



December 18, 2018

Timm Schimke, Director  
Deschutes County Solid Waste Department  
61050 SE 27<sup>th</sup> Street  
Bend, OR 97702

Subject: Preliminary Landfill Gas Characterization  
Knott Landfill  
Deschutes County  
PBS Project No. 80429.010, Phase 005

Dear Mr. Schimke:

PBS Engineering and Environmental Inc (PBS) conducted sampling of landfill gas (LFG) at Knott Landfill in Bend, Oregon for the Deschutes County Department of Solid Waste (DCSW). The purpose of the sampling was to characterize the quality of the LFG for potential use as an energy source. The work was conducted under the General Services Agreement between Deschutes County and PBS (Document 2018-524) dated August 16, 2018.

### **Background**

PBS discussed the objectives of the sampling with DCSW staff and laboratory personnel familiar with LFG sampling to determine the appropriate test methods and sampling locations. It was determined that the most representative location to obtain an average gas sample was the sample port associated with the main trunk line feeding the on-site gas flare. In order to provide a preliminary characterization of the LFG, the following analyses were performed on the sample:

- Fixed gases (H<sub>2</sub>, N, CH<sub>4</sub>, CO and H<sub>2</sub>S)
- Sulfur Compounds
- Gross and Net Heating Values (Dry Gas and Wet Gas)
- Siloxanes
- Volatile Organic Compounds (VOCs)

### **Field Methods**

PBS procured the necessary field equipment and mobilized to the site on November 8, 2018 to conduct the sampling. PBS met with DCSW personnel to review health and safety protocols and access the central collection and flare area. PBS used a DCSW provided GEM 5000 landfill gas monitor to measure gas concentrations at the sampling port to verify that representative concentrations of fixed gases were consistent with recent monitoring activities. The following percentage ranges were measured in the field prior to sampling: methane (47% to 48%), carbon dioxide (37% to 38%), oxygen (approximately 1%) and balance gases were presumed to be nitrogen (13 to 14 %). Due to the significant negative pressure (greater than -30 inches of mercury

("Hg) of the blower associated with the flare, sampling could not be conducted under normal flare operation. It was determined that the blower system needed to be shut down to reduce the negative pressure in the trunk line.

Once the blower was shut down, the Summa canister was filled at a controlled rate using the negative vacuum pressure of the canister. The canister was filled from a pressure of -15.5"Hg to a pressure of -4"Hg over a period of 28 minutes. For the siloxane analysis, a laboratory prepared sample sorbent tube was connected to a low-volume sampling pump and collected LFG at a rate of 0.2 liter/minute for a period of approximately 30 minutes.

### **Laboratory Analyses**

Samples were submitted via overnight courier under a chain-of-custody to ALS Laboratory in Simi Valley, California for analysis. Samples were analyzed using methods ASTM D55104 (Sulfur Compounds) ASTM D3588-98 (Fixed Gases and Heating Values), EPA Method TO-15 (VOCs) and a laboratory-specific method using Gas Chromatograph/Mass Spectrometer for Siloxanes.

Data were reviewed in accordance with the procedures specified in the U. S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA, 1999) and Inorganic Data Review (US EPA, 2004) as applicable. All data were considered usable for project objectives. The data quality review for the specified analyses is attached with the laboratory report.

### **Findings**

The analytical results of the sample are summarized below and presented in the attached tables. The analyzed concentrations of the fixed gases corresponded well with the field measured values; methane (46.15%), carbon dioxide (35.16 %), nitrogen (17.13%) and oxygen (1.53%). The gross heating value of the gas was calculated to be 468.2 BTU/ft<sup>3</sup> (dry gas) and 458.8 BTU/ft<sup>3</sup> (water saturated). Hydrogen sulfide is the predominant sulfur compound at 130,000 µg/m<sup>3</sup> with low concentrations of carbonyl sulfide, methyl mercaptan, dimethyl sulfide and isopropyl mercaptan also detected above the method reporting limit (MRL). The primary siloxanes detected in the sample was trimethylsilanol (6,800 µg/m<sup>3</sup>) and hexamethyldisiloxane (L2; 1,800 µg/m<sup>3</sup>). The total siloxane detected is 9,109 µg/m<sup>3</sup>. Several volatile organic compounds were detected above the MRL in the sample with Ethanol (26,000 µg/m<sup>3</sup>), Propene (10,000 µg/m<sup>3</sup>) and 2-Propanol (7,500 µg/m<sup>3</sup>) having the largest detected concentrations. The complete laboratory report is attached.

