1
490-157729	GW-060866-081418-LB-MW-11	49015772910	NWTPH-Dx	C10-C24		ug/l	U	UJ	1
490-157307	S-060866-8818-DT-H 15.0	49015730724	NWTPH-Dx	C10-C24	779	mg/kg		J	13L

Appendix I
Waste Disposal Documentation

MAR 10 1:3PM 3:40

***24 HOUR EMERGENCY RESPONSE, CALL (877) 577-2669 ***

Stericycle
Environmental Solutions

SHIPPING PAPER

Lading Manifest: 099153-19

pg 1 of 3

DELIVERY DATE	JOB #3464695

SHIPPER / CUSTOMER Shell oil products US	POINT OF CONTACT Tia Bruce
ADDRESS 701 Bozarth Ave	PHONE # (206)224-0489
CITY, STATE, ZIP Woodland WA 98674	
CARRIER / TRANSPORTER Stericycle Specialty Waste	PHONE # (612)285-9865
CONSIGNEE / FACILITY BURLINGTON ENVIRONMENTAL, LLC.	POINT OF CONTACT
ADDRESS 1701 East Alexander Avenue	PHONE # (253)627-7568
CITY, STATE, ZIP TACOMA , WA 98421	

HM	US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	Containers No.	Containers Type	Total Quantity	UOM
A	MATERIALS NOT REGULATED BY THE DOT	7	DM	4200 est.	P
B					
C					
D					

20408

Special Handling Instruction and Additional Information:

a) 978171-01 - PETROLEUM IMPACTED IDW SOIL - LF07 (3)

Placards Provided YES_____ NO_____

SHIPPER'S CERTIFICATION: "I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations." I also certify that all times listed above are true and correct.

		MONTH	DAY	YEAR
(SHIPPER) PRINT OR TYPE NAME x D. Trudeau IN BEHALF OF Shell	SIGNATURE x	02	27	19
(CARRIER/TRANSPORTER) PRINT OR TYPE NAME x BILL CLARK	SIGNATURE x	02	27	19
(CONSIGNEE/FACILITY) PRINT OR TYPE NAME x Lalchmoun Sovan	SIGNATURE x	3	10	19

CONSIGNEE

Stericycle
Environmental Solutions

SHIPPING PAPER

099153-19

pg 2 of 3

DELIVERY DATE	JOB # 34164695
SHIPPER / CUSTOMER: Shell Oil Products US	POINT OF CONTACT: Tig Bruce
ADDRESS: 701 Bozarth Ave	PHONE #: 206-224-4489
CITY, STATE, ZIP: Woodland WA 98674	
CARRIER / TRANSPORTER: Certified Cleaning Services	PHONE #: 253-536-5500
CONSIGNEE / FACILITY: Burlington Environmental, LLC	POINT OF CONTACT
ADDRESS: 1701 East Alexander Avenue	PHONE #: 253-627-7568
CITY, STATE, ZIP: Tacoma, WA 98421	

HM	US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	Containers No.	Containers Type	Total Quantity	UOM
A					
B					
C					
D					

Special Handling Instruction and Additional Information:

Placards Provided YES_____ NO_____

SHIPPER'S CERTIFICATION: "I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations." I also certify that all times listed above are true and correct.

		MONTH	DAY	YEAR
(SHIPPER) PRINT OR TYPE NAME: X	SIGNATURE: X			
(CARRIER/TRANSPORTER) PRINT OR TYPE NAME: X Jesse Peikham	SIGNATURE: X	3	6	19
(CONSIGNEE/FACILITY) PRINT OR TYPE NAME: X	SIGNATURE: X			

CONSIGNEE

Stericycle
Environmental Solutions

SHIPPING PAPER

099153-19

Pg 3 of 3

DELIVERY DATE	JOB # 3464695
SHIPPER / CUSTOMER: Shell Oil Products US	POINT OF CONTACT: Ty Bruce
ADDRESS: 701 Bozarth Ave	PHONE #: 206-274-6489
CITY, STATE, ZIP: Woodland WA 98674	
CARRIER / TRANSPORTER: Stericycle Specialty Waste Solutions Inc	PHONE #: 612-285-9865
CONSIGNEE / FACILITY: Burlington Environmental, LLC	POINT OF CONTACT
ADDRESS: 1701 East Alexander Avenue	PHONE #: 253-627-7568
CITY, STATE, ZIP: Tacoma, WA 98421	

HM	US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	Containers No.	Containers Type	Total Quantity	UOM
A					
B					
C					
D					

Special Handling Instruction and Additional Information:

Placards Provided YES_____ NO_____

SHIPPER'S CERTIFICATION: "I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations." I also certify that all times listed above are true and correct.

		MONTH	DAY	YEAR
(SHIPPER) PRINT OR TYPE NAME X	SIGNATURE X			
(CARRIER/TRANSPORTER) PRINT OR TYPE NAME X Laxmam Sayan	SIGNATURE X	3	6	19
(CONSIGNEE/FACILITY) PRINT OR TYPE NAME X	SIGNATURE X			

CONSIGNEE

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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Appendix J
Letters designating Shell Oil Products US (Shell) as a Potentially Liable Party (PLP)

Appendix J

Letters designating Shell Oil Products US (Shell) as a Potentially Liable Party (PLP)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

November 18, 2010

Ms. Beth A. Flowers
Environmental Claims Manager
Shell Oil Products U.S.
One Shell Plaza #666
910 Louisiana
Houston, TX 77002

Re: Notice of Potential Liability under the Model Toxics Control Act for the Release of Hazardous Substances at the following Hazardous Waste Site:

- Name: Fuel Processors Facility
- Address: 701 Bozarth Ave., Woodland, WA 98674
- County Assessor's Parcel Number(s) 50144 50145
- Facility/Site No. 810

Dear Ms. Flowers:

Under the Model Toxics Control Act (MTCA), chapter 70.105D RCW, which governs the cleanup of hazardous waste sites in Washington State, the Department of Ecology (Ecology) may identify persons that it finds are liable for the release of hazardous substances at a site. Before making such a finding, Ecology must provide persons with notice and an opportunity to comment on the proposed finding. Any person whom Ecology finds, based on credible evidence, to be liable is known as a "potentially liable person" or "PLP."

Proposed Finding of Liability

Based on credible evidence, Ecology is proposing to find Shell Oil Products US liable under RCW 70.105D.040 for the release of hazardous substances at the Fuel Processors Inc. (FPI) Facility (Site). This proposed finding is based on the following site history and chemical evidence:

1. Historical records indicate that the site was purchased in 1928 by Washington Refining Company from a lumber mill. Shell Oil Products US operated at the site from 1931 to 1953 as an "Oil and Lubricants Dealer". In 1953, Shell Oil purchased the site from Washington Refining Co. and maintained ownership of the property until 1969, when it sold the property to Marcus and Irene Deans. Between 1972, when the Deans sold the property and 1985 when it was purchased by Mr. Bill Briggs the property was bought and sold numerous times, however, based on Ecology's understanding of the site history, the property was not used for oil and gas storage

operations. Mr. Briggs, as ORRCO, operated a used oil recycling and transfer facility at the property until 2005 when operations at the property ceased. Additional details regarding property history are described in Enclosure 1, Detailed History of the Fuel Processors Property, Woodland Washington.

2. Chemical evidence of releases to the environment is based on the results of pre-2008 environmental assessments, investigations, and soil sampling, as described in detail in Agreed Order No. DE 5054. Investigations and soil/ground water sampling conducted at the facility from September 2008 to the present as required by the agreed order were compiled from the Phase I RI Summary Report, laboratory reports and forensic analysis summaries. A detailed summary of the history of environmental investigation at the Site follows:

   In April, 1985, EPA conducted soil sampling within the uncovered portion of the tank farm. Laboratory analytical results indicated that soil at the site was impacted by chlorinated solvents, with tetrachloroethylene (PCE) and trichloroethylene (TCE) above regulatory criteria. Polychlorinated biphenyls (PCBs) were also detected but at concentrations below the MTCA Method A soil cleanup level of 1 mg/kg.

   In 1976 when the Resource Conservation and Recovery Act (RCRA) came into effect, the EPA was given the authority to control the generation, transportation, treatment, storage, and disposal of hazardous waste. Hazardous waste treatment, storage and disposal (TSD) facilities in existence when RCRA came into effect were considered to have interim status permits and were treated as if they had been issued a permit. Under the assumption that the facility held federal interim status, on April 2, 1986 EPA began a RCRA Facility Assessment (RFA) at the Facility to identify those areas where release(s) of hazardous substances, as defined in RCW 70.105D.020(10), may have occurred or may be occurring. The RFA focused primarily on the waste pile located in a surface impoundment north of the facility boundary. Additional soil samples were collected from seven locations (three within and four outside of the tank farm). Because the intent of the RFA was to determine if releases to the environment occurred at the Site, the actively used storage tanks were not investigated. The RFA indicated that the soil beneath the Site was contaminated with chlorinated solvents.

   In 1996, EPA conducted a second RFA that consisted of a review of records and sampling results from the Ecology sampling of the waste pile north of the facility boundary on July 8, 1982. In 1996, EPA also reviewed the 1986 RFA sampling and subsequent correspondence, submittals and inspections conducted by Ecology and EPA.

   Pursuant to the RFA Reports and other information, Ecology identified a number of solid waste management units (SWMUs) and AOCs at the Dangerous Waste Management Facility. Based on credible evidence, Ecology in a letter dated October 30, 2006, issued a preliminary PLP status letter to Mr. Bill Briggs owner of Fuel Processors Inc. and Oil Re-Refining Co. (ORCCO), pursuant to RCW 70.105D.040, -

.020(21), and WAC 173-340-500. By letter dated November 11, 2006, Mr. Briggs voluntarily waived his rights to notice and comment and accepted Ecology's preliminary determination that Mr. Briggs is a PLP under RCW 70.105D.040.

On December 28, 2007 Ecology notified Mr. Briggs of its determination that he was a PLP for a release or releases at the Fuel Processors Inc. (FPI) Facility. Ecology, however, stated that FPI and ORRCO would be named in the order. On August 18, 2008 Ecology issued Agree Order No. DE 5054 which requires Fuel Processors Inc. and ORRCO to determine the nature and extent of contamination at the site, select appropriate remedies and to implement those remedies. Specifically the order requires Fuel Processors to conduct a Remedial Investigation and Feasibility Study (RI/FS) to define investigate releases to the environment and develop remedies that would be implemented under a cleanup action plan (CAP).

The Phase I RI investigation consisting of soil sampling, the installation of ground water monitoring wells and sampling of ground water was conducted on September 29-30, 2008. Results of laboratory analyses indicated that fifteen soil samples from eight locations contained hydrocarbon contamination in the form of gasoline, diesel or oil above MTCA Method A cleanup levels. In addition, PAHs were detected in eight soil samples. Significant concentrations of PCBs were detected in one sample.

Additional soil sampling at the property was conducted in February and August, 2010 to determine the relative age of the hydrocarbons. Petroleum product fingerprinting analysis of soil samples was performed by two independent laboratories:

- Manchester Environmental Laboratory, Port Orchard, Washington
- Freidman & Bruya, Environmental Chemist, Seattle, Washington

The result of the TPH-Gx GC/FID (gasoline range) analysis (see enclosure) indicated high concentrations of gasoline, diesel, and high boiling material such as lube oil. The loss of normal alkanes hydrocarbon and the low level of alkyl benzene in the gasoline trace also indicated the presence of extremely weathered (old) gasoline.

Review of the TPH-Dx (diesel) analysis result showed that the diesel range hydrocarbons were extensively degraded resulting in the presence of primarily only the isoprenoid compounds: norpristane, pristine and phytane. The abundance of the isoprenoids in conjunction with the total loss of normal alkanes showed that the diesel present in the sample was an old spill. The analysis of soil samples for metals and organo metals indicated the presence of trace metals such as Lead, Mercury, Manganese and Nickel. Tetraethyl lead (TEL), an organic lead gasoline additive was present in the soil samples. Methylclopentadienyl Manganese Tricarbonyl (MMT) an organic lead supplement was also found in the soil samples.

Tetraethyl lead was first manufactured in 1923 and until 1960 TEL was the only additive blended to gasoline. Methylclopentadienyl Manganese Tricarbonyl was blended to leaded gasoline at an allowable concentration of 0.125 grams of manganese per gallon of gasoline from 1960 until the mid 1970's. The concentration of organic lead and in the soil samples is consistent with leaded gasoline produced

prior to 1986. The concentration of MMT found in the soil sample is consistent with the amount of MMT used as leaded gasoline supplement prior to its prohibition in 1977. The forensic evaluation indicates that gasoline and diesel releases at the Site occurred before 1985, possibly as early as 1940's.

Shell Oil's status as a PLP is based on the following converging lines of evidence:

1. Gasoline, diesel and oil detected in the soil was highly weathered indicating that it was released long before 1985
2. Laboratory analyses of soil samples detected concentrations of tetra ethyl lead (TEL) consistent with the permissible amounts of lead in gasoline manufactured before 1986.
3. The amount of Methylclopentadienyl Manganese Tricarbonyl (MMT) detected in soil samples is consistent with concentrations permitted to be blended with gasoline prior to its prohibition in 1977
4. MMT was blended with leaded gasoline only between 1960 and 1977
5. Shell Oil operated at the site from at least 1923 to 1969
6. After 1972 the site was not used to store or distribute gasoline or lube oil

3. A release of a hazardous substance(s) to the environment has occurred on the Site. This release(s) has been documented in 1986 and1996 (RFAs), the 2008 Phase I RI, and sampling conducted in February and August 2010. Laboratory analyses of soil samples indicate that high concentrations of weathered gasoline, weathered diesel fuel and metal additives such as lead and manganese were present. Laboratory analyses of ground water samples indicated the presence of gasoline, diesel or oil and VOCs at concentrations that exceed their respective MTCA Method A criteria. In addition, the RFAs indicate the release of halogenated hydrocarbons and PCBs to soil and possibly the ground water at the Site. These releases potentially pose a threat to human health and the environment.

Opportunity to Respond to Proposed Finding of Liability

In response to Ecology's proposed finding of liability, you may either:

1. Accept your status as a PLP without admitting liability and expedite the process through a voluntary waiver of your right to comment. This may be accomplished by signing and returning the enclosed form or by sending a letter containing similar information to Ecology;

2. Challenge your status as a PLP by submitting written comments to Ecology within thirty (30) calendar days of the date you receive this letter; or

3. Choose not to comment on your status as a PLP.

Please submit your waiver or written comments to the following address:

Stan Leja
Department of Ecology
Hazardous Waste and Toxics Reduction Program - SWRO
PO Box 47775
Olympia, WA 98504-7775

After reviewing any comments submitted or after 30 days if no response has been received, Ecology will make a final determination regarding your status as a PLP and provide you with written notice of that determination.

Identification of Other Potentially Liable Persons

Ecology has notified the following additional persons that they are potentially liable for the release of hazardous substances at the Site:

1. Fuel Processors, Inc., c/o Wilmer L. Briggs, President.
2. Oil Re-Refining Co., c/o Wilmer L. Briggs, President
3. Wilmer L. Briggs, in his individual capacity.

If you are aware of any other persons who may be liable for the release of hazardous substances at the Site, Ecology encourages you to provide us with their identities and the reason you believe they are liable. Ecology also suggests you contact these other persons to discuss how you can jointly work together to most efficiently clean up the Site.

Responsibility and Scope of Potential Liability

Please note that Ecology may either conduct or require PLPs to conduct remedial actions to investigate and clean up the release of hazardous substances at a site. PLPs are encouraged to initiate discussions and negotiations with Ecology and the Office of the Attorney General that may lead to an agreement on the remedial action to be conducted.

Please also note that each liable person is strictly liable, jointly and severally, for all remedial action costs and for all natural resource damages resulting from the release of hazardous substances at a site. If Ecology incurs remedial action costs in connection with the investigation or cleanup of real property and those costs are not reimbursed, then Ecology has the authority under RCW 70.105D.055 to file a lien against that real property to recover those costs.

Next Steps in Cleanup Process

In response to the release of hazardous substances at the Site, Ecology is requiring FPI and ORRCO to perform the following actions under MTCA:

1. Continue the Remedial Investigation/Feasibility Study (RI/FS) under Agreed Order No. 5054. FPI and ORRCO have conducted an initial RI with supplemental soil and

ground water sampling for forensic analyses. Additional characterization of the site will be performed to define the nature and extent of contamination in the vadose zone and ground water. Potential remedial alternatives will be evaluated under the FS;

2. Develop and implement a cleanup action plan (CAP).

For a description of the process for cleaning up a hazardous waste site under MTCA, please refer to the enclosed fact sheet.

Ecology's policy is to work cooperatively with PLPs to accomplish the prompt and effective cleanup of hazardous waste sites. Please note that your cooperation in planning or conducting remedial actions at the Site is not an admission of guilt or liability. Should Shell Oil Co. be named a PLP Ecology expects they will be included in the existing agreed order.

Contact Information

If you have any questions regarding this letter or if you would like additional information regarding the cleanup of hazardous waste sites, please call me at (360) 407-6345. Thank you for your cooperation.

Sincerely,

Stan Leja

Stan Leja
Hazardous Waste and Toxics Reduction Program - SWRO

Lt:SL
Enclosures:
(1) FOCUS: MODEL TOXICS CONTROL ACT CLEANUP REGULATION: PROCESS FOR CLEANUP OF HAZARDOUS WASTE SITES (Pub. No. #94-129)
(2) VOLUNTARY WAIVER OF RIGHT TO COMMENT FORM
(3) AGREED ORDER No. DE 5054
(4) PRODUCT FINGERPRINTING ANALYSIS RESULTS OF SOIL SAMPLES FROM FUEL PROCESSOR WOODLAND WASHINGTON
(5) MANCHESTER ENVIRONMENTAL LABORATORY RESULTS OF SOIL SAMPLES
(6) FRIEDMAN & BRUYA ORGANOMETALS ANALYSIS RESULTS
(7) FRIEDMAN & BRUYA GC/FID HYDROCARBON ANALYSIS RESULTS

cc: Bill Briggs, ORRCO billb@orrco.biz
Dave Coles, Coles Environmental dcolescec@comcast.net
Kate Moore, Dunn Carney Allen Higgins & Tongue LLP kmoore@dunncarney.com
Sonia Wolfmann, AGO SoniaW@ATG.WA.GOV
Samuel Iwenofu, Ecology
Ava Edmonson, Ecology

Shell Oil Products US
Environmental Claims
One Shell Plaza, Rm 666
910 Louisiana
Houston, Texas 77002
Tel (713) 241-0548
Fax (713) 241-6926
Email beth.flowers@shell.com
Internet http://www.shell.com

Mr. Stan Leja
Hazardous Waste and Toxics Reduction Program - SWRO
State of Washington
Department of Ecology
P.O. Box 47775
Olympia, Washington 98504-7775

Via E-Mail (SLEJ461@ECY.WA.GOV) and U.S. Mail

January 12, 2011

Re: 701 Bozarth Avenue, Woodland, Washington

Dear Mr. Leja:

This letter is provided in response to your letter of November 18, 2010 which was received in this office on November 29, 2010. An extension for response to that letter until January 15, 2011 was granted in writing by you. Per your letter, the Department of Ecology is proposing that Shell Oil Products US ("Shell") be named as a potentially liable party ("PLP"). You have given Shell the opportunity to comment on this matter prior to naming Shell as a PLP.

Each of the points referring to Shell's status as a potential PLP as outlined on page 4 of your letter are addressed below.

1. **Gasoline, diesel and oil detected in the soil were highly weathered indicating that it was released long before 1985.**
   There is no data provided in the forensic report that would "date" the hydrocarbons detected in soil as "released long before 1985". Weathering depends on many environmental factors and age assignment is not possible unless the presence or absence or certain components can be correlated with regulations. In this case, the detection of lead reported for one of the samples (HA-01(2') was used to speculate that this was a release of leaded gasoline which was in use prior to 1985. The sample is described in the Friedman and Bruya report as *"indicative of a mixture of a low boiling material such as gasoline; a middle distillate such as a diesel fuel; and a high boiling material such as lube oil or similar materials"*. This description is consistent with used oil which contains residual gasoline (if from a gasoline engine) and diesel range material (if from a diesel engine). The site was used by an oil recycler after Shell left the site in 1969. Leaded gasoline was in use until 1996. Any used oil from a gasoline engine that ran on leaded gasoline would have residual gasoline in the waste oil from engine blowby. The chromatogram provided for sample HA-01(2') is typical of used oil.

2. **Laboratory analyses of soil samples detected concentrations of tetra ethyl lead ("TEL") consistent with the permissible amounts of lead in gasoline manufactured before 1986.**
   With regard to the TEL, it is unlikely that TEL is present as TEL in soil as TEL is not stable in soil. Furthermore, TEL was reported as 0.2 mg/kg just above the reporting limit of 0.1 mg/kg with a concentration of organic lead of 0.1 mg/kg with a TPH value of

approximately 2100 mg/kg. The actual concentration of lead in the sample is uncertain. It should be mentioned that because of exchange and lead credits, lead was not reduced effectively until 1988 and was in use at some level until 1996. Shell left the site in 1969.

3. **The amount of Methylclopentadienyl Manganese Tricarbonyl ("MMT") detected in soil samples is consistent with concentrations permitted to be blended with gasoline prior to its prohibition in 1977.**
   The presence of MMT was not confirmed in sampling conducted. It was at the reporting limit as MMT (0.1 mg/kg) and not detected as organic manganese at <0.05 mg/kg. The presence and amount of manganese in this sample is questionable.

4. **MMT was blended with leaded gasoline only between 1960 and 1977.**
   As indicated in item 3, the presence of MMT or manganese was not confirmed in the sampling conducted. MMT was also used without lead after 1974. It should be mentioned that the use of MMT was banned in 1977 in the US by the Clean Air Act until the Ethyl Corporation could prove that the additive would not lead to failure of new car emissions-control systems. As a result of this ruling, the Ethyl Corporation began a legal battle with the EPA, presenting evidence that MMT was harmless to automobile emissions-control systems. In 1995, the U.S. Court of Appeals ruled that the EPA had exceeded its authority and, as a result, MMT became a legal fuel additive in the US. However, it is believed that there was limited use of MMT in the US after the ban was lifted.

5. **Shell Oil operated at the site from at least 1923 to 1969.**
   Deed information provided by Fuel Processors, Inc. ("FPI") clearly shows that Shell's first ownership interest at the Property was in late 1953. Prior to 1953, the property appears to have been owned by Washington Refining Company. Shell last operated at the site as a petroleum products terminal in 1969.

6. **After 1972 the site was not used to store or distribute gasoline or lube oil.**
   FPI operated a used oil recycling facility at the site between 1984 and 2005. As part of those operations, used oil which typically contains metals and various gasoline, diesel, and lube oil constituents would have been stored and treated at the facility.

Shell does not disagree that it operated a bulk terminal at the property. However, FPI and Oil Re-Refining Co. ("ORRCO") also conducted used oil recycling activities at the site and entered into an Agreed Order with the Department of Ecology. Further, analytical data provided by FPI does not support the conclusion that petroleum constituents identified at the property are solely attributable to Shell's former operations. Therefore, Shell respectfully requests that if it is named as a PLP to the Agreed Order that FPI and ORRCO remain parties to the order as well.

Sincerely,
Shell Oil Products US

Beth A. Flowers

Beth A. Flowers
Environmental Claims Manager

Cc: David P. Rossmiller – Dunn Carney Allen Higgins & Tongue LLP, Suite 1500, 851 S.W. Sixth Avenue, Portland, Oregon 97204-1357 (via e-mail – drossmiller@dunncarney.com)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

March 31, 2011

Ms. Beth A. Flowers
Environmental Claims Manager
Shell Oil Products US
One Shell Plaza, #666
910 Louisiana
Houston, TX 77002

Dear Ms. Flowers:

RE: Determination of Potentially Liable Person Status

On November 18, 2010 the Department of Ecology (Ecology) sent you written notice regarding your proposed status as a potentially liable person (PLP) for a release of hazardous substances at the following site:

- Name: Fuel Processors Facility
- Address: 701 Bozarth Ave., Woodland, WA 98674
- County Assessor's Parcel Number(s) 50144 50145
- Facility/Site No.: 810

The 30-day comment period on this preliminary notice was extended by Ecology and expired on January 15, 2011.

We have received and evaluated your comments in your January 12, 2011 letter, received by Ecology on January 18, 2011. Based on the information available to date, the Department finds that credible evidence exists which supports your status as potentially liable for the release or releases at the Fuel Processors, Inc. (FPI) facility. On the basis of this finding, Ecology has determined that you are a Potentially Liable Party (PLP) with regard to the FPI site.

Ecology intends to provide you the option of not signing on to the existing agreed order, or amending the existing order to include Shell Oil Company as a party to the Agreed Order as requested in your letter dated January 12, 2011.

Your rights and responsibilities as a PLP are outlined in Chapter 70.105D RCW, and WAC 173-340. Ecology's site manager for the facility, Stan Leja, will contact you with information about how Ecology intends to proceed with the cleanup at this site.

If you have any questions regarding this notice, please contact Stan at (360)-407-6345.

Sincerely,

Ava Edmonson, Section Manager
Hazardous Waste and Toxic Reduction Program
Southwest Regional Office

By Certified Mail
7010 0780 0002 3400 2677

SL/lt: Shell Oil Co. final PLP Notice

cc: Bill Briggs, ORRCO billb@orrco.biz
Dave Coles, Coles Environmental dcolescec@comcast.net
Kate Moore, Dunn Carney Allen Higgins & Tongue LLP
kmoore(wdunncarney.com
Stan Leja, Ecology
Samuel Iwenofu
Kerry, Graber, Ecology
Sonia Wolfman, AAG
Central Files

CONESTOGA-ROVERS
& ASSOCIATES

20818 44th Avenue West, Suite 190, Lynnwood, Washington 98036
Telephone: 425-563-6500 Facsimile: 425-563-6599
www.CRAworld.com

copy in file

August 10, 2011

Reference No. 060866

Mr. Stan Leja
Hazardous Waste and Toxics Reduction Program - SWRO
Washington State Department of Ecology
PO Box 47775
Olympia, Washington 98504-7775

Re: Response to Determination of Potentially Liable Person Status
701 Bozarth Avenue
Woodland, Washington

Dear Mr. Leja:

Conestoga-Rovers & Associates (CRA), on behalf of Shell Oil Products US (Shell), is submitting this response to Washington State Department of Ecology's (Ecology) letter dated March 31, 2011 indicating that there is credible evidence that Shell is potentially liable for the release or releases at the facility located at 701 Bozarth Avenue, Washington (site; Figure 1), and should be named as a Potential Liable Person (PLP) to the Agreed Order at the site.

The site is currently a non-operational Fuel Oil Processors, Inc. (FPI) facility. The former oil recycling facility configuration is presented in Figure 2. CRA agrees that a release, as identified in Agreed Order No. 5054, has occurred at the site, however, the information summarized in this letter indicates that the former Shell terminal operation is not the source of this release. Furthermore, Solid Waste Management Units (SWMUs) 1, 3, 4, 5, 6, 8, 9, and 10 and Area of Concern (AOC) 2, referenced in Agreed Order No. 5054 (Agreed Order), clearly operated after Shell ceased operations at the referenced site. The locations of the SWMUs and AOCs referenced in the Agreed Order are presented in Attachment A.

Ecology's claim is based on the results of soil sampling conducted in 2008 and 2010 that indicated that weathered gasoline (pre-1985) is present at the site, citing the presence of banned gasoline additives including tetra ethyl lead (TEL) and manganese tricarbonyl (MMT). Ecology also indicated as part of their determination that Shell operated at the site from at least 1923 to 1969, and that the facility was not used to store or distribute gasoline after 1972.

SITE CONFIGURATION DURING SHELL TERMINAL OPERATION:

Based on review of aerial photographs and a 1943 Sanborn map, a fuel terminal operated from at least 1939 through at least 1966 and was located in the northwestern portion of the property with piping running south to an apparent drum platform and fueling area. Washington

Refining Company, the owner of the terminal facility prior to December 29, 1953, added an additional aboveground storage tank (AST) to the existing three AST fuel farm sometime between 1939 and 1948. The remainder of the property appeared undeveloped and not used for fuel storage.

As noted in a January 12, 2011, letter to Ecology, Shell purchased the terminal facility on December 29, 1953. The condition of assets received at the time of sale of the facility from Washington Refining Company to Shell are unknown. According to the Bill of Sale dated August 19, 1969, the property was sold by Shell to Marcus and Irene Deans and included the following personal property:

(1) 30' x 30' combination building and pump house; (2) meters; (5) transfer pumps; (1) barrel platform; (1) fillstand; (1) 200' fencing and gates; (1) water and sewer system; (1) railroad siding; (1) 2,000 gallon underground storage tank (UST); (3) 12,000 gallon USTs; and (1) 25,000 gallon UST.

Based on the aerial photographs, the Bill of Sale appears to be incorrect in identifying the 12,000-gallon USTs and the 25,000-gallon UST as underground tanks and are actually ASTs. The location of the 2,000-gallon UST could not be identified from the aerial photograph review. Based on the Bill of Sale and the review of the aerial photographs, Figure 3 identifies the configuration of the historical structures on the property at the time of the Shell terminal operation.

SITE ACTIVITY CHRONOLOGY

Information gathered during review of Ecology and United States Environmental Protection Agency (EPA) files for the site is summarized below.

1985 –FPI excavated approximately 1 to 2 feet of contaminated soil across the tank farm area totaling a reported 900 cubic yards of excavated soil. The area was subsequently filled and a concrete containment berm was constructed. The actual documented extent of the excavation was not available in the Ecology or EPA files; however based on descriptions within file correspondence, the approximate extent is presented in Figures 4a and 4b.

1985/1986 – Soil sampling was conducted at the property in association with a RCRA Facility Assessment (RFA). Results of the soil sampling indicated that elevated levels of organic solvents and PCBs were present in near surface samples. Benzene was detected in one near surface sample (0 to 0.5 feet below ground surface [bgs]) in the vicinity of the G-1 spec fuel tank (see Attachment A) but was not detected in the sample collected at 5 feet bgs. No other soil samples contained benzene concentrations above regulatory limits. The sample containing

benzene also contained chlorinated hydrocarbons including tetrachloroethene (PCE) at concentrations 80 times higher than the benzene concentration.

August/September 1991 – Ecology conducted a series of inspections of the FPI facility. The Ecology inspector observed the storage of approximately 85 55-gallon drums labeled "non-regulated waste" located in the north central portion of the facility west of the resident house (see Figure 2). Two of these drums were observed to be leaking. Six 85-gallon overpack drums located at the western edge of the drum area closest to the tank farm were labeled "waste gasoline". At least one of these "waste gasoline" drums was observed leaking. The owner was informed of these leaking drums, however, the drums were still present and leaking during subsequent inspections conducted over the next 12 days. Additionally, the concrete containment structure was noted to be excessively cracked at this time. In a subsequent letter to FPI dated October 8, 1992, the exact number of "waste gasoline" drums was not given, however, both 55-gallon and 85-gallon drums of waste gasoline were documented in the letter.