Based on a cursory review of available information the methane and BTU values are typical of landfill gas. The total siloxane of the sample (9,109 µg/m<sup>3</sup>) is on the lower end of the range (2,000 to 135,000 µg/m<sup>3</sup>)<sup>1</sup>. This may be due to the gradual exhaustion of siloxane over time or it may be because there less siloxane in the waste. There is also considerable variation in siloxane values depending on the sample collection and analytical method used.

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<sup>1</sup> Siloxanes in Landfill and Digester Gas, Wheless and Pierce, 2004, 27<sup>th</sup> Annual SWANA LFG Symposium

### **Limitations**

This study was limited to the sampling as indicated to assess the presence of certain contaminants in landfill gas being generated at the site. The site as a whole may have other contaminants that are not characterized by this study. The findings and conclusions of this report are not scientific certainties, but probabilities based on professional judgment concerning the significance of the data gathered during the course of this investigation.

Please feel free to contact me at 541.323.5884 or toby.scott@pbsusa.com with any questions or comments.

Sincerely,

N. Toby Scott, RG  
Hydrogeologist/Sr. Project Manager  
PBS Engineering and Environmental Inc.

Attachments: Tables 1-3  
Data Quality Review and Laboratory Report ALS P1806199

NTS:BM

**Table 1- Sulfur and Siloxane Analysis Summary**  
**LFG Characterization**  
**Knott Landfill - Bend OR**

**PBS Project No. 80429.010, Ph.5**  
**December 2018**

<b>Sulfur Compounds - ASTM D5504-12</b>					
<b>Compound</b>	<b>Result</b> <b>µg/m<sup>3</sup></b>		<b>MRL</b> <b>µg/m<sup>3</sup></b>	<b>Result</b> <b>ppbV</b>	<b>MRL</b> <b>ppbV</b>
Hydrogen Sulfide	<b>130,000</b>		250	<b>92,000</b>	180
Carbonyl Sulfide	<b>490</b>		430	<b>200</b>	180
Methyl Mercaptan	<b>990</b>		350	<b>500</b>	180
Ethyl Mercaptan		ND	450		180
Dimethyl Sulfide	<b>910</b>		450	<b>360</b>	180
Carbon Disulfide		ND	270		88
Isopropyl Mercaptan	<b>1,100</b>		550	<b>350</b>	180
tert-Butyl Mercaptan		ND	650		180
n-Propyl Mercaptan		ND	550		180
Ethyl Methyl Sulfide		ND	550		180
Thiophene		ND	610		180
Isobutyl Mercaptan		ND	650		180
Diethyl Sulfide		ND	650		180
n-Butyl Mercaptan		ND	650		180
Dimethyl Disulfide		ND	340		88
3-Methylthiophene		ND	710		180
Tetrahydrothiophene		ND	630		180
2,5-Dimethylthiophene		ND	810		180
2-Ethylthiophene		ND	810		180
Diethyl Disulfide		ND	440		88
<b>Siloxanes - GC/MS</b>					
<b>Compound</b>	<b>Result</b> <b>µg/Tube</b>	<b>Result</b> <b>µg/m<sup>3</sup></b>	<b>MRL</b> <b>µg/m<sup>3</sup></b>	<b>as Silicon</b> <b>µg/m<sup>3</sup></b>	<b>MRL</b> <b>µg/m<sup>3</sup></b>
Trimethylsilanol	41	<b>6,800</b>	54	<b>2,100</b>	17
Hexamethyldisiloxane (L <sub>2</sub> )	11	<b>1,800</b>	47	<b>610</b>	16
Hexamethylcyclotrisiloxane (D <sub>3</sub> )	0.75	<b>130</b>	50	<b>47</b>	19
Octamethyltrisiloxane (L <sub>3</sub> )	< 0.29		48		17
Octamethylcyclotetrasiloxane (D <sub>4</sub> )	1.8	<b>310</b>	48	<b>120</b>	18
Decamethyltetrasiloxane (L <sub>4</sub> )	< 0.29		48		17
Decamethylcyclopentasiloxane (D <sub>5</sub> )	0.42	<b>69</b>	47	<b>26</b>	18
Dodecamethylpentasiloxane (L <sub>5</sub> )	< 0.29		48		18
Dodecamethylcyclohexasiloxane (D <sub>6</sub> )	< 0.29		48		18
<b>Total</b>		<b>9,109</b>		<b>2,900</b>	
<b>Notes</b>					
MRL - Method Reporting Limit					
ND- Not Detected above the method reporting limit.					