December 1996 – Ecology conducted an inspection of the FPI facility. A description of this inspection was not found in the file, however, the laboratory report for liquid and solid samples collected during the inspection, presumably from facility infrastructure, were included in the file. The exact locations of these samples was not able to be determined, however, a number of the samples contained elevated constituents found in gasoline including benzene, toluene, ethylbenzene, and xylenes (BTEX). Water samples were labeled "YARDSUMP FP1", "TANKSUMP FP2", "RUSTY FP3 E1", and "TANK FP4 E2". A sediment/soil sample was labeled "HEATER RMFP5". Results of the water sample collected from "RUSTY FP3 E1" included elevated benzene concentrations (3,860 micrograms per liter [µg/l]), as well as toluene, ethylbenzene, xylenes, 1,2,4- and 1,3,5-trimethylbenzene, 2-butanone, acetone, and various chlorinated hydrocarbons. Results of the water sample collected from "TANK FP4 E2" contained the same constituents as "RUSTY FP3 E1" but at higher concentrations, including benzene (9,980 µg/l) and toluene (41,100 µg/L). The soil sample "HEATER RMFP5" contained similar elevated constituents detected in the water samples described above including BTEX constituents and various chlorinated hydrocarbons.

2008 – 2010 Site Investigation Activities: Coles Environmental Consulting (CEC), on behalf of FPI, conducted site investigation activities at the site including collection of soil samples and installation of three monitoring wells. The locations of soil and groundwater sampling conducted at the site by the EPA and CEC are presented in Figures 4a, 4b, and 5. Soil sampling within the oil recycling tank farm indicated the presence of elevated concentrations of total petroleum hydrocarbons (TPH) in the gasoline range (TPHg), diesel range (TPHd) and oil range (TPHo). The highest concentration of TPHg collected from soil during this investigation was encountered at probe location HP-1 at a depth of 5-5.5 feet bgs. The location of HP-1 is approximately 40 feet east of the easternmost boundary of the former Shell terminal footprint

(Figure 4a). The highest TPHg concentrations from grab groundwater samples collected during this investigation were collected from hydroprobe location HP-5 located approximately 55 feet east and upgradient of the easternmost boundary of the former Shell terminal footprint adjacent to the H-1 sump (Figure 5). Monitoring wells MW-1 through MW-3 were sampled in January 2009. The highest TPHg concentration was observed in monitoring well MW-2 directly downgradient of hydroprobe location HP-5. Monitoring well MW-3 is located south of the warehouse building and upgradient of the former Shell operation footprint and contained low concentrations of TPHg and TPHd in soil relative to samples collected in other areas of the tank farm; however, the TPHg concentration in groundwater was similar to monitoring well MW-2. Based on the gauging of monitoring wells MW-1 through MW-3 in January 2009, CEC reported a groundwater flow direction of west-northwest.

Additional soil sampling was conducted in February and August 2010. The results of the February 2010 sampling event were not found in the Ecology file, however, the location of an additional boring, HA-01, was estimated based on email correspondence between CEC and Ecology dated July 21, 2010. Boring HA-01 was advanced adjacent to the former hydroprobe location HP-1. The purpose of HA-01 appeared to be to determine the relative age of the hydrocarbons detected in this area. Soil samples were collected from HA-01 at 1-foot intervals from 1 foot bgs to 5 feet bgs. The highest TPHg concentration was detected in the samples collected at 1 foot and 2 feet bgs. The sample from 2 feet bgs was additionally analyzed for TEL and MMT along with additional analyses used to fingerprint hydrocarbons. TEL was detected at a concentration of 0.2 milligrams per kilogram (mg/kg) which is just above the reporting limit of 0.1 mg/kg. MMT was detected at the reporting limit of 0.1 mg/kg. As stated above, the location of boring HA-01 and hydroprobe location HP-1 is approximately 40 feet east of the easternmost boundary of the former Shell terminal footprint. The greatest concentrations of TPHg in soil sampled (at 1 foot and 2 feet bgs) were from an area which was excavated and re-filled by Fuel Processors, Inc. in 1985 to a depth of approximately 2 feet bgs.

SUMMARY AND CONCLUSIONS

Ecology has named Shell as a PLP at the site due to "credible evidence" based on the results of soil and groundwater sampling conducted by FPI since 2008. FPI and Ecology are claiming that concentrations of TPHg and TPHd present in site soil and groundwater is actually highly weathered gasoline. Furthermore, Ecology claims that the presence of TEL and MMT in one soil sample collected from 2 feet bgs within the tank farm area substantiates that the gasoline release is pre-1985 due to the suspension of use of these additives in the 1970s and 1980s.

Based on aerial photograph review, the footprint of the former Shell terminal is clearly limited to the westernmost portion of the property (Figure 3). The highest concentrations of TPHg

detected in soil and groundwater were identified in site investigation activity completed east of the former Shell operation footprint within the expanded tank farm constructed in the 1970s. Aerial photographs clearly indicate that the area east of the former Shell terminal remained vacant until Shell sold the site in 1969. USEPA sampled soil in April 1986 as part of the RFA including soil sampling within the former Shell terminal footprint. Results of these soil samples were not analyzed for TPHg, however, the samples were analyzed for BTEX. None of the samples contained BTEX concentrations above the laboratory reporting limit, with the exception of estimated values of toluene which was well below regulatory limits.

Results of soil sampling conducted by CEC in 2008 and 2010 included the detection of weathered TPHg, however, only soil samples from hydroprobe locations HP-7 and HP-8 contained TPHg concentrations within the footprint of the former Shell operation (Figure 4). The percentage of TPHg from the cumulative TPH mixture for the soil sample collected from HP-8 was approximately 1 percent. The percentage of TPHg from the cumulative TPH mixtures for the soil samples collected from HP-7 ranged from approximately 0.1 percent in unsaturated soil to 0.2 to 4 percent in saturated soil.

A soil sample collected in 2008 at a depth of 1 to 1.5 feet bgs from boring HP-2 located near the eastern edge of the former Shell terminal footprint contained a TPHg concentration of 5,050 milligrams per kilogram. Soil sampling conducted in August 2010 at one foot intervals from 1 foot to 5 feet bgs in the area of the highest suspected TPHg impact had the highest TPHg concentrations at depths of 1 foot bgs and 2 feet bgs. According to FPI, in 1985 the uppermost 1 to 2 feet of soil within the tank farm was excavated, and backfilled with presumably clean fill prior to construction of the concrete containment structure. If the soil sampling conducted in this area in 2008 and 2010 encountered impacted material at depths of 1 to 2 feet bgs, then it is reasonable to conclude that the impact to shallow soil likely occurred subsequent to the 1985 excavation of the fuel farm.

The highest concentrations of TPHg have been detected in groundwater in the northeastern corner of the oil recycling tank farm near the H-1 sump. There is a storm drain located immediately adjacent to the H-1 sump just outside the concrete berm and is connected to the H-1 sump and an additional surface drain located approximately 25 feet further to the east. These surface drains are located in close proximity to the area identified during the 1991 Ecology inspection used to store leaking "waste gasoline" drums. The 1991 inspection identified the concrete in the vicinity of these leaking drums to be heavily stained, and that extensive cracks were evident in the concrete containment structure as well as the curb between the concrete containment structure and the northern gate in the vicinity of the stored drums. It should be noted that in 1991, TEL in gasoline was still present in Washington state, and furthermore, the origin of the waste gasoline is unknown and may have contained both TEL and MMT.

Ecology has indicated in the letter to Shell, that the facility never stored gasoline. Based on the information revealed during the file review, this does not appear to be the case; sampling results of both liquid and shallow soil during the 1996 Ecology inspection appear to contain gasoline constituents at concentrations that indicate the possible use of gasoline in the oil recycling process, which is substantiated by the interview conducted by Ecology with Mr. Dave Clark in 1999, a former partner of Bill Briggs of FPI, indicating that used gasoline was blended into the used oil.

The impacted soil and groundwater at the facility is well outside and upgradient of the former Shell terminal footprint. There does not appear to be adequate evidence linking the gasoline impact detected at the site with the operation of the former Shell fuel terminal.

If you have any questions regarding the contents of this document, please contact Brian Peters at (425) 563-6506.

Respectfully,

CONESTOGA-ROVERS & ASSOCIATES

BRIAN C. PETERS

Brian Peters
BP/cd/1
Encl.

Figure 1	Vicinity Map
Figure 2	Oil Recycling Facility
Figure 3	Former Shell Terminal Footprint
Figure 4a	TPHg Concentrations in Soil
Figure 4b	Benzene Concentrations in Soil
Figure 5	Groundwater Sampling Locations
Attachment A	SWMU Location Map

cc: Ms. Carol Campagna, Shell Oil Products US
Ms. Beth Flowers, Shell Oil Products US
Ms. Carita Walker, Shell Oil Products US

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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August 10, 2012

Brian Peters
Conestoga-Rovers & Associates.
20818 44th Avenue West, Suite 190
Lynnwood, Washington 98036

Re: 701 Bozarth Avenue, Woodland Washington
Determination of Potentially Liable Person status

Dear Mr. Peters:

Washington State Department of Ecology (Ecology) received your letter dated August 10, 2011 on behalf of Shell Oil Products US (Shell). Your letter is written in response to Ecology's letter dated March 31, 2011, which indicated that there is credible evidence that Shell is potentially liable for the release of petroleum products at the facility located at 701 Bozarth Avenue, Woodland Washington.

Shell does not dispute that a release has occurred at the site; however Shell contends that the former Shell terminal operation was not the source of the petroleum product releases. Shell asserts that the Solid Waste Management units (SWMUs) and the Area of Concern (AOC) referenced in Agreed Order No. 5054 (AO) operated only after Shell ceased operation at the site.

For reasons described below, the letter from Conestoga-Rovers & Associates (CRA) does not change Ecology's position that there is credible evidence that Shell is potentially liable for the release or releases at the site, and should be named as a Potentially Liable Person (PLP) with regard to Fuel Processor Inc., at 701 Bozarth Avenue, Woodland Washington State.

Ecology's responses to each of the points outlined in CRA's letter are as follows:

Site configuration during Shell Terminal Operation

CRA Comment 1.

Based on review of the aerial photographs and a 1943 Sanborn map, a fuel terminal operated from at least 1939 through at least 1966 and was located in the northwestern portion of the property with piping running south to an apparent drum platform and fueling area. Washington Refining Company, the owner of the terminal prior to December 29, 1953, added an additional aboveground storage tank (AST) to the existing three AST fuel farm sometime between 1939 and 1948. The remainder of the property appeared underdeveloped and not used for fuel storage.

Ecology Response:

CRA appears to assert that Shell's operations did not commence at the site until 1953, when in fact the evidence shows that Shell was operating at the site much earlier. Historical records indicate that between 1928 and 1953 bulk petroleum facility operations were conducted on the property. Shell was listed in the City Directories as an Oil and Lubricant Dealer" at the property from at least 1936 until 1951. In addition, a review of the 1943 Sanborn Fire Insurance Maps indicates that Shell occupied the property, as well as the following structures:

- One 25,000-gallon capacity gasoline tank and structure with oil pumps and were located at the northwestern portion of the property.
- One "Oil Drum" structure
- One "filling" structure, and
- One Grease Warehouse" structure with an adjacent shade containing numerous containers of chemicals was located on the southwest portion of the property.

Historical aerial photographs from 1939 showed that Shell had acquired two additional storage tanks located adjacent to and west of the 25,000-gallon capacity gasoline tank and by 1948 there was a new tank constructed at the property located adjacent and south of the 25,000-gallon tank. The Woodland City directory indicated that between 1951 and 1969 both Shell and M.H. Deans Distribution were located at the property. Title records indicate that Shell purchased the property from Washington Refining in 1953 and owned the property until 1969.

CRA Comment 2.

Based on the aerial photographs, the Bill of Sale appears to be incorrect in identifying the 12,000-gallon USTs and the 25,000-gallon UST as underground storage tanks and actually ASTs. The location of the 12,000-gallon UST could not be identified from the aerial photograph review. Based on the Bill of Sale and the review of the aerial photographs, Figure 3- identifies the configuration of the historical structure on the property at the time of Shell terminal operation.

Ecology Response:

CRA appears to assert that the footprint was limited to only portions of the site when in fact the evidence shows that the company operated throughout the site. A historical 1948 aerial photograph indicates that an AST was constructed on the property south of the 25,000-gallon capacity gasoline AST located at the northwest portion of the property. The structure and developed areas of the property matched those noted in the 1943 the Sanborn Fire Insurance Maps. These maps indicate that Shell occupied the property, as well as the structures identified in the Sanborn Fire Insurance Maps. Structure (s) or materials were located on the northeast corner of the property.

Based on a comparison of a 1957 historical photograph, the property does not appear to have changed much from the 1948 historical photograph. A historical photograph from 1963 shows that the oil drum structure and the structures on the northeast of the property were removed some time

prior. An above ground storage tank was added to the nest of ASTs at the northwest portion of the property. Marcus and Irene Dean were listed as distributor for Shell Oil, and Shell Oil/Marcus Dean Distributor were listed in the City directory from 1953-1954. There appear to be no significant changes to the property from 1963 to 1973 based on the review of historic aerial photographs. Shell ceased operation at the property in 1969, when the property was sold to Marcus and Irene Dean.

The Deans sold the property in 1972. By 1980, a structure was added at the central portion of the property, and additional tanks were added to the eastern portion of the property in 1981. Used oil was not stored at the property until 1985 when Warren W. Bingham sold the property to Fuel Processor, Inc (FPI). FPI operated a used oil recycling operation at the property from 1985 to 2003. A review of historical documentation and correspondence indicates that gasoline was not stored on the property during FPI's operations.

Site Activity Chronology

CRA Comment 3.

CRA gathered site activity information during review of Ecology and United States Environmental Protection Agency (EPA) files. The CRA summary of the reviewed file contained inaccurate assumptions and conclusion.

In 1985, FPI excavated approximately 1to 2 feet of contaminated soil across the tank farm area totaling a reported 900 cubic yards of excavated soil. The area was subsequently filled and a concrete berm was constructed. The actual documented extent of excavation was not available in Ecology or EPA files; however based on descriptions within file correspondence, the approximate extent is presented in Figure 4a and 4b (not included).

Ecology Response:

CRA speculates as to the extent of the excavated area, and Ecology does not necessarily agree with figures 4a and 4b. In addition, Shell appears to imply that the spill was a gasoline spill when in fact it was a used oil spill. FPI excavated between 1 to 2 feet of soil as a result of the used oil spill that occurred in the spring of 1985 when FPI was preparing the site for their use. The oil was immediately pumped out and about a foot of impacted soil was removed, and the concrete floor to the containment area was then constructed. There was little or no chance for percolation of oil through the soil.

CRA Comment 4.

Around 1985 and1986 soil sampling was conducted at the property in association with RCRA Facility Assessment (RFA). Results of the soil sampling indicated that elevated levels of organic solvents and PCBs were present in near surface samples. Benzene was detected in one near surface sample (0 to 0.5 feet below ground surface (bgs)) in the vicinity of the G-1 spec fuel tank (see Attachment A) but was not detected in the sample collected at 5 feet bgs. No other soil samples contained benzene concentration above regulatory limits. The samples containing benzene also

contained chlorinated hydrocarbons including tetrachloroethane (PCE) at concentration 80 times higher than benzene concentration.

Ecology Response:

In asserting that Shell is not a PLP, CRA ignores other findings in the RFA report. In 1985, subsurface soil samples were collected from the uncovered portion of the tank farm area at the property. In April 1986, soil samples were also collected within and outside the tank farm from subsurface to 5 feet bgs through the concrete. A review of the 1985 sampling data indicates the presence of solvents and metals commonly associated with used –oil recycling operation and the 1986 sampling results show that the analyzed soil samples contained elevated levels of Benzene, Toluene, Ethyl-benzene and Xylenes (BTEX) hydrocarbons and Polycyclic Aromatic Hydrocarbons (PAHs). Aromatic compounds are a major ingredient in gasoline. They can be present in used oil, but at much lower level. BTEX compounds represent 6.43 to 36.87 percent of gasoline by weight and account for less than 0.1 percent total of diesel fuel (Louden, 1993). The results also indicate weathered BTEX hydrocarbon constituents (Morrison, 2000), and the level of xylene in the soil further indicates weathered gasoline (Kaplan et al., 1997). Xylenes are preferentially retained in soil relative to benzene, and they are more resistant to degradation. Degradation of the more soluble BTEX indicates an older gasoline spill (Raymond et al.1976).

Shell used the facility as a new product distribution facility and used it to store gasoline, diesel, and oil product. The source of the aromatic compounds at the site can be attributed to Shell operation at the site since gasoline was never stored at the site after Shell ceased operation. After Shell ceased operation, the property was a used – oil recycling facility.

CRA Comment 5.

2008 – 2010 Site investigation Activities: CRA stated in its report that "The location of HP-1 is approximately 40 feet easternmost boundary of the former Shell terminal footprint. The greatest concentration of TPHg in soil sampled was from an area which was excavated and re-filled by Fuel Processor Inc, in 1985 to a depth of approximately 2 feet bgs."

Ecology Response:

As explained above, the former Shell operations were not limited to a portion of the site as CRA would suggest. As stated above, historical aerial photographs and Sanborn Fire Insurance Maps indicate that Shell occupied the entire property, as well as the structures in the property. The bill of sale dated 1969 between Shell and the Deans include a list of buildings and ASTs referred to as USTs in the bill of Sale. The ASTs are in the northern half (tank farm area) of the property. Based on a comparison of historical photographs from 1968 and 1972, the structures on the property do not appear to have changed. Probe HP-1 was placed in the central portion of the former tank farm to the east. This probe was advanced to a total depth of 15 feet bgs. Petroleum odor consistent with weathered gasoline odor was noted at a deeper core of 10-15 feet bgs.

In February and August 2010, Ecology re-sampled the tank farm area with probes EC-02 placed near probe HP-1 location. The boring log for EC-02 showed that the recovered core (4-10 feet

bgs) had a strong gasoline odor and sheen. Soil samples were obtained in August from the most contaminated area of the tank farm. Boring HA-1 (see attached) was a deeper sample collected at 5 feet bgs, and which showed very strong evidence of weathered gasoline spill. Boring HA-1 was located between EC-02 and HP-01.

This indicates that the weathered gasoline in the sampled soil at the above sampled locations is not from the oil spill that occurred in the spring of 1985 as claimed by CRA.

The 1985 used- oil spill occurred in the eastern-most tank and the released oil immediately was pumped from the soil surface, thus limiting any opportunity for soil infiltration. Some spreading occurred to the west, but the oil mostly was contained in the eastern third of the tank farm. FPI removed 12-18 inches of soil that showed visual impact and backfilled it with gravel so that the concrete pad could be constructed. As gasoline is a minor component of used oil, this spill essentially had no contribution to the gasoline contamination found at the site.

Two key sources are believed to account for the major concentration of gasoline detected in the soil and groundwater at the site. One is general spills from the former Shell bulk plant tanks/plumbing. The other is the up-gradient loading rack. This rack was where gasoline was transferred to/from the storage tanks and trucks. The rack area was unpaved and graveled for its service life. ORRCO or FPI never used this rack. Any similar rack used in the pre-80s likely experienced numerous gasoline spills because of a general lower level of care that was common at that time. The groundwater flow essentially is from the rack to the tank farm. Finally, the argument that gasoline contamination found in the fill immediately under the concrete (clean fill that was placed after the 1985 cleanup of used oil) is due to recent releases ignores the shallow groundwater at the site, particularly in the wet season. Groundwater reaches the near surface in low areas such as the tank farm. High concentrations of gasoline were found in the soil to a depth of over five feet. This represents old gasoline in a smear zone reaching to the base of the concrete. With such shallow groundwater, gasoline migration in the shallow soils, to the base of the concrete, is probable and unrelated to the 1985 release. The clean fill placed after the cleanup was most likely contaminated later by gasoline in the deeper smear zone migrating upward during the wet season. Gasoline also will migrate horizontally under the conditions observed at this site. Assumptions of spill location verses the present distribution of contamination ignores the vertical and horizontal migration of gasoline at this site given that the contamination has probably been present for 50 to 60 years. There has been more than sufficient time for the contamination to migrate in the immediate area of the rack, tank farm, and possibly off-site.

CRA Comment 6.

Results of soil sampling conducted by Coles Environmental Consulting in 2008 and 2010 included the detection of weathered TPHg. However, only soil samples from hydro probe locations HP-7 and HP-8 contained TPHg concentrations within the footprint of the former Shell operation. The percentage of TPHg from the cumulative mixture for sample collected from HP-8 was approximately 1 percent. The percentage TPHg from the cumulative TPH mixture for soil sample collected from HP-7 ranged from approximately 0.1 percent in unsaturated soil to 0.2 to 4 percent in saturated soil.

Ecology Response:

CRA claims that the footprint of Shell's former operations is limited to the southern portion of the property, and the area of hydro-probe locations HP-7 and HP-8 that contained TPHg. However, Ecology and Coles and Associates (formerly Coles Environmental Consulting) investigations found that gasoline contamination is present over the entire property, and dominates mostly the northern half of the property while oil contamination is present over the entire site, and tends to dominate the southern half of the property. The oil consists of a mixture of used oil from the mid-1980s while the gasoline (TPHg) is highly weathered. Site history suggests that gasoline releases occurred during the period of Shell's use of the site as a bulk petroleum distribution facility.

CRA Comment 7.

The highest concentrations of TPHg have been detected in groundwater in the northeastern corner of the oil recycling tank farm near the H-1 sump. There is a storm drain located immediately adjacent to H-1 sump just outside the concrete berm and is connected to the H-1 sump and an additional surface drain located approximately 25 feet further to the east. These are surface drains located in close proximity to the area identified during the 1991 Ecology Inspection used to store leaking "waste gasoline" drums. The 1991 inspection identified the concrete in the vicinity of these leaking drums to be heavily stained, and that extensive cracks were evident in the concrete containment structure as well as the curb between the concrete containment structure and the northern gate in the vicinity of the stored drums. It should be noted that in 1991, TEL in gasoline was still present in Washington State, and furthermore the origin of the waste gasoline is unknown and may have contained both TEL and MMT.

Ecology Response:

CRA asserts that gasoline contamination at the site was the result of the leaking "waste gasoline" drums. However, FPI provided clarification regarding the "waste gasoline" drums in response to the August and September 1991 Ecology's Inspection Report. Mr. Briggs was present when EPA and Ecology inspected the facility on September 5, 1991. Mr. Briggs noted that the drums near the northern fence line including the "waste gasoline" drums contained oil sludge and tanks bottoms from UST removal at Fort Lewis. They had loose bungs (plugs were not tightened down) and some rainwater that created sheen on the top of the drums. Any gasoline that might have drained down the side of the drums was minor and could not account for all the gasoline found in the soil and groundwater. The drums were only present at the site for a short period (days) and they were set on concrete. Gasoline does not stain concrete to the extent observed in the area of the drum, which was more consistent with used oil staining. TEL and MMT found at the site were consistent with chemical additives found in pre-1986 gasoline. The "waste gasoline" drums are not a source for extensive gasoline contamination found in the soil and groundwater at the site.

CRA Comment 8.

Ecology has indicated in the letter to Shell that the facility never stored gasoline. Based on the information revealed during the file review, this does not appear to be the case. Sampling results of both liquid and shallow soil during the 1996 Ecology inspection appear to contain gasoline

constituents at concentrations that indicate the possible use of gasoline in oil recycling process. This is substantiated by the interview conducted by Ecology with Mr. Dave Clark in 1999, a former partner of Bill Briggs of FPI, in which Mr. Clark indicated that used gasoline was blended into used oil.

Ecology Response:

In the interview conducted by an Ecology Inspector with Mr. David Clark, Mr. Clark told Ecology Inspector that blending of gasoline was conducted at an ORRCO facility. Mr. Clark did not indicate the exact ORRCO location where the blending occurred. According to the Ecology's Inspector memo, the fuel blending activities occurred at the Portland Oregon ORRCO facility and not at their Woodland, Washington facility.

The chemical evidence supports a finding that the used oil operations at the site did not utilize gasoline. Used oil and heavy fuel oil are known to contain aromatic hydrocarbons. Liquid samples were collected from the process water tanks at the south western end of the tank farm and a soil/sludge sample was collected at the cooker/heater area inside the building located south of the tank farm. The soil sample is from sludge that was removed from raw used oil and not from shallow soil. The results of the water and sludge samples included gasoline and chlorinated hydrocarbon constituents typical of a used oil processing operation. It does not indicate any use of pure gasoline in the used oil recycling operation. Mr. Briggs and Coles and Associates provided the following account of FPI used oil processing operation:

"Used oil collected from various generators was brought to the Woodland facility for limited processing. Typically, used oil contains water, soil, sludges, and other debris and very small concentrations of gasoline, diesel, and chlorinated compounds. The oil was offloaded into storage tanks. Upon processing, the raw used oil was directed via piping to a "shaker" which is essentially a fine, vibrating screen. Sludge, soil, and other debris were removed with this processing step. The filtered oil was then directed to a dehydrator tank (aka "cooker") located in the southwest part of the plant where the temperature was raised to distill off the water. The water, along with a small amounts of light ends (volatile compounds such as BTEX compounds, chlorinated compounds, and smaller alkyl compounds), was condensed and captured in a tank. The light ends were then skimmed off the water and blended back into the oil to improve the final fuel product's BTU content. The water that remained contained dissolved BTEX and other light ends, at concentrations based on individual compound solubilities. This water was shipped to ORRCo's Portland facility where it was either evaporated or processed and then batch discharged to the POTW. A "heater", used to provide heat to the dehydrator tank, was located in a former garage west of the dehydrator room. A heat-transfer oil was heated with a burner and the transfer oil pumped through coils in the dehydrator tank. The heater was fueled with diesel from the F-2 fuel oil tank located north of the heater system. No raw gasoline was used at the facility".

In summary, Ecology's position is that Shell is potentially liable for the release of petroleum products at the facility based on available evidence. Historical records indicate that Shell conducted bulk petroleum operations at the property going back to at least 1936. Sanborn Fire Insurance Maps show that Shell occupied the property, as well as the structures within the

property, as far back as 1943. Sampling conducted in 1986 as part of an RFA for the facility confirm the presence of weathered gasoline constituents and this is corroborated by the results of the 2008 and 2010 forensic analysis that found extensively weathered gasoline and diesel in the soil at the property. There is credible evidence linking the gasoline impact detected at the site with the operation of the former Shell fuel terminal.

Next steps:

Shell's rights and responsibilities as a PLP are outlined in Chapter 70.105D RCW, and WAC 173-340. Ecology proposes to amend the existing AO to include Shell as a signatory to the AO for participation in the cleanup. If Shell chooses not to sign the AO, Shell is still deemed to be a PLP by Ecology. Ecology reserves the right to issue an enforcement order to any PLP that has not signed the AO, should that become necessary.

Ecology's site manager for the facility is Stan Leja. Mr. Leja, will contact Shell with information about how Ecology intends to proceed with the cleanup at this site. If you have any questions, please contact Mr. Leja at (360) 407-6345.

Sincerely,

Ava Edmonson, Section Manager
Hazardous Waste and Toxics Reduction
Southwest Regional Office.

By Certified Mail: (7011 1150 0000 7970 2719)

Enclosure(s): 1943 Sandborn Fire Insurance Maps
Historical Aerial photos
Fuel Processors, Inc. Woodland Facility Site Diagram, Subsurface Sampling Locations

cc: Ms. Beth Flowers, Shell Oil Products US (beth.flowers@shell.com)
Sonia Wolfman, Assistant Attorney General, AGO Ecology Division (soniaw@atg.wa.gov)
Samuel Iwenofu (Ecology)
Stan Leja (Ecology)
Central File (Ecology)

References

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Appendix K
Letters with Department of Ecology's review and comments to the RI Report

Appendix K

Letters with Department of Ecology's review and comments to the RI Report

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

May 18, 2020

Mr. Brian Peters, L.G.
GHD
20818 44th Avenue W, Suite 190
Lynnwood, WA 98036

Re: Fuel Processors Site, Woodland, Washington – Draft Remedial Investigation Report Review Comments

Dear Mr. Peters:

The Department of Ecology (Ecology) has reviewed the document titled, "Draft Remedial Investigation Report, Fuel Processors Facility." Our review comments are listed on the enclosed document.

Some of our comments address statements in the draft report that are subject to interpretation, opinion, or bias. We ask you to remove these statements to only provide information based on fact. This will not affect compliance of the report to the requirements of WAC 173-340-350 or a future cleanup remedy.

Please email me at chof461@ecy.wa.gov if I can provide additional information or answer any questions.

Sincerely,

Charles P. Hoffman

Charles P. Hoffman, P.E.
Environmental Engineer
Hazardous Waste & Toxics Reduction Program
Southwest Regional Office

Enclosure

cc: Bill Briggs, ORRCO
Andrea Wing, Shell Oil
Dave Coles, Coles & Associates
Jill Betz, Coles & Associates

Fuel Processors Facility
Remedial Investigation Report
Ecology Review Comments

1. Section 2.1. Page 2. First paragraph. "The approximate extent of the former Shell footprint, based on a review of aerial photographs and a 1943 Sanborn fire insurance map, is presented on Figure 2 and Figure 2A." And Section 4.7. Page 17. Second paragraph. "Based on a review of historical records, former Shell operations were limited to the western half of the Property."

   Ecology Comment

   The demarcated footprint on the figures show Shell Oil's infrastructure. However, Shell Oil owned the entire site and the operator had access to the entire site that is now Fuel Processors. This was previously addressed by Ecology in a letter to Conestoga-Rovers & Associates (now GHD) dated August 9, 2012.

2. Section 2.1. Page 2. First complete paragraph. The last sentence seems incomplete.

3. Section 2.1. Page 2. Second paragraph. "All fueling infrastructure was reportedly removed and/or decommissioned from the Property in 2005 and 2007; however, in 2018 and 2019, GHD observed leaves, debris, and approximately six inches of oily liquid within the H-3 sump, and heavy oil within a stand pipe under the loading rack canopy."

   Ecology Comment

   Fuel Processors submitted a Closure Report to Ecology on September 12, 2007. According to the report, some of the tanks were cleaned in 2002 and subsequently removed. The remaining tanks were cleaned in February 2007 and then removed from the site. The report states that all used oils, oily solids, and contaminated rinse water were transported to Fuel Processors' Portland facility for treatment and disposal. The closure report also states:

   Run-on and run-off protection was the same as when the site is operating. All tank's (sic) *interiors were pumped dry of rinse fluid during the rinsing process. Rinse fluid from the decontamination of the exterior surfaces were collected within the sealed and bermed concrete enclosure. The enclosure sump was then pumped free of rinse fluids and decontaminated.*

   Also, Sump H-3 was cleaned on October 13, 2005 (letter with photographs from ORRCO to Ecology dated December 13, 2005). The letter also describes the cleaning process used for 6 underground pipes located under the concrete containment area used for product transfer from the tanks to the loading rack. The removed contents, including cleaning fluids, were transported to the Portland facility for processing.

   Since Fuel Processors has not processed used oil at the site for about 20 years, it seems likely that the contents in Sump H-3 observed by GHD accumulated over the past 15 years from runoff and/or onsite contamination.

4. Section 2.2. Page 2. First paragraph. "a release of several thousand gallons of used oil was reportedly spilled from a punctured tank or broken pipe in the eastern portion of the former tank farm in March 1985. At the time of this spill, the tank farm was unpaved and a remedial excavation was subsequently completed by Fuel Processors Inc. (FPI) across the tank farm area." And Section 6. Page 18. "Petroleum hydrocarbons were likely released to the subsurface prior to 1985 and during a report spill of several thousand gallons of used oil in March 1985 in the eastern portion of the former tank farm."