**Table 2- Fixed Gas Analyses and Heating Value Calculation** **PBS Project No. 80429.010, Ph.5**  
**LFG Characterization** **December 2018**  
**Knott Landfill - Bend OR**

<b>Heating Value Calculation ASTM D3588-98</b>				
<b>Components</b>	<b>Result Volume %</b>	<b>Result ppmV</b>		<b>MRL ppmV</b>
Hydrogen	< 0.01		ND	3,500
Oxygen	<b>1.53</b>	<b>15,300</b>		3,500
Nitrogen	<b>17.13</b>	<b>171,000</b>		3,500
Carbon Monoxide	< 0.01		ND	3,500
Methane	<b>46.15</b>	<b>462,000</b>		3,500
Carbon Dioxide	<b>35.16</b>	<b>352,000</b>		3,500
Hydrogen Sulfide	< 0.01	<b>92</b>		0.18
C2 as Ethane	< 0.01		ND	18
C3 as Propane	< 0.01	<b>69</b>		18
C4 as n-Butane	< 0.01	<b>20</b>		18
C5 as n-Pentane	< 0.01		ND	18
C6 as n-Hexane	< 0.01		ND	18
> C6 as n-Hexane	< 0.01	<b>96</b>		35
<b>TOTALS</b>	<b>99.99</b>			
<b>Components</b>	<b>Mole %</b>	<b>Weight %</b>		
Carbon	<b>21.77</b>	<b>34.70</b>		
Hydrogen	<b>49.44</b>	<b>6.61</b>		
Oxygen	<b>19.62</b>	<b>41.65</b>		
Nitrogen	<b>9.16</b>	<b>17.03</b>		
Sulfur	< 0.10		< 0.10	
Specific Gravity (Air = 1)		<b>0.9731</b>		
Specific Volume		<b>13.47</b>	ft3/lb	
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)		<b>468.2</b>	BTU/ft3	
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)		<b>421.6</b>	BTU/ft3	
Gross Heating Value (Water Saturated at 0.25636 psia)		<b>458.8</b>	BTU/ft3	
Net Heating Value (Water Saturated at 0.25636 psia)		<b>413.2</b>	BTU/ft3	
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)		<b>6,304.2</b>	BTU/lb	
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)		<b>5,676.6</b>	BTU/lb	
Compressibility Factor "Z" (60 F, 14.696 psia)		<b>0.9975</b>		
WOBBE Index		<b>474.6</b>		
<b>Notes</b>				
MRL - Method Reporting Limit				
ND- Not Detected above the method reporting limit.				

Table 3 - Volatile Organic Compounds Analysis Summary			PBS Project No. 80429.010, Ph.5	
LFG Characterization			December 2018	
Knott Landfill - Bend OR				
VOCs - EPA Method TO-15				
Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV
Propene	10,000	92	5,800	53
Dichlorodifluoromethane (CFC 12)	2,600	33	520	6.7
Chloromethane	ND	32	ND	16
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	33	ND	4.7
Vinyl Chloride	4,900	34	1,900	13
1,3-Butadiene	ND	33	ND	15
Bromomethane	ND	32	ND	8.2
Chloroethane	360	33	140	12
Ethanol	26,000	330	14,000	170
Acetonitrile	260	33	160	20
Acrolein	ND	64	ND	28
Acetone	4,200	350	1,800	150
Trichlorofluoromethane (CFC 11)	440	34	78	6.0
2-Propanol (Isopropyl Alcohol)	7,500	130	3,000	55
Acrylonitrile	ND	33	ND	15
1,1-Dichloroethene	42	35	10	8.7
Methylene Chloride	730	35	210	10
3-Chloro-1-propene (Allyl Chloride)	ND	34	ND	11
Trichlorotrifluoroethane (CFC 113)	130	34	16	4.4
Carbon Disulfide	110	70	36	23
trans-1,2-Dichloroethene	88	34	22	8.6
1,1-Dichloroethane	170	33	42	8.2
Methyl tert-Butyl Ether	ND	35	ND	9.6
Vinyl Acetate	ND	340	ND	96
2-Butanone (MEK)	2,800	64	950	22
cis-1,2-Dichloroethene	1,500	34	370	8.6
Ethyl Acetate	1,500	70	420	20
n-Hexane	6,500	35	1,800	9.8
Chloroform	ND	35	ND	7.1
Tetrahydrofuran (THF)	3,100	34	1,000	12
1,2-Dichloroethane	200	34	50	8.4
1,1,1-Trichloroethane	ND	35	ND	6.3
Benzene	1,100	33	350	10
Carbon Tetrachloride	ND	33	ND	5.3
Cyclohexane	2,000	64	580	19
1,2-Dichloropropane	ND	35	ND	7.5
Bromodichloromethane	ND	34	ND	5.1
Trichloroethene	ND	34	ND	6.3
1,4-Dioxane	ND	34	ND	9.4
Methyl Methacrylate	ND	70	ND	17
n-Heptane	2,700	35	670	8.4
cis-1,3-Dichloropropene	ND	36	ND	7.9
4-Methyl-2-pentanone	40	34	9.9	8.3
trans-1,3-Dichloropropene	ND	34	ND	7.5
1,1,2-Trichloroethane	36	35	6.6	6.3
Toluene	2,200	34	590	9.0
2-Hexanone	ND	35	ND	8.4
Dibromochloromethane	ND	35	ND	4.1
1,2-Dibromoethane	ND	35	ND	4.5
n-Butyl Acetate	ND	35	ND	7.3
n-Octane	180	35	38	7.4
Tetrachloroethene	50	34	7.4	5.0
Chlorobenzene	ND	34	ND	7.4
Ethylbenzene	78	33	18	7.7
m,p-Xylenes	ND	70	ND	16
Bromoform	ND	34	ND	3.3
Styrene	ND	34	ND	8.0
o-Xylene	ND	34	ND	7.8
n-Nonane	ND	35	ND	6.6
1,1,2,2-Tetrachloroethane	ND	34	ND	4.9
Cumene	ND	34	ND	6.9
alpha-Pinene	ND	33	ND	6.0
n-Propylbenzene	ND	35	ND	7.0
4-Ethyltoluene	ND	34	ND	6.9
1,3,5-Trimethylbenzene	ND	34	ND	6.9
1,2,4-Trimethylbenzene	ND	34	ND	6.9
Benzyl Chloride	ND	70	ND	14
1,3-Dichlorobenzene	ND	35	ND	5.8
1,4-Dichlorobenzene	ND	35	ND	5.8
1,2-Dichlorobenzene	ND	35	ND	5.8
d-Limonene	ND	33	ND	5.9
1,2-Dibromo-3-chloropropane	ND	33	ND	3.4
1,2,4-Trichlorobenzene	ND	34	ND	4.6
Naphthalene	ND	33	ND	6.2
Hexachlorobutadiene	ND	34	ND	3.2

Notes

MRL - Method Reporting Limit

ND- Not Detected above the method reporting limit.

## Data Quality Review: Knott Landfill, Preliminary Landfill Gas Characterization

PBS collected one landfill gas (LFG) sample at Knott Landfill in Deschutes County, Oregon. This data quality review assesses the quality of the laboratory data from this sampling event. One primary LFG sample was collected on November 8, 2018. The sample was analyzed for the following parameters:

Parameter	Method
Fixed Gases <sup>1</sup>	ASTM D3588-98
Siloxanes	ALS AQL 111
Sulfur Compounds <sup>2</sup>	ASTM D5504-12
Volatile Organic Compounds (VOCs)	TO-15 Modified

<sup>1</sup>Fixed Gases: Hydrogen, Oxygen, Nitrogen, Carbon Monoxide, Methane, Carbon Dioxide, Hydrogen Sulfide, C2 as Ethane, C3 as Propane, C4 as n-Butane, C5 as n-Pentane, C6 as n-Hexane, and > C6 as n-Hexane

<sup>2</sup>Sulfur Compounds: Hydrogen Sulfide, Carbonyl Sulfide, Methyl Mercaptan, Ethyl Mercaptan, Dimethyl Sulfide, Carbon Disulfide, Isopropyl Mercaptan, tert-Butyl Mercaptan, n-Propyl Mercaptan, Ethyl Methyl Sulfide, Thiophene, Isobutyl Mercaptan, Diethyl Sulfide, n-Butyl Mercaptan, Dimethyl Disulfide, 3-Methylthiophene, Tetrahydrothiophene, 2,5-Dimethylthiophene, 2-Ethylthiophene, and Diethyl Disulfide

The samples were submitted to ALS Environmental (ALS) of Simi Valley, California, for analysis. The results are summarized in the main body of the ALS report, which is attached. Field and laboratory data are summarized in the attached table. Table 1 correlates the PBS sample ID and laboratory sample IDs.