Ecology Comment

The following is from the report titled, "Initial Site Investigation: Fuel Processors Inc., Facility, 701 Bozarth Avenue, Woodland, WA" dated December 15, 2011:

During FPI's early renovation of the facility, a pipe from a used-oil tank was broken by an excavator. An oil spill within the bermed area was created by this accident. The released oil was cleaned up immediately with a vacuum truck. Because the bermed area between the tanks consisted of gravel over soil, FPI excavated visually-contaminated gravel and soil from the tank secondary containment structure. The concrete was placed so that its surface sloped toward sumps in order to contain rain water, meet the requirements of the SPCC, and more recently meet the requirements of 40 CFR 270 (Federal Used-Oil Regulations).

In a letter dated August 9, 2012, from Ecology to Conestoga-Rovers & Associates, Ecology discussed this spill with the following:

FPI excavated between 1 to 2 feet of soil as a result of the used oil spill that occurred in the spring of 1985 when FPI was preparing the site for their use. The oil was immediately pumped out and about a foot of impacted soil was removed, and the concrete floor to the containment area was then constructed. There was little or no chance for percolation of oil through the soil.

The RI needs to include additional information regarding the 1985 spill and Fuel Processors response.

5. Section 2.2. Page 2. Second Paragraph. "In October 1985, an additional remedial excavation was completed in the western portion of the former tank farm."

   Ecology Comment

   Based on information in a RCRA reconnaissance inspection report dated April 2, 1986, and recollection by Fuel Processor's consultant, the excavation of soil in October 1985 occurred north of the fence line, not within the tank farm.

6. Section 2.6. Page 5. According to a discussion of the property history by Coles & Associates, the 1963 aerial photograph showed a new structure west of the filling structure and a new tank within the tank farm.

7. Section 2.6. Page 6. According to Ecology's information, Fuel Processors ceased processing used oil at the site in 1992. Fuel Processors used the facility from 1992 until 2003 as a transportation and storage facility for used oil.

8. Section 2.6. Page 6. Bullet heading "1985-2002." "Based on a review of historical records, products that were reportedly received at the facility included PCB-contaminated transformer oil and waste oil, spent Tarr solvent, and waste oil that was processed at the facility contained up to six percent benzene."

   Ecology Comment

   Fuel Processors had interim status for State Dangerous Waste W001, less than 50 parts per million (ppm) PCB contaminated oil. However, the records are not clear if Fuel Processors received shipments of PCB contaminated oil at the Woodland facility. (A review of a manifest in 1991 determined that a shipment of PCB contaminated oil went to Fuel Processor's Portland facility.) The

tank identified for storing PCB contaminated oil was used for diesel fuel storage and later sampling did not detect PCBs.

Please provide a description of spent Tarr solvent and cite the reference.

Please cite the reference for the statement "waste oil that was processed at the facility contained up to six percent benzene."

9. Section 2.6. Page 6. Bullet heading "1985-2002." Additionally, one drum was observed leaking and labeled "waste gasoline" during a site inspection conducted by Ecology and the EPA (Ecology Inspection Report, September 12, 1991.)"

   Ecology Comment

   The referenced leaking drum was an 85-gallon overpack drum that was observed by an Ecology inspector on August 28, 1991, through a fence because the facility was closed at the time. The location of this drum was on the north side of the site, near the fence and east of the entrance gate. The Ecology inspector returned to Fuel Processors on September 5, 1991, accompanied by an EPA employee.

   A letter from Ecology to Fuel Processors, dated October 8, 1992, states the drums of "waste gasoline" were stored on a concrete pad and that the "concrete beneath this drum was dark and freshly stained." Investigation into the source and contents of the drum indicated that it was sludge from underground storage tank removal on Fort Lewis.

   The August 10, 2012, letter from Ecology to Conestoga-Rovers & Associates addresses the drums of "waste gasoline":

   CRA asserts that gasoline contamination at the site was the result of leaking "waste gasoline" drums. However, FPI provided clarification regarding the "waste gasoline" drums in response to the August and September 1991 Ecology's Inspection Report. Mr. Briggs was present when EPA and Ecology inspected the facility on September 5, 1991. Mr. Briggs noted that the drums near the northern fence line including the "waste gasoline" drums contained oil sludge and tanks bottoms from UST removal at Fort Lewis. They had loose bungs (plugs were not tightened down) and some rainwater that created sheen on the top of the drums. Any gasoline that might have drained down the side of the drums was minor and could not account for all the gasoline found in the soil and groundwater. The drums were only present at the site for a short period (days) and they were set on concrete. Gasoline does not stain concrete to the extent observed in the area of the drum which was more consistent with used oil staining. TEL and MMT found at the site were consistent with chemical additives found in pre-1986 gasoline. The "waste gasoline" drums were not a source for extensive gasoline contamination found in the soil and groundwater at the site.

10. Section 2.6. Page 6. Bullet heading "1985-2002." Include in the chronology that Fuel Processors ceased processing used oil at the site in 1992 and used the site for storage and as a transfer facility from 1992 to 2003 (March 18, 2005, letter from Fuel Processors to Ecology).

11. Section 4.1.2.3. Page 11. "GHD also noted apparent oil-impacted soil beneath the elevated warehouse floor, where the flooring had been removed east of the former AST location. Since this impacted soil was unknown prior to these field activities, samples were not collected."

Ecology Comment

The oil impacted soil beneath the warehouse floor was known prior to GHD conducting monitoring or well installation at Fuel Processors. Coles & Associates conducted soil sampling at locations HP-6 and HP-7 in 2008 and HP-13 in 2015. Table 1 of the draft RI lists the laboratory test results.

12. Section 4.1. The draft RI has summaries of the sampling, well installation, and soil probes conducted by GHD in 2016, 2016, and 2019. Coles and Associates began the site investigation in 2009 and proceeded with installation of additional monitoring wells and soil probes and sampling through 2015. The draft RI has summaries of Coles and Associates work in Appendix B. However, the descriptions of this work need to be included in the main body of the RI and should not be relegated to an appendix.

13. Section 4.3.1. Page 16. The topic and discussion of "Fuel Fingerprint Analysis" is subject to interpretation and bias to who was or was not responsible for the site contamination. The purpose of the RI is to collect data necessary to adequately characterize the site for the purpose of developing and evaluating cleanup action alternatives (WAC 173-340-350(7)(a)). The discussion in Section 4.3.1. may be useful for private discussion between Shell Oil and Fuel Processors. Please delete Section 4.3.1. from the RI report.

14. Section 4.7. Page 17. Fifth Paragraph. "The 2019 finger printing results performed by Pace indicates that the sample contained a predominately lighter distillate petroleum product that may be somewhat "fresher.""

Ecology Comment

Delete "that may be somewhat "fresher"." That part of the statement could be a respected opinion but it could be challenged and refuted by another party's expert.

15. Section 4.7. Page 17. Fifth Paragraph. "This product did have a detection of tetramethyl lead; however, Pace states that assuming a moderate subsurface weathering regime on-Site, it is plausible that the petroleum have experienced a residence time in the environment of 0-8 years."

Ecology Comment

Delete "however, Pace states that assuming a moderate subsurface weathering regime on-Site, it is plausible that the petroleum have experienced a residence time in the environment of 0-8 years."

16. Section 4.7. Page 18. Paragraph at Top of Page. This paragraph discusses contamination identified inside and outside of Shell Oil's "footprint." The "footprint refers to the location of the infrastructure when Shell Oil owned and operated the site. However, as previously discussed in Comment No. 1, Shell Oil owned and had access to the entire site.

17. Section 5. Second Paragraph. "In October 1985, an additional remedial excavation was completed in the western portion of the former tank farm. Approximately 10 cubic yards of soil was removed."

Ecology Comment

See response to Comment No. 5.

18. Section 5. Last Paragraph. "In early 2016, Coles performed a vacuum truck total fluids recovery event to remove the measured SPH from MW-10. According to the bill of lading, 46 gallons of fuel were removed and disposed at ORRCO's Portland, Oregon facility."

Ecology Comment

Even through the bill of lading may have stated 46 gallons of fuel, that statement requires additional explanation. The contents of MW-10 were removed by vacuum truck on March 10, 2016. The well had approximately 5 feet of floating product that day. The well diameter is 2 inches which results in an initial removal of 0.82 gallon of floating product, not accounting for any petroleum product mixed within the groundwater or recharged while the well contents were removed. "46 gallons of fuel" gives an impression of non-diluted petroleum product.

19. Provide a figure of the site showing the boundaries of the groundwater concentrations as MTCA Method A groundwater cleanup levels for TPHg, TPHd, TPHo, and benzene. These lines could be shown on one figure if possible. Groundwater contamination is discussed in the text of the report but a figure would provide the public with a visual tool to understand the extent of contaminated groundwater.

August 10, 2020 Reference No. 060866

Department of Ecology - TCP
Attn: Charles Hoffman
P.O. Box 47600
Olympia, WA 98604-7600

Dear Mr. Hoffman:

Re: Response to Comments – Draft Remedial Investigation Report
Fuel Processors – 701 Bozarth Avenue, Woodland, Washington (AO 5054)

GHD Services Inc. (GHD) has prepared this letter on behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell) to respond to the Washington State Department of Ecology (Ecology) letter dated May 18, 2020 commenting on GHD's *Draft Remedial Investigation Report* (RI Report) dated January 21, 2020 for the property located at 701 Bozarth Avenue, Woodland, Washington (Property). Ecology has suggested that some of the statements in the draft RI Report are subject to interpretation, opinion, or bias. GHD and Shell believe the report summarizes historical information, communications, investigations, and observations factually and to the best of our understanding.

Based on our review of Ecology's letter, responses to comments are provided below. Additionally, after reviewing the Agreed Order and First Amendment of Agreed Order, No. 5054, Section VII, Work to be Performed, some of the required remedial actions (i.e., Progress Reports) and Exhibit C Schedule of Deliverables should be re-visited.

Ecology Comment #1: *Section 2.1. Page 2. First paragraph. "The approximate extent of the former Shell footprint, based on a review of aerial photographs and a 1943 Sanborn fire insurance map, is presented on Figure 2 and Figure 2A." And Section 4.7. Page 17. Second paragraph. "Based on a review of historical records, former Shell operations were limited to the western half of the Property."*

Ecology Comment

The demarcated footprint on the figures show Shell Oil's infrastructure. However, Shell Oil owned the entire site and the operator had access to the entire site that is now Fuel Processors. This was previously addressed by Ecology in a letter to Conestoga-Rovers & Associates (now GHD) dated August 9, 2012.

GHD Response: Based on the information that we have for the property, Shell operated a fuel terminal that had a footprint that was reported in the RI Report. We do not have information that identifies Shell or other parties having access to the remaining portion of the Property. We identified Shell as owning the Property previously, and we will change Section 4.7, Page 17, second paragraph to read "Based on a review of historical records, former Shell terminal infrastructure was limited to the western half of the Property".

GHD
20818 44th Avenue West Suite 190 Lynnwood Washington 98036 USA
T 425 563 6500 F 425 563 6599 W www.ghd.com

Ecology Comment #2: *Section 2.1. Page 2. First complete paragraph. The last sentence seems incomplete.*

GHD Response: This sentence fragment will be deleted.

Ecology Comment #3: *Section 2.1. Page 2. Second paragraph. "All fueling infrastructure was reportedly removed and/or decommissioned from the Property in 2005 and 2007; however, in 2018 and 2019, GHD observed leaves, debris, and approximately six inches of oily liquid within the H-3 sump, and heavy oil within a stand pipe under the loading rack canopy."*

Ecology Comment

Fuel Processors submitted a Closure Report to Ecology on September 12, 2007. According to the report, some of the tanks were cleaned in 2002 and subsequently removed. The remaining tanks were cleaned in February 2007 and then removed from the site. The report states that all used oils, oily solids, and contaminated rinse water were transported to Fuel Processors' Portland facility for treatment and disposal. The closure report also states:

"Run-on and run-off protection was the same as when the site is operating. All tank's (sic) interiors were pumped dry of rinse fluid during the rinsing process. Rinse fluid from the decontamination of the exterior surfaces were collected within the sealed and bermed concrete enclosure. The enclosure sump was then pumped free of rinse fluids and decontaminated."

Also, Sump H-3 was cleaned on October 13, 2005 (letter with photographs from ORRCO to Ecology dated December 13, 2005). The letter also describes the cleaning process used for 6 underground pipes located under the concrete containment area used for product transfer from the tanks to the loading rack. The removed contents, including cleaning fluids, were transported to the Portland facility for processing.

Since Fuel Processors has not processed used oil at the site for about 20 years, it seems likely that the contents in Sump H-3 observed by GHD accumulated over the past 15 years from runoff and/or onsite contamination.

GHD Response: Section 2.1, Page 2, second paragraph of the RI Report is factual. This information was reported in Fuel Processors' Closure Report and observed in the field by GHD staff and, at least in part, by Fuel Processors representatives. No modifications to the RI Report are proposed.

Ecology Comment #4: *Section 2.2. Page 2. First paragraph. "a release of several thousand gallons of used oil was reportedly spilled from a punctured tank or broken pipe in the eastern portion of the former tank farm in March 1985. At the time of this spill, the tank farm was unpaved and a remedial excavation was subsequently completed by Fuel Processors Inc. (FPI) across the tank farm area." And Section 6. Page 18. "Petroleum hydrocarbons were likely released to the subsurface prior to 1985 and during a report spill of several thousand gallons of used oil in March 1985 in the eastern portion of the former tank farm."*

Ecology Comment

The following is from the report titled, "Initial Site Investigation: Fuel Processors Inc., Facility, 701 Bozarth Avenue, Woodland, WA" dated December 15, 2011:

"During FPI's early renovation of the facility, a pipe from a used-oil tank was broken by an excavator. An oil spill within the bermed area was created by this accident. The released oil was cleaned up immediately with a vacuum truck. Because the bermed area between the tanks consisted of gravel over soil, FPI excavated visually-contaminated gravel and soil from the tank secondary containment structure. The concrete was placed so that its surface sloped toward sumps in order to contain rain water, meet the requirements of the SPCC, and more recently meet the requirements of 40 CFR 270 (Federal Used-Oil Regulations)."

In a letter dated August 9, 2012, from Ecology to Conestoga-Rovers & Associates, Ecology discussed this spill with the following:

"FPI excavated between 1 to 2 feet of soil as a result of the used oil spill that occurred in the spring of 1985 when FPI was preparing the site for their use. The oil was immediately pumped out and about a foot of impacted soil was removed, and the concrete floor to the containment area was then constructed. There was little or no chance for percolation of oil through the soil."

The RI needs to include additional information regarding the 1985 spill and Fuel Processors response.

GHD Response: The information presented in the RI Report is factual, additional information is also provided in Appendix B – Summary of Previous Investigations. Since there was no confirmation sampling or reporting of excavation activities that occurred in 1985, there is no evidence to corroborate that all of the petroleum hydrocarbon impacted soil was removed. No modifications to the RI Report are proposed.

Ecology Comment #5: *Section 2.2. Page 2. Second Paragraph. "In October 1985, an additional remedial excavation was completed in the western portion of the former tank farm."*

Ecology Comment

Based on information in a RCRA reconnaissance inspection report dated April 2, 1986, and recollection by Fuel Processor's consultant, the excavation of soil in October 1985 occurred north of the fence line, not within the tank farm.

GHD Response: There is a memorandum detailing the April 2, 1986 sampling performed by the EPA. There is no mention of the October 1985 excavation. The memorandum did indicate that the area in the northwest corner of the bermed area is now "paved". Attached is an October 1985 sampling plan indicating that the remaining uncovered portion of the bermed area, the northwestern portion of the concrete bermed area, is planned to be excavated to a depth of 2 to 4 feet below ground surface.

Because the results of the subsequent EPA sampling in April 1986 indicated that soil impacts still remain at the surface, it is unclear if this additional excavation was completed before paving this area.

The report will be changed to say, "In October 1985, an additional remedial excavation was "reportedly" completed in the western portion of the former tank farm (Patrick H. Wicks, Sampling and Analysis Plan, October 1985)."

Ecology Comment #6: *Section 2.6. Page 5. According to a discussion of the property history by Coles & Associates, the 1963 aerial photograph showed a new structure west of the filling structure and a new tank within the tank farm.*

GHD Response: Due to poor photograph quality, it is difficult to ascertain whether there is a new structure west of the filling structure and new tank within the tank farm. Additionally, a new tank was not identified in the 1969 Bill of Sale from Shell to the Deans. No modifications to the RI Report are proposed.

Ecology Comment #7: *Section 2.6. Page 6. According to Ecology's information, Fuel Processors ceased processing used oil at the site in 1992. Fuel Processors used the facility from 1992 until 2003 as a transportation and storage facility for used oil.*

GHD Response: The text will be modified to indicate the 1992 date.

Ecology Comment #8: *Section 2.6. Page 6. Bullet heading "1985-2002." "Based on a review of historical records, products that were reportedly received at the facility included PCB-contaminated transformer oil and waste oil, spent Tarr solvent, and waste oil that was processed at the facility contained up to six percent benzene."*

Ecology Comment

Fuel Processors had interim status for State Dangerous Waste W001, less than 50 parts per million (ppm) PCB contaminated oil. However, the records are not clear if Fuel Processors received shipments of PCB contaminated oil at the Woodland facility. (A review of a manifest in 1991 determined that a shipment of PCB contaminated oil went to Fuel Processor's Portland facility.) The tank identified for storing PCB contaminated oil was used for diesel fuel storage and later sampling did not detect PCBs.

Please provide a description of spent Tarr solvent and cite the reference.

Please cite the reference for the statement "waste oil that was processed at the facility contained up to six percent benzene."

GHD Response: The Ecology Inspection Report dated September 12, 1991 reported that "PCB-contaminated oil were received at Fuel Processors". This is what was indicated in the RI Report. Additionally, PCBs have been detected in soil and groundwater beneath the site.

The reference to the spent Tarr solvents is contained in the attached internal Ecology, February 3, 1999 memorandum from Jerry French to Lisa Rozmyn. This memorandum will be added in the Reference section of the RI Report.

Page 6 paragraph 4 of the Ecology Inspection Report dated September 12, 1991 – "Mr. Briggs told the inspection team that the waste oil this plant has been processing contains up to six percent (6%) benzene."

Ecology Comment #9: *Section 2.6. Page 6. Bullet heading "1985-2002." Additionally, one drum was observed leaking and labeled "waste gasoline" during a site inspection conducted by Ecology and the EPA (Ecology Inspection Report, September 12, 1991.)"*

Ecology Comment

The referenced leaking drum was an 85-gallon overpack drum that was observed by an Ecology inspector on August 28, 1991, through a fence because the facility was closed at the time. The location of this drum was on the north side of the site, near the fence and east of the entrance gate. The Ecology inspector returned to Fuel Processors on September 5, 1991, accompanied by an EPA employee.

A letter from Ecology to Fuel Processors, dated October 8, 1992, states the drums of "waste gasoline" were stored on a concrete pad and that the "concrete beneath this drum was dark and freshly stained." Investigation into the source and contents of the drum indicated that it was sludge from underground storage tank removal on Fort Lewis.

The August 10, 2012, letter from Ecology to Conestoga-Rovers & Associates addresses the drums of "waste gasoline":

"CRA asserts that gasoline contamination at the site was the result of leaking "waste gasoline" drums. However, FPI provided clarification regarding the "waste gasoline" drums in response to the August and September 1991 Ecology's Inspection Report. Mr. Briggs was present when EPA and Ecology inspected the facility on September 5, 1991. Mr. Briggs noted that the drums near the northern fence line including the "waste gasoline" drums contained oil sludge and tanks bottoms from UST removal at Fort Lewis. They had loose bungs (plugs were not tightened down) and some rainwater that created sheen on the top of the drums. Any gasoline that might have drained down the side of the drums was minor and could not account for all the gasoline found in the soil and groundwater. The drums were only present at the site for a short period (days) and they were set on concrete. Gasoline does not stain concrete to the extent observed in the area of the drum which was more consistent with used oil staining. TEL and MMT found at the site were consistent with chemical additives found in pre-1986 gasoline. The "waste gasoline" drums were not a source for extensive gasoline contamination found in the soil and groundwater at the site."

GHD Response: The statement in the RI report is factual and a reference cited. Ecology's added clarification appears to be speculative and cannot be verified in any of the documents reviewed. No modifications to the RI Report are proposed.

Ecology Comment #10: *Section 2.6. Page 6. Bullet heading "1985-2002." Include in the chronology that Fuel Processors ceased processing used oil at the site in 1992 and used the site for storage and as a transfer facility from 1992 to 2003 (March 18, 2005, letter from Fuel Processors to Ecology).*

GHD Response: This is the same comment as #7.

Ecology Comment #11: *Section 4.1.2.3. Page 11. "GHD also noted apparent oil-impacted soil beneath the elevated warehouse floor, where the flooring had been removed east of the former AST location. Since this impacted soil was unknown prior to these field activities, samples were not collected."*

Ecology Comment

The oil impacted soil beneath the warehouse floor was known prior to GHD conducting monitoring or well installation at Fuel Processors. Coles & Associates conducted soil sampling at locations HP-6 and HP-7 in 2008 and HP-13 in 2015. Table 1 of the draft RI lists the laboratory test results.

GHD Response: GHD requested permission, which FPI approved, to sample beneath the elevated warehouse floor where GHD had previously identified oil impacted soil. GHD arrived on site to sample and the area was secured with multiple layers of plywood. Upon removing the plywood, the entire exposed area was filled with debris rendering the area completely inaccessible for sampling. There was no explanation provided as to why access was not made available to us.

It's GHD's technical opinion that borings HP-6, HP-7, and HP-13, do not adequately assess the nature or extent of this heavily oil-impacted soil which also contains elevated concentrations of PCBs, carcinogenic PAHs, and lead. Further waste characterization is necessary to identify appropriate disposal or other treatment options prior to implementing site cleanup. The RI Report will be modified as follows: "GHD also noted apparent oil-impacted soil beneath the elevated warehouse floor, where the flooring had been removed east of the former AST location. A representative of Coles would not allow GHD to sample the oil-impacted soil because this task was not included in the approved Work Plan. During February 2019, FPI and Coles approved a subsequent sampling attempt, however, the area was not accessible for sampling when GHD arrived on site. Historically, samples collected from borings HP-6, HP-7, and HP-13 were collected from this area, however, these borings do not adequately characterize the extent of impacts."

Ecology Comment #12: *Section 4.1. The draft RI has summaries of the sampling, well installation, and soil probes conducted by GHD in 2016, 2016, and 2019. Coles and Associates began the site investigation in 2009 and proceeded with installation of additional monitoring wells and soil probes and sampling through 2015. The draft RI has summaries of Coles and Associates work in Appendix B. However, the descriptions of this work need to be included in the main body of the RI and should not be relegated to an appendix.*

GHD Response: The data collected by GHD had not previously been provided to Ecology in a report. The data Coles collected was presented in previous reports provided to Ecology. The draft RI Report provides prior investigation data in figures and tables and is presented in the discussion of contaminant occurrence in the main body of the report. The history of prior investigations is also summarized in Appendix B and is appropriate for this type of report. No modifications to the RI Report are proposed.

Ecology Comment #13: *Page 16. The topic and discussion of "Fuel Fingerprint Analysis" is subject to interpretation and bias to who was or was not responsible for the site contamination. The purpose of the RI is to collect data necessary to adequately characterize the site for the purpose of developing and*

evaluating cleanup action alternatives (WAC 173-340-350(7)(a)). The discussion in Section 4.3.1. may be useful for private discussion between Shell Oil and Fuel Processors. Please delete Section 4.3.1. from the RI report.

GHD Response: As part of developing the RI's Conceptual Site Model, it is necessary to understand the type of contaminants present, as well as when they were released to the environment. The operational history of this site lends itself to a number of potential sources of contamination and adequately understanding the type of separate phase hydrocarbons present in the subsurface is important. Furthermore, during an on-site meeting between Ecology and GHD, Ecology indicated that an independent third party laboratory should perform the fuel fingerprinting, therefore, the 2019 sample was analyzed by Pace Energy Services. No modifications to the RI report are proposed.

Ecology Comment #14: *Section 4.7. Page 17. Fifth Paragraph. "The 2019 finger printing results performed by Pace indicates that the sample contained a predominately lighter distillate petroleum product that may be somewhat "fresher.""*

Ecology Comment

Delete "that may be somewhat "fresher"." That part of the statement could be a respected opinion but it could be challenged and refuted by another party's expert.

GHD Response: This is the interpretation of a third party subject matter expert from a respected laboratory. No modifications to the RI report are proposed.

Ecology Comment #15: *Section 4.7. Page 17. Fifth Paragraph. "This product did have a detection of tetramethyl lead; however, Pace states that assuming a moderate subsurface weathering regime on-Site, it is plausible that the petroleum have experienced a residence time in the environment of 0-8 years."*

Ecology Comment

Delete "however, Pace states that assuming a moderate subsurface weathering regime on-Site, it is plausible that the petroleum have experienced a residence time in the environment of 0-8 years."

GHD Response: This is the interpretation of a third party subject matter expert from a respected laboratory. No modifications to the RI report are proposed.

Ecology Comment #16: *Section 4.7. Page 18. Paragraph at Top of Page. This paragraph discusses contamination identified inside and outside of Shell Oil's "footprint." The "footprint refers to the location of the infrastructure when Shell Oil owned and operated the site. However, as previously discussed in Comment No. 1, Shell Oil owned and had access to the entire site.*

GHD Response: We will modify text to include "terminal infrastructure footprint".

Ecology Comment #17: *Section 5. Second Paragraph. "In October 1985, an additional remedial excavation was completed in the western portion of the former tank farm. Approximately 10 cubic yards of soil was removed."*

Ecology Comment

See response to Comment No. 5.

GHD Response: See GHD's response to Comment No. 5. We will add "reportedly" prior to "completed" in the first sentence above.

Ecology Comment #18: *Section 5. Last Paragraph. "In early 2016, Coles performed a vacuum truck total fluids recovery event to remove the measured SPH from MW-10. According to the bill of lading, 46 gallons of fuel were removed and disposed at ORRCO's Portland, Oregon facility."*

Ecology Comment

Even through the bill of lading may have stated 46 gallons of fuel, that statement requires additional explanation. The contents of MW-10 were removed by vacuum truck on March 10, 2016. The well had approximately 5 feet of floating product that day. The well diameter is 2 inches which results in an initial removal of 0.82 gallon of floating product, not accounting for any petroleum product mixed within the groundwater or recharged while the well contents were removed. "46 gallons of fuel" gives an impression of non-diluted petroleum product.

GHD Response: GHD reported what was indicated on the bill of lading. No field data sheets were provided describing the event, and therefore, there is no indication as to the depth to groundwater or SPH, SPH thickness, the amount of water that was removed along with the product, the extraction event time, extraction flow rate, the recharge rate, and recoverability of the product. The RI Report will be modified as follows: "Due to incomplete information at the time of the extraction event, the concentration of petroleum in the extracted fluids is unknown."."

Ecology Comment #19: *Provide a figure of the site showing the boundaries of the groundwater concentrations as MTCA Method A groundwater cleanup levels for TPHg, TPHd, TPHo, and benzene. These lines could be shown on one figure if possible. Groundwater contamination is discussed in the text of the report but a figure would provide the public with a visual tool to understand the extent of contaminated groundwater.*

GHD Response: A figure will be included showing the extent of petroleum COPCs in groundwater beneath the Site.

If you have any questions, please contact Brian Peters with GHD at (425) 563-6506.

Sincerely,

GHD

Brian Peters, LG

BP/cd/2

Encl.

Attachment A Ecology Memorandum dated February 3, 1999
Attachment B Sampling and Analysis Plan dated October 1985

cc: Andrea Wing, Shell
Jeff Bullen, Shell
Aselda Thompson, Shell

Attachment A
Ecology Memorandum dated February 3, 1999

MEMORANDUM

Date: February 3, 1999

To: Lisa Rozmyn

Subject: Envirosafe Northwest
524 132nd Street, Suite 104
Everett, WA 98208

From: Jerry French

I am writing this memo to document information that I gathered from Dave Clark on January 27, 1999 during a site visit concerning the transport and waste management activities performed by Envirosafe Northwest (EN) and ORRCO. I had previously visited EN in November/1998 as part of the Transporter Project during which time Dave Clark expressed no concerns with working with ORRCO. On January 26, 1999 Scott Lamb called and asked that I call Dave Clark because Dave had some concerns about the transportation and management of spent solvents handled by EN. I had plans to be in King County the next day so I called Dave and told him I would meet him then.

I understand that you are site manager for ORRCO in Woodland. I hope that the information provided in this memo will help you in any follow up actions with ORRCO. Pictures and other items are attached.

I met Dave Clark in his Everett office where he told me the following:

- Dave Clark, former owner of EN and Bill Briggs, owner of ORRCO, went into partnership with each other in the spring of 1998. Dave and Bill were joint partners, 50/50, of EN. Dave said he was not aware of any previous formal enforcement actions against ORRCO or Briggs at the time of the merger.

- Dave had dissolved his partnership with Briggs just days prior to my visit on 1/27/99. Dave had recently found out about Briggs' prior record of non-compliance with hazardous waste regulations in Oregon. Dave expressed dissatisfaction with the way Briggs or ORRCO accepted and handled waste solvents and used oil with no sampling, testing or analysis being performed on a generators waste.

- John Briggs is the current part owner of EN. John Briggs and Bill Briggs are not related according to Dave Clark. John and Bill are apparently joint partners, 50/50, of EN. John Briggs spends more time working out of the ORRCO Portland Office then the EN Everett facility. Cam Bell is the driver who picks up waste streams from EN customers and transports it to the EN transfer facility in Everett . John Briggs was not present during this site visit.

- ORRCO markets a solvent product that is manufactured by Tarr out of Oregon. The phone numbers for Tarr is 503-288-5294 or 1-800-422-5069. A Tarr manufactuerers label on one

of the drums read "Solvent 140F Petroleum distillates". ORRCO transports this solvent product to EN in Everett. EN then markets the Tarr solvent product to its customers as a parts washer and picks up the spent Tarr solvent. Review of a logbook revealed that EN currently has 25 different customers that it provides parts washer solvent service too with most of them in the Kitsap County area. Business clients noted were Kitsap Transit and U-Haul in Olympia.

- EN was storing 6x30 gallon sized drums of spent Tarr solvent at its transfer facility. A label on one of the drums read "NON-REGULATED WASTE, Bremerton Tire & Auto, 2647 Perry Ave., Bremerton, WA 98310, 10/14/98, Contents: Spent 140°F solvent, Combustible liquid, mineral spirits, oil, grease".

- EN and ORRCO use a NON-HAZARDOUS WASTE MANIFEST as a shipping paper for the spent Tarr solvent. Its shipping description on the manifest is"Used oil, > 140°, Going for recycle". A copy of a manifest and profile for such a shipment from Drive Train Distributors out of Fife is attached.

- Some of the spent Tarr solvent is transported to ORRCO in Woodland and some of it is transported to ORRCO in Portland. John Briggs transports the spent Tarr solvent in a 22 foot long box truck from EN in Everett to either of the ORRCO facilities. The spent Tarr solvent is blended in with used oil.

- EN also picks up used antifreeze, used oil, used absorbents and used gasoline. The used gasoline is blended into used oil at ORRCO.] *

- John Briggs of EN had pumped out a tank of used oil that was hot into 7 drums located at Integrity Auto Service on Newport Way in Issaquah @ January 20, 1999. Dave Clark had previously had this same batch of oil tested in July, 1998 when he partly owned EN and found it to be hot and having halogens >2000 PPM. Dave Clark would not accept it as used oil, and told Integrity Auto at that time that it needed further testing. Integrity Auto did not want to pay so it stayed at Integrity Auto until @1/20/99 when John Briggs pumped it out into 7 drums. John was going to transport it to ORRCO as used oil, as is and untested, until Dave Clark intervened. Samples were sent to Sol Pro where it will probably end up going for treatment. Dave Clark dissolved the business partnership with Bill Briggs shortly after this incident. The 7 drums were located in the EN facility during this visit. Dave Clark took a sample of the hot oil to have it tested for his own knowledge and to cover himself.