**Table 1. Sample Summary**

PBS Sample ID	Sample Date	ALS Sample ID
KTLF110818FL1	11/8/18	P1806199-001 P1806199-002

A quality assurance/quality control (QA/QC) review was conducted on the results. This QA/QC review includes evaluation of representativeness, accuracy, field and analytical precision, comparability, and completeness, each of which are described as follows:

- Representativeness is the degree to which sample data accurately and precisely describe the characteristics of a population of samples, parameter variations at a sampling point, or environmental conditions. Representativeness is assessed by examining chain-of-custody documentation and verifying that sample analyses were performed within allowable holding times.
- Accuracy is evaluated using the analytical results for blanks, laboratory control sample/laboratory control sample duplicates (LCS/LCSD), and matrix spike/matrix spike duplicates (MS/MSD).
- Precision is evaluated by comparing results of primary, field duplicate, and laboratory duplicate analyses.
- Comparability is a qualitative characteristic of the data, expressing the degree of confidence with which one data set can be compared with another.
- Completeness is evaluated by calculating the percentage of acceptable data.

Data were reviewed in accordance with the procedures specified in the Environmental Protection Agency (EPA) *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA, October 1999) and *Inorganic Data Review* (EPA, October 2004) as applicable.

## REPRESENTATIVENESS

### Chain-of-Custody, Holding Times, and Sample Preservation

The chain-of-custody (COC) forms indicate that samples were maintained under proper custody. The forms were signed upon release from the field staff and receipt at the laboratory. All samples were extracted and analyzed within the associated technical holding times. Samples were received by the laboratory with proper vacuum as per method requirements. Samples were analyzed for fixed gases by ASTM D3588-98, but this analysis is not listed on the COC. This does not affect the representativeness of the data.

## ACCURACY

### Blanks

The laboratory analyzed one method blank for each analytical batch, per method requirements. Target compounds were not detected in the method blanks.

### Laboratory Control Samples

LCS/LCSD analyses were used to assess laboratory accuracy for the target compounds of concern. At least one LCS and LCSD were analyzed per method frequency requirements. All LCS/LCSD data were within laboratory-specific control limits.

### Surrogate Recovery

All surrogate recoveries and QC surrogate recoveries were within laboratory-specific control limits.

### Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analysis is not required for the methods used in this report and were not analyzed.

### Internal Standards

There were no internal standard anomalies identified in the laboratory report.

## PRECISION

### Laboratory Duplicates

Laboratory duplicate analyses were used to assess laboratory precision for the target compounds of concern. The RPDs were within laboratory-specific criteria for all compounds, and the data are considered valid.

## COMPARABILITY

Since this is the first sampling event for these analyses, it will be compared to future sampling events to ensure that techniques in collecting representative samples are reliable, consistent application of sample preparation and analytical method protocols are followed, and reporting analytical results note appropriate units and reporting limits.

## REPORTING LIMITS

The method reporting limits (MRLs) for LFG sample analysis did not deviate from standard laboratory reporting limits. The MRL is raised proportional to the dilution. When this occurred, it had no adverse effect on data quality.

## LABORATORY QUALIFIERS

There were no laboratory qualifiers assigned to the data analyzed in this data quality review.



**COMPLETENESS**

The completeness of the ALS report for the LFG characterization event is 100 percent. Upon consideration of the information presented in this report, the data are considered usable, which is based on EPA guidance documents referenced in the introduction.

**QUALIFIED DATA**

Data qualifiers assigned by the laboratory are shown on the laboratory reports. There were no additional qualified analytical results identified by PBS during this data quality review.

Attachments: ALS Environmental, Service Request P1806199



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## LABORATORY REPORT

December 5, 2018

Toby Scott  
PBS Engineering and Environmental  
390 NE Emerson Ave. Suite C  
Bend, OR 97701

**RE: Knott Landfill - Flare Sampling / 80429.010 Phase 005**

Dear Toby:

Enclosed are the results of the samples submitted to our laboratory on November 12, 2018. For your reference, these analyses have been assigned our service request number P1806199.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at [www.alsglobal.com](http://www.alsglobal.com). Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

**ALS | Environmental**

By Sue Anderson at 2:53 pm, Dec 05, 2018

Sue Anderson  
Project Manager



Client: PBS Engineering and Environmental Service Request No: P1806199  
Project: Knott Landfill - Flare Sampling / 80429.010 Phase 005

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## CASE NARRATIVE

The samples were received intact under chain of custody on November 12, 2018 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

### BTU and CHONS Analysis

The results for BTU and CHONS were generated according to ASTM D 3588-98. The following analyses were performed and used to calculate the BTU and CHONS results. This method is not included on the laboratory's NELAP or DoD-ELAP scope of accreditation.