- Dave Clark's biggest concern is that proper procedures are not being followed to ensure that the spent Tarr solvent, used oil and spent gasoline meets the specifications of a non-hazardous waste fuel or used oil. He questions whether metals and other constituents are present prior to introduction to the furnace. With no profiles, lab testing and no hazardous waste manifests being completed Dave Clark says he wonders how legitimate ORRCO is.]

- When Dave Clark was part owner of EN he had devised his own profile forms, lab testing data forms and customer checklists to assure that waste streams were either hazardous or non-hazardous. Attached are profile sheets that Dave Clark had completed for spent Tarr solvent that he handled when he partly owned EN. Dave Clark's profile sheet shows the spent Tarr solvent to designate while the profile sheet completed by John Briggs and ORRCO for waste generated by Drive Train Distributors shows that it does not designate.

- Dave Clark had spent much time and effort to designate the spent Tarr solvent while John Briggs and Bill Briggs did not use these types of forms or waste sample testing. Dave Clark said he did not want to be put in the position where he may have to face a formal enforcement action because of Brigg's disregard to environmental statutes.

I want to point out a discrepancy found on paperwork gathered during this site visit. Look at the transporter ID# on the attached NON-HAZARDOUS WASTE MANIFEST. You will see that the ID# is WAD980978142. If you go into HWIMSY you find that this ID# is the same as Reflex Recycling Corp. in Tacoma. You will also see the Reflex ID# on a Chemical Sample Profile Sheet for Pacific Resource Recovery (Attached). Dave Clark had made arrangements for transport of hazardous waste fuels to Pacific Resource Recovery. It is apparent that EN used Reflex as a transporter for certain shipments. So the question: Why is EN using the Reflex ID# on a NON HAZARDOUS WASTE MANIFEST when EN is actually transporting the spent Tarr solvent and using an EN truck? You would think that EN should of used their own ID# on the NON HAZARDOUS WASTE MANIFEST. The EN ID# is WAH000006122. More on this later.

Dave Clark also informed me of his relationship with Reflex Recycling Corp. during the summer of 1998 and here is that story:

- Last summer John Briggs, Bill Briggs (ORRCO), EN (Dave Clark), and Jerry Moran—Reflex planned to form an agreement to work together and use the Reflex recycling stills for reclaiming spent solvents, to use the Reflex pit for accumulating oil/water waste, to use the Reflex facility for temporary storage of oil filters, absorbents and antifreeze, and to use Reflex as a transporter. John Briggs, ORRCO and EN planned to collect various waste streams from their customers and then have it transported to Reflex for treatment or storage.

- The four parties mentioned above had actually arranged for and had different waste streams transported to Reflex for a short time period. Shortly after waste was being transported to Reflex, the 3 owners of the Reflex property dissolved their working relationship. The business plan put together by the four parties described above also dissolved at the same time. What little waste was transported to and stored at Reflex was transported down to ORRCO. Jerry Moran, part owner of Reflex, works out of an office space at the EN facility in Everett as an independent waste broker.

3

What kind of wastes?

- Reflex employed a driver named Cam Bell. Cam Bell is apparently employed by ORRCO but drives primarily for EN. Cam receives all direction from John Briggs and does what he is told to do.

From all this information it appears that Cam Bell is a driver who transports waste materials for Reflex and EN and quite possibly for ORRCO also. Cam Bell may have mistakenly placed the Reflex ID# on the NON HAZARDOUS WASTE MANIFEST. Only additional follow up investigation would provide the answers needed on the ID# discrepancy.

During my visit I advised Dave Clark to contact Sheri Dotson so he could complete a Form 2 to have his name removed as the EN contact and owner since he had dissolved his business relationship with Bill Briggs and with EN. Dave Clark now operates Environmental Technology Services (ETS) and works as a waste broker and also provides bioremediation technology services for cleanup of PCS and other organics. ETS is located in the same building as EN and has the same address. ETS does not operate a transfer facility, they only set up waste disposal services through other companies. EN uses a garage for temporary storage of drums of waste while ETS works out of an office. Dave Clark's phone number is (425) 741-8639.

Upon review of all of this information there are compliance items that need follow up which are as follows:

- Full designation of spent Tarr solvent, used absorbents, used oils, used gasoline and other waste streams at the point of generation. ORRCO and EN are telling their customers that these waste streams are non-hazardous and picking it up with no prior testing or designation.

- If the above waste streams designate as dangerous waste then all of EN's customers could be in non-compliance with generator requirements.

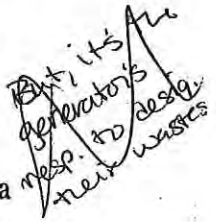
- If the spent Tarr solvent material designates then is the ORRCO Woodland facility permitted to accept it? If it does not designate is it still permitted to accept it?

- Oregon DEQ needs to know about this as these waste materials may affect the permit conditions of the ORRCO receiving facility in Portland.

- Transporter ID#'s need to be corrected. The interrelationship between EN, ORRCO and Reflex needs to be understood. A driver employed by one transporter company with its specific ID# but who also drives and transports for another transporter company with its ID# is okay as far as Dangerous Waste Regulations are concerned. However, we must also understand that the generator always designates the transporter and must know who is handling their waste. If there are any problems with transport then the transporter is required under WAC 173-303-250 to contact the generator to receive further instructions.

This is another case where a transporter takes custody of a generators waste, and then does not inform the generator who is transporting it and where it's at, which is not acceptable.

- Please read WAC 173-303-950(3). If any of this material designates as dangerous waste then I believe that this rule could be applied against EN and ORRCO for falsely representing information on a manifest, profile or any other record that is used for the purpose of compliance. The generator is totally reliant on EN and ORRCO to designate their waste streams and to also complete the paperwork. I have used this section against a transporter/broker here in ERO who represented that a waste material was non hazardous on a standard shipping paper when in fact it was hazardous waste and a uniform hazardous waste manifest should have been completed. I issued an enforcement letter against the transporter for violation of 950(3) and also issued an enforcement letter against the generator for failure to comply with generator requirements. Both parties had sufficient information to ensure compliance so they were both out of compliance, the generator more so than the transporter. WAC 173-303-950(3) may very well be the means for us to require a transporter or consultant or waste broker to be held accountable for their actions. There is other enforcement cases on record where the transporter/broker were found in non-compliance for falsely representing information on a manifest, label or other documents used for the purpose of compliance with hazardous waste regulations. Some people may disagree with me on this but I would like your opinion.



- If any of the waste streams that are handled by EN, or John Briggs or ORRCO also designate as a hazardous waste, and is also transported across state lines from Washington to Oregon by the same persons, then a criminal investigation is warranted.

I hope this information helps you during any future enforcement actions you may have with ORRCO. As you know, if I observe any items of non-compliance in any of the other regions during the Transporter Project that need further investigation then I am obligated to inform of such. I am available if you need any help on this.

Cc: Jim Sachet
Dave Misko w/attachments
Scott Lamb
Chuck Clinton, Oregon DEQ

WASHINGTON STATE DEPARTMENT OF ECOLOGY

TELEPHONE RECORD

Date 2/3/99

Time ☐ a.m. ☐ p.m.

☐ CALLED BY
☒ CALLED

(Mr)/Ms. Dave Clark

Telephone 425/741-8639

Address

Representing Env. Tech Services

Project

Discussed He was bus. partner for ~1 yr.
Using Reflex tanks
Dave & John Briggs left Clean Care, 8½ yrs. started Envirosafe
Moved to Woodland - 800 #, office
Bill did Env. Sale ↑ calls
Solvent - testing, 150 Flash solvent, filtration - 6 mos -> 4 yr.
TCLP, Chlor,
Bill said no - its used oil.

Ben Taylor - Clean Care -
Catch basins, enzyme sol. for remed., Stormh2o P2 plans

Signed

ECY 010-46(b) Rev 8/91

Attachment B
Sampling and Analysis Plan dated October 1985

SAMPLING AND ANALYSIS PLAN

FOR

FUEL PROCESSORS

WOODLAND, WASHINGTON

October 1985

Prepared for:
Fuel Processors, Inc.
701 Bozarth Street
Woodland, Washington

Prepared by:
Patrick H. Wicks, P. E.
2535 152nd. Avenue NE., Suite B-2
Redmond, Washington 98052

TABLE OF CONTENTS

INTRODUCTION

This plan has been prepared in response to the U.S. Environmental Protection Agency request for a RCRA Part B permit application on the former AARCOM facility located at this site. The site was acquired by Fuel Processors, Inc. in 1985.

The principle use of this site has been as a petroleum product bulk plant during most of its history. In more recent years, it was used reportedly by AARCOM for waste handling activities. Fuel Processors intends to use the facility for waste oil reclamation.

This sampling and analysis plan may be modified based on comments from the U.S. Environmental Protection Agency and/or included in a closure plan for this facility if necessary.

The site is located at 701 Bozarth Street, Woodland, Washington.

SITE DESCRIPTION

A plan view of the site is shown in the attached figure, Fuel Processors, Inc. Sampling Site Plan. At the site, a number of oil storage and processing tanks with associated equipment, and buildings are present. The entire site is fenced with a chain link fence, although this is not indicated on the site plan. Note that the attached site plan is not to scale and locations of various facilities are approximate. Most of the site is covered by a concrete paving and/or pads. Two areas are unpaved: the driveway and one area within the one and a half foot high concrete berm at the northwest corner of the site. Both of these are designated on the plan. The unpaved area within the concrete berm is small, measuring approximately 35 feet by 50 feet. This is the area where previous EPA samples were collected.

During late September or early October 1985, it is planned to excavate and remove potentially contaminated soil to a depth of 2 feet to 4 feet at the unpaved area within the concrete berm. This soil removal will precede any sampling as discussed below.

The locations on the site plan of previous EPA samples are based on a sketch provided by EPA. The Washington Department of Ecology (DOE) sample locations are also indicated on the site plan. These sample locations are understood to be correct, but may not be.

AVAILABLE ANALYTIC DATA

Analytic results for previous samples collected and analyzed by EPA and DOE are summarized in the attached table. This summary will be updated when results are available from the analyses discussed below.

SAMPLE COLLECTION & HANDLING

The area subject to sample collection in this plan is the unpaved area within the berm at the northwest corner of the site. Four soil sample locations have been selected using a random number generator (IBM PC computer and Lotus Symphony software). These locations are indicated in the table below, with coordinates relative to the east and north concrete berms at the boundaries of this unpaved area. A fifth sample will be collected (as a composite of two individual random samples) from the surface of the soil pile at the northwest corner of this area. Sample numbers (other than those indicated below)will be assigned at the time of sample collection. These locations are also indicated on the sampling site plan.

SOIL SAMPLE LOCATION COORDINATES, FT

	EAST OF WEST BERM	SOUTH OF NORTH BERM
Sample 1	28	4
Sample 2	8	37
Sample 3	16	19
Sample 4	31	38

Since samples cannot be collected below tank H2 and other foundations or certain equipment present in this area, any sample location indicated above will be moved either to the north, south, east or west, remaining as close as possible to the selected location. Also due to the minimal space between tanks, equipment and pipelines, in the sampling area, samples will be collected using the small backhoe, hand shovel, hand auger or other appropriate means.

Samples will be collected at 2 depths in each location, i.e., at the surface and at a depth of 5 feet beneath the surface (or until no contamination is apparent at a lesser depth). Please note that surface in this case means the surface of the ground after potentially contaminated soil has been removed from this area as discussed in the site description section above.

Samples will be collected in full duplicates for each sample in the event that the analysis planned as discussed below is insufficient to characterize conditions at the site. This would allow analysis for other parameters with the duplicate retained sample without additional sampling. An additional duplicate of one of these samples will be collected for analysis at a second analytic laboratory.

Sample collection and handling procedure will be in accordance with standard practice, including precautions to avoid cross contamination between samples (i.e., sampling devices will be cleaned between samples), proper labeling of sample containers, use of proper sample containers with respect to parameters to be analyzed, use of chain of custody procedures and forms, marking and measurement of sample locations and samples being collected by qualified personnel.

Samples will be collected within three weeks after review and concurrence by EPA of this plan.

LABORATORY ANALYSIS

Analysis of the samples discussed above will include the following:

Analysis Method (1)	# of Samples (2)	Lower detection limit, ppb (3)
PP VOLATILES SW-846 # 8240 (4)	11	1-10
PNA/PAH's SW-846 # 8100 (5)	11	1-200
PCB's SW-846 # 8080	4	100

(1) 3 week turnaround.

(2) 4 soil sample locations at 2 samples per location, plus 1 duplicate for analysis at a second laboratory, plus 1 soil pile sample = 10 total samples for 8240 and 8100 analysis. 2 soil sample locations at 2 samples per location = 4 total samples for PCB analysis.

(3) Detection limits for low contamination levels; detection limits for higher contamination levels will be higher.

(4) Expected to detect all F003 and F005 constituents except Pyridine; a forward search for 20 non-priority pollutants that would not normally be reported for method # 8240 is included.

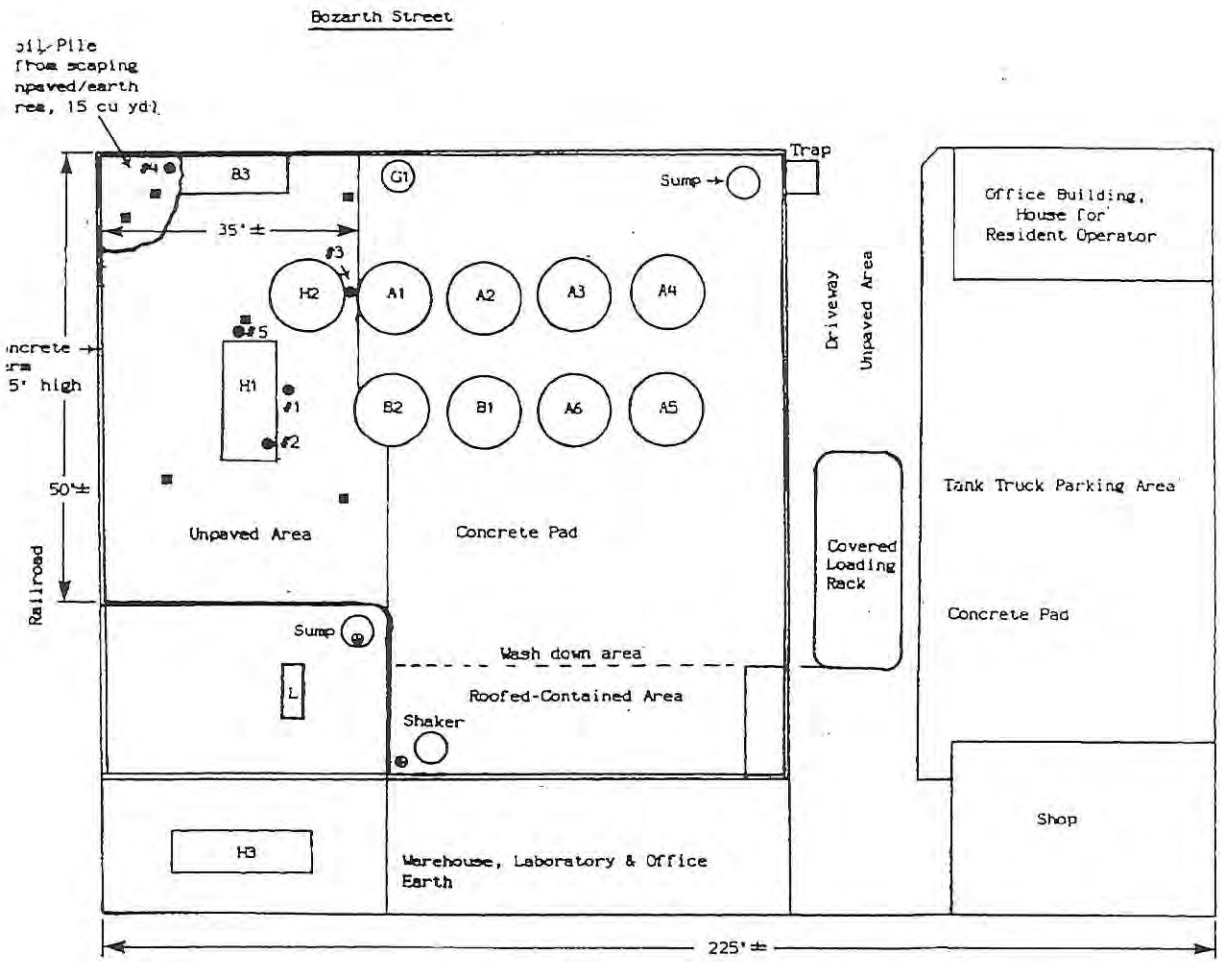
(5) Will not detect Pyridine (F005 constituent).