### C2 through C6 Hydrocarbon Analysis

The Silonite canister sample was analyzed according to modified EPA Method TO-3 for C2 through >C6 hydrocarbons using a gas chromatograph equipped with a flame ionization detector (FID). This method is included on the laboratory's DoD-ELAP scope of accreditation, however it is not part of the NELAP accreditation.

### Fixed Gases Analysis

The Silonite canister sample was also analyzed for fixed gases (hydrogen, oxygen/argon, nitrogen, carbon monoxide, methane and carbon dioxide) according to modified EPA Method 3C (single injection) using a gas chromatograph equipped with a thermal conductivity detector (TCD). This method is included on the laboratory's DoD-ELAP scope of accreditation, however it is not part of the NELAP accreditation.

### Hydrogen Sulfide Analysis

The Silonite canister sample was also analyzed for hydrogen sulfide per ASTM D 5504-12 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). Method ASTM D 5504-12 is included on the laboratory's NELAP scope of accreditation, however it is not part of the DoD-ELAP accreditation.

### Siloxanes Analysis

The tube sample was analyzed for siloxanes according to laboratory SOP SVO-Siloxanes using an analytical system comprised of a gas chromatograph/mass spectrometer (GC/MS). This method is not included on the laboratory's NELAP or DoD-ELAP scope of accreditation.



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Client: PBS Engineering and Environmental Service Request No: P1806199  
Project: Knott Landfill - Flare Sampling / 80429.010 Phase 005

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## CASE NARRATIVE

### Sulfur Analysis

The Silonite canister sample was also analyzed for twenty sulfur compounds per ASTM D 5504-12 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). All compounds with the exception of hydrogen sulfide and carbonyl sulfide are quantitated against the initial calibration curve for methyl mercaptan. This method is included on the laboratory's NELAP scope of accreditation, however it is not part of the DoD-ELAP accreditation.

### Volatile Organic Compound Analysis

The Silonite canister sample was also analyzed for volatile organic compounds in accordance with EPA Method TO-15 from the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition (EPA/625/R-96/010b), January, 1999. This procedure is described in laboratory SOP VOA-TO15. The analytical system was comprised of a gas chromatograph / mass spectrometer (GC/MS) interfaced to a whole-air preconcentrator. The method was modified to include the use of helium as a diluent gas in place of zero-grade air for container pressurization. When necessary, analytical sample volumes were adjusted by a correction factor for containers pressurized with helium. A summary sheet has been included listing the affected samples. This method is included on the laboratory's NELAP and DoD-ELAP scope of accreditation. Any analytes flagged with an X are not included on the NELAP or DoD-ELAP accreditation.

The container was cleaned, prior to sampling, down to the method reporting limit (MRL) reported for this project. For projects requiring DoD QSM 5.1 compliance canisters were cleaned to <1/2 the MRL. Please note, projects which require reporting below the MRL could have results between the MRL and method detection limit (MDL) that are biased high.

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*The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and ALS Environmental (ALS) is not responsible for utilization of less than the complete report.*

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ALS Environmental – Simi Valley

CERTIFICATIONS, ACCREDITATIONS, AND REGISTRATIONS

Agency	Web Site	Number
Alaska DEC	<a href="http://dec.alaska.gov/eh/lab.aspx">http://dec.alaska.gov/eh/lab.aspx</a>	17-019
Arizona DHS	<a href="http://www.azdhs.gov/preparedness/state-laboratory/lab-licensure-certification/index.php#laboratory-licensure-home">http://www.azdhs.gov/preparedness/state-laboratory/lab-licensure-certification/index.php#laboratory-licensure-home</a>	AZ0694
Florida DOH (NELAP)	<a href="http://www.floridahealth.gov/licensing-and-regulation/environmental-laboratories/index.html">http://www.floridahealth.gov/licensing-and-regulation/environmental-laboratories/index.html</a>	E871020
Louisiana DEQ (NELAP)	<a href="http://www.deq.louisiana.gov/page/la-lab-accreditation">http://www.deq.louisiana.gov/page/la-lab-accreditation</a>	05071
Maine DHHS	<a href="http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/professionals/labCert.shtml">http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/professionals/labCert.shtml</a>	2018027
Minnesota DOH (NELAP)	<a href="http://www.health.state.mn.us/accreditation">http://www.health.state.mn.us/accreditation</a>	1347317
New Jersey DEP (NELAP)	<a href="http://www.nj.gov/dep/enforcement/oqa.html">http://www.nj.gov/dep/enforcement/oqa.html</a>	CA009
New York DOH (NELAP)	<a href="http://www.wadsworth.org/labcert/elap/elap.html">http://www.wadsworth.org/labcert/elap/elap.html</a>	11221
Oregon PHD (NELAP)	<a href="http://www.oregon.gov/oha/ph/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx">http://www.oregon.gov/oha/ph/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx</a>	4068-005
Pennsylvania DEP	<a href="http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx">http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx</a>	68-03307 (Registration)
PJLA (DoD ELAP)	<a href="http://www.pjlabs.com/search-accredited-labs">http://www.pjlabs.com/search-accredited-labs</a>	65818 (Testing)
Texas CEQ (NELAP)	<a href="http://www.tceq.texas.gov/agency/qa/env_lab_accreditation.html">http://www.tceq.texas.gov/agency/qa/env_lab_accreditation.html</a>	T104704413-18-9
Utah DOH (NELAP)	<a href="http://health.utah.gov/lab/lab_cert_env">http://health.utah.gov/lab/lab_cert_env</a>	CA01627201 8-9
Washington DOE	<a href="http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html">http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html</a>	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at [www.alsglobal.com](http://www.alsglobal.com), or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

**ALS ENVIRONMENTAL**

DETAIL SUMMARY REPORT

Client: PBS Engineering and Environmental  
 Project ID: Knott Landfill - Flare Sampling / 80429.010 Phase 005

Service Request: P1806199

Date Received: 11/12/2018  
 Time Received: 09:00

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	Container ID	Pi1 (psig)	Pf1 (psig)	ASTM D 5504-12 - Sulfur Can	TO-15 Modified - VOC Cans	TO-3 Modified - ClC6+ Can	3C Modified - Fxd Gases Can	ASTM D5504-01 - H2S Can	ALS AQL 111 - Siloxanes Tube
KTLF 110818FL1	P1806199-001	Air	11/8/2018	11:11	AS00727	-2.76	5.13	X	X	X	X	X	
KTLF 110818FL1	P1806199-002	Air	11/8/2018	12:45									X



**ALS ENVIRONMENTAL**  
**Sample Volume Correction for Helium Pressurization**  
**for SCAN Analysis**

<u>Sample ID</u>	<u>P0</u>	<u>Pi</u>	<u>Pf</u>	<u>Sample Volume (L)</u>	<u>Adjusted Volume (L)</u>
P1806199-001	-8.4	-2.76	5.13	0.043	0.0550
P1806199-001DIL	-8.4	-2.76	5.13	0.016	0.0200







**ALS ENVIRONMENTAL**

RESULTS OF ANALYSIS

Page 1 of 1

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** KTLF 110818FL1  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P1806199-001

Test Code: ASTM D3588-98  
 Analyst: Gilbert Gutierrez/Magaly Rodriguez  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: 11/8/18  
 Date Received: 11/12/18  
 Date Analyzed: 11/13 & 27/18

Components	Result Volume %	Container Dilution Factor: 3.52		Data Qualifier
		Result ppmV	MRL ppmV	
Hydrogen	< 0.01	ND	3,500	
Oxygen	1.53	15,300	3,500	
Nitrogen	17.13	171,000	3,500	
Carbon Monoxide	< 0.01	ND	3,500	
Methane	46.15	462,000	3,500	
Carbon Dioxide	35.16	352,000	3,500	
Hydrogen Sulfide	< 0.01	92	0.18	
C2 as Ethane	< 0.01	ND	18	
C3 as Propane	< 0.01	69	18	
C4 as n-Butane	< 0.01	20	18	
C5 as n-Pentane	< 0.01	ND	18	
C6 as n-Hexane	< 0.01	ND	18	
> C6 as n-Hexane	< 0.01	96	35	

**TOTALS** **99.99**

Components	Mole %	Weight %	Data Qualifier
Carbon	21.77	34.70	
Hydrogen	49.44	6.61	
Oxygen	19.62	41.65	
Nitrogen	9.16	17.03	
Sulfur	< 0.10	< 0.10	

Specific Gravity (Air = 1)		<b>0.9731</b>
Specific Volume	ft3/lb	<b>13.47</b>
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	<b>468.2</b>
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	<b>421.6</b>
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	<b>458.8</b>
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	<b>413.2</b>
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	<b>6,304.2</b>
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	<b>5,676.6</b>
Compressibility Factor "Z" (60 F, 14.696 psia)		<b>0.9975</b>
WOBBE Index		<b>474.6</b>