The analytic methods noted above will be sufficient to detect constituents of concern, including volatile organics, PNA's (polynuclear aromatics), PAH's (polynuclear aromatic hydrocarbons) and PCB's. Due to the analyses previously conducted by EPA and DOE, analysis for heavy metals and other parameters are believed to be unnecessary. Previous analytic results for metals indicated levels which were not at a level of concern. In addition, the planned analyses should detect all F003 and F005 hazardous waste constituents with the exception of pyridine. Analysis for pyridine is believed to be unnecessary since it is unlikely that this material was used by previous owners or operators and should not be present at the site. It has also been indicated by EPA that analysis for other 40 CFR 261 Appendix VIII constituents is not needed.

Also indicated above is the expected detection level for the various analytic procedures for relatively clean samples. For samples collected and analyzed under this plan, detection limits may be higher if significant contamination is present.

Due to budget constraints, samples collected at the surface at sample locations 1 through 4 and the soil pile composite sample will be analyzed first. If analytic results for these samples are at or below levels of concern, analysis of the deeper samples would be unnecessary and the associated expense avoided. If results for these samples are not below levels of concern, then analysis of the deeper samples would be performed.

Results of laboratory analysis are expected to be available within three weeks after delivery to the laboratory for the first set to be analyzed. As soon as results are received and reviewed by Fuel Processors, Inc., they will be provided to EPA.



LEGEND

● EPA Sample Locations: #
⊕ DOE Sample Locations

TANKS

Horizontal Above Ground

B3 - 12,500 gal
H1 - 15,000 gal
H3 - 15,000 gal
G1 - 2,500 gal

Vertical Above Ground

H2 - 12,500 gal
A1,A2,A3,A4,A5,A6 - 25,000
B1,B2 - 12,500 gal each

Underground Tank

L - 2,000 gal diesel fuel

Note:
Dimensions and location of
and other features are base
EPA sketch: FUEL PROCESSORS
INCORPORATED RCRA RECONNAIS
INSPECTION, 701 Bozarth St.
Woodland, WA 4-16-85.
This drawing is not to scal

■ Planned Sample Locations

FUEL PROCESSORS, INC. SAMPLING SITE PLAN

SCALE

APPROVED BY

DATE 10/7/85

PATRICK H. WICKS, P.E.

Consultant in Hazardous Waste Management

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 · Olympia, Washington 98504-7775 · (360) 407-6300
711 for Washington Relay Service · Persons with a speech disability can call 877-833-6341

April 19, 2021

Mr. Brian Peters, L.G.
GHD
20818 44th Avenue W, Suite 190
Lynnwood, WA 98036

Re: Fuel Processors Site, Woodland, Washington – Remedial Investigation Report

Dear Brian Peters:

GHD submitted an Agency Review Draft Remedial Investigation (RI) report for the Fuel Processors Site (Site) in Woodland, Washington, to the Department of Ecology (Ecology) on January 22, 2020. Ecology reviewed the report and responded with comments by letter dated May 18, 2020. GHD responded to Ecology's review comments by letter dated August 10, 2020.

Ecology has determined that the Agency Review Draft RI report has the basic requirements required by WAC 173-340-350. However, the report continues to contain material that Ecology previously addressed in 2012 when Shell Oil (Shell) responded to Ecology naming Shell as a Potentially Liable Person (PLP) for the Site. Ecology also does not concur with statements in the RI report about certain laboratory reports and opinions regarding the contamination and allocation or liability for the releases. While such statements could be correct, Ecology must consider all reports and data when developing the required cleanup action, including laboratory reports from other PLPs that appear to contradict statements in the RI report.

After consideration of GHD's response and the Agency Review Draft RI, Ecology concurs with some, but not all, of GHD's responses. Instead of further delaying the RI process and to move forward with the feasibility study, Ecology proposes that you submit a final Agency Review Draft RI report with the changes GHD agreed to in the August 10, 2020, letter and provide Ecology with an electronic copy.

For the Public Review Draft RI report, Ecology will add statements via comment bubbles or other documentation to the Agency Review Draft RI report prepared by GHD. These additional agency comments will note where Ecology does not have a basis to agree with the statement or where there is contradictory technical data in the record. The comments we will include will be similar in content to our May 18, 2020, comment letter. Also, Coles & Associates conducted sampling studies and produced reports prior to GHD's more recent involvement with the Site. Ecology will add a report produced by Coles & Associates as an appendix to the Public Review Draft RI report.

Please email me at chof461@ecy.wa.gov if I can provide additional information or answer any questions.

Sincerely,

Charles P. Hoffman

Charles P. Hoffman, P.E.
Environmental Engineer
Hazardous Waste & Toxics Reduction Program
Southwest Regional Office

Enclosure

cc: Bill Briggs, ORRCO
Andrea Wing, Shell Oil
Jeff Bullen, Shell Oil
Dave Coles, Coles & Associates
Jill Betz, Coles & Associates

Appendix L
DRAFT Remedial Investigation Report
Vapor Intrusion Assessment Amendment
January 27, 2022

Memorandum

27 January 2022

To	Kaia Petersen, Department of Ecology, kpet461@ECY.WA.GOV		
Copy to	Andrea Wing, Shell, andrea.wing@shell.com; Jeff Bullen, Shell, jeff.bullen@shell.com, Jill Betts, Coles and Betts Environmental Consulting, colesandbetts.com;		
From	Jeff Gaarder, GHD Inc.	**Tel**	425.563.6504
Subject	701 Bozarth Ave, Woodland WA, Draft Remedial Investigation Report - Vapor Intrusion Assessment Amendment - Due 1/28/22	**Project no.**	11218521

GHD Inc. (GHD) has prepared this memo as requested by the Department of Ecology in their January 20, 2022 email for the subject site. The memo presents the findings of the initial assessment of the vapor intrusion (VI) pathway following the steps outlined in Appendix B of *Ecology's November 2021 Draft Guidance for Evaluating Vapor Intrusion in Washington.* The VI assessment amends the *Draft Remedial Investigation Report (RI)* issued to Ecology on May 18, 2020.

GHD followed the eight-step process in Appendix B for the neighboring properties and the results are presented below:

STEP 1: Confirm the release. See RI Section 2.2 Site Discovery and Regulatory Status

STEP 2: Determine if an immediate action is necessary. There are no safety concerns or acute exposure threats from vapor intrusion, therefore immediate action is unnecessary. See RI Section 6 Interim Actions for remedial work performed between 1985 and 2016.

STEP 3: Characterize the site and develop a conceptual site model (CSM). *See RI Section 6 Conceptual Site Model.*

STEP 4: Evaluate whether there are any contaminants besides petroleum. See RI Section 8 Areas Requiring Future Management. As discussed, other non-petroleum constituents have been detected, however, the primary constituents of concern are petroleum.

STEP 5: Determine if there are precluding factors. Based on the RI findings, it is unlikely that there are precluding factors as listed below, that would prevent using this process for assessing the VI pathway.

a. Changing site conditions, such as an expanding plume or planned development above/adjacent to the contamination.
b. Preferential pathways.
c. Extremely low soil moisture content.
d. Limited oxygen in the soil due to the presence of relatively impermeable ground cover surrounding the building of interest, large structures, or methanogenesis (due to the release of higher ethanol blends of gasoline or the presence of very high organic material in the soil).
e. The presence of lead scavengers in the released fuel.
f. The presence of other additives in the released fuel that may aerobically biodegrade more slowly than benzene.
g. Subsurface petroleum VOC contamination in direct contact with the building's foundation.

STEP 6: Determine if buildings are within the lateral inclusion zone. The degree and extent of contamination at the Site is well defined and the dissolved phase plume is stable or

receding. Consequently, a horizontal separation distance of 30 feet is appropriate for establishing a lateral inclusion zone for the vapor intrusion pathway. As shown on the attached Figure 3, neither the MTCA Site Boundary nor the 30 ft horizontal separation boundary intersect neighboring structures located on the north, east or south sides of the Site. **Therefore, the initial vapor intrusion pathway assessment is complete for the neighboring properties and the final two steps of this process (7 and 8) are unnecessary.** Note that the property structures within the Site if occupied do represent a potential vapor intrusion data gap, however, this will be addressed as part of the final cleanup action.

The initial VI assessment presented above will be added to the RI following the public comment period as shown in the second paragraph of Section 8.4 below:

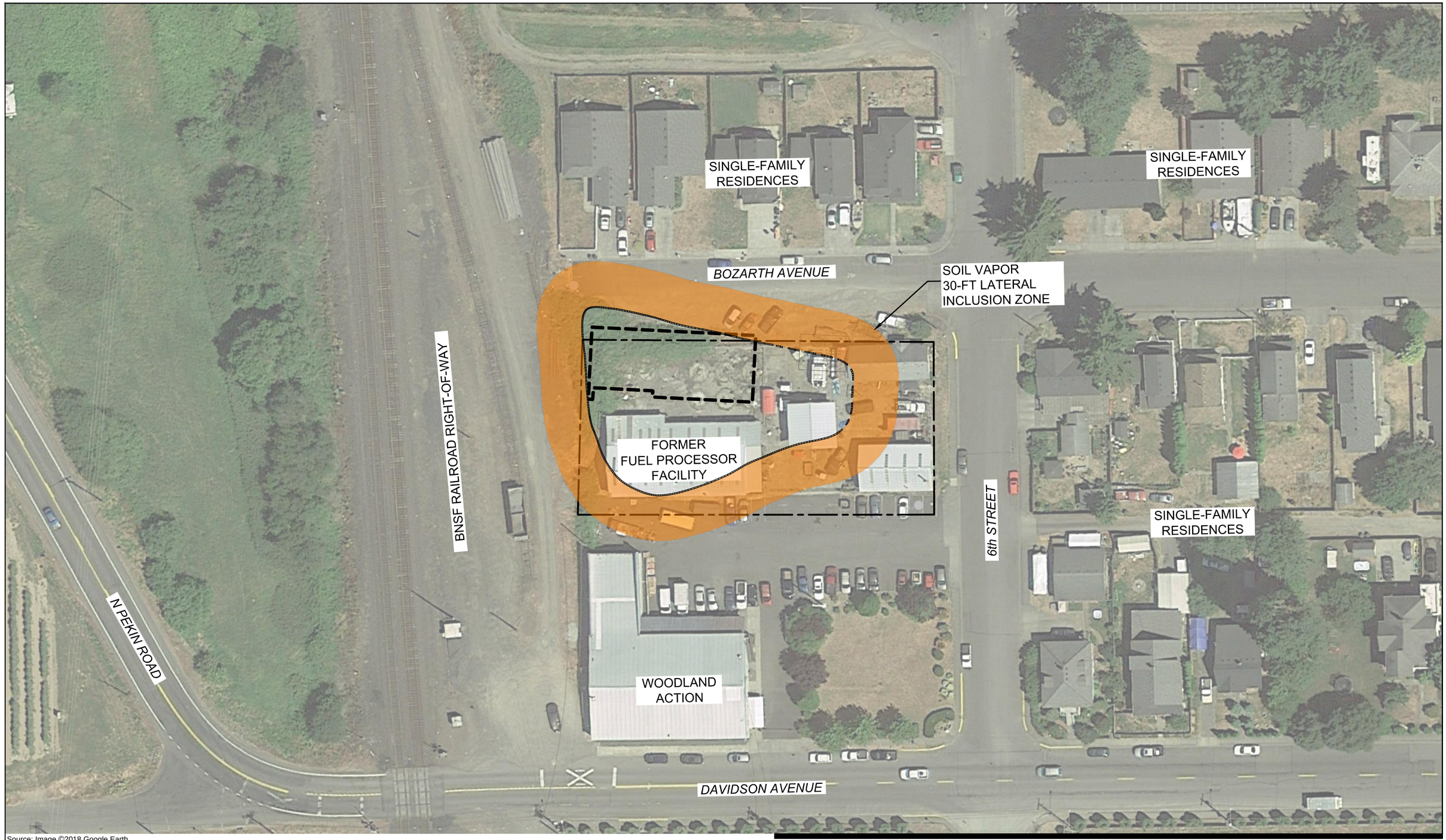
> **8.4 Soil Vapor Requiring Future Management**
>
> *Based on a review of previous subsurface investigations at the Site, the soil vapor intrusion pathway at the Site represents a data gap. Shallow petroleum-impacted soil and groundwater are present within the footprint of the warehouse building and within approximately 20 to 25 feet of the on-Property house and shop building. The shallow petroleum-impacted soil and groundwater is also present within approximately 35 to 85 feet of the south and north adjoining property buildings. Additionally, SPH is present within at least 40 feet of on-Property buildings and within 100 feet of adjoining property buildings. Based on the current and proposed mixed-use of the Property and adjoining properties as residential and light industrial, the soil vapor intrusion pathway at the Site requires further evaluation.*
>
> *As a result, an initial assessment of the vapor intrusion pathway was conducted as outlined in Ecology's November 2021 Draft Guidance for Evaluating Vapor Intrusion in Washington. GHD followed the steps outlined in Appendix B to evaluate the vapor intrusion pathway for the neighboring properties located beyond the MTCA Site Boundary as shown on Figure 3. Pursuant to Step 6 of the Appendix B process, GHD believes the degree and extent of contamination at the Site is well defined and the dissolved phase plume is stable or receding. Consequently, a horizontal separation distance of 30 feet is appropriate for establishing a lateral inclusion zone for the vapor intrusion pathway. As shown on Figure 3, neither the MTCA Site Boundary nor the 30 ft horizontal separation boundary intersect neighboring structures located on the north, east or south sides of the Site. Therefore, the initial vapor intrusion pathway assessment is complete for the neighboring properties. Note that the property structures within the Site if occupied do represent a potential vapor intrusion data gap, however, this will be addressed as part of the final cleanup action.*

Please contact us if you have questions or would like to discuss the contents of this memo.

Regards,

Jeff Gaarder
Principal

Brian Peters
Associate



Source: Image ©2018 Google Earth.

LEGEND

SUBJECT SITE BOUNDARY

MODEL TOXICS CONTROL ACT (MTCA) SITE BOUNDARY, DASHED WHERE INFERRED

0 30 60 ft

1" = 60 ft

Coordinate System: STATE PLANE WA-NAD83-SF

N

GHD

FUEL PROCESSORS FACILITY
701 BOZARTH AVENUE
WOODLAND, WASHINGTON

AREA MAP

Project No. **11218521**
Date **January 2022**

FIGURE 3

Filename: N:\US\Lynnwood\Projects\561\11218521\Digital_Design\ACAD\Figures\FUEL PROCESSORS\11218521-GHD-0000-RPT-EN-0101_DE-FUELPROCESSOR.dwg
Plot Date: 07 January 2022 2:56 PM