**ALS ENVIRONMENTAL**

RESULTS OF ANALYSIS

Page 1 of 1

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** KTLF 110818FL1  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P1806199-002

Test Code: GC/MS  
 Instrument ID: Tekmar AUTOCAN/HP5972/HP5890 II+/MS2  
 Analyst: Zheng Wang  
 Sample Type: Siloxane Tube  
 Test Notes: **BC, DE**

Date Collected: 11/8/18  
 Date Received: 11/12/18  
 Date Analyzed: 11/15/18  
 Desorption Volume: 3.0 ml  
 Volume Sampled: 6 Liter(s)

CAS #	Compound	Result µg/Tube	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result as Silicon µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Data Qualifier
1066-40-6	Trimethylsilanol	41	<b>6,800</b>	54	<b>2,100</b>	17	
107-46-0	Hexamethyldisiloxane (L <sub>2</sub> )	11	<b>1,800</b>	47	<b>610</b>	16	
541-05-9	Hexamethylcyclotrisiloxane (D <sub>3</sub> )	0.75	<b>130</b>	50	<b>47</b>	19	
107-51-7	Octamethyltrisiloxane (L <sub>3</sub> )	< 0.29	ND	48	ND	17	
556-67-2	Octamethylcyclotetrasiloxane (D <sub>4</sub> )	1.8	<b>310</b>	48	<b>120</b>	18	
141-62-8	Decamethyltetrasiloxane (L <sub>4</sub> )	< 0.29	ND	48	ND	17	
541-02-6	Decamethylcyclopentasiloxane (D <sub>5</sub> )	0.42	<b>69</b>	47	<b>26</b>	18	
141-63-9	Dodecamethylpentasiloxane (L <sub>5</sub> )	< 0.29	ND	48	ND	18	
540-97-6	Dodecamethylcyclohexasiloxane (D <sub>6</sub> )	< 0.29	ND	48	ND	18	
<b>Total Silicon</b>					<b>2,900</b>		

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

BC = Results reported are not blank corrected.

DE = Results reported are corrected for desorption efficiency.

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 1

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Method Blank  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181115-MB

**Test Code:** GC/MS  
**Instrument ID:** Tekmar AUTOCAN/HP5972/HP5890 II+/MS2  
**Analyst:** Zheng Wang  
**Sample Type:** Siloxane Tube  
**Test Notes:** BC, DE

**Date Collected:** NA  
**Date Received:** NA  
**Date Analyzed:** 11/15/18  
**Desorption Volume:** 3.0 ml  
**Volume Sampled:** NA Liter(s)

CAS #	Compound	Result µg/Tube	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result as Silicon µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Data Qualifier
1066-40-6	Trimethylsilanol	< 0.32	NA	NA	NA	NA	
107-46-0	Hexamethyldisiloxane (L <sub>2</sub> )	< 0.28	NA	NA	NA	NA	
541-05-9	Hexamethylcyclotrisiloxane (D <sub>3</sub> )	< 0.30	NA	NA	NA	NA	
107-51-7	Octamethyltrisiloxane (L <sub>3</sub> )	< 0.29	NA	NA	NA	NA	
556-67-2	Octamethylcyclotetrasiloxane (D <sub>4</sub> )	< 0.29	NA	NA	NA	NA	
141-62-8	Decamethyltetrasiloxane (L <sub>4</sub> )	< 0.29	NA	NA	NA	NA	
541-02-6	Decamethylcyclopentasiloxane (D <sub>5</sub> )	< 0.28	NA	NA	NA	NA	
141-63-9	Dodecamethylpentasiloxane (L <sub>5</sub> )	< 0.29	NA	NA	NA	NA	
540-97-6	Dodecamethylcyclohexasiloxane (D <sub>6</sub> )	< 0.29	NA	NA	NA	NA	
Total Silicon					NA		

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

NA = Not applicable.

BC = Results reported are not blank corrected.

DE = Results reported are corrected for desorption efficiency.

**ALS ENVIRONMENTAL**

LABORATORY CONTROL SAMPLE / DUPLICATE LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Duplicate Lab Control Sample  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181115-DLCS

Test Code: GC/MS  
 Instrument ID: Tekmar AUTOCAN/HP5972/HP5890 II+/MS2  
 Analyst: Zheng Wang  
 Sampling Type: Siloxane Tube  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 11/15/18  
 Volume(s) Analyzed: NA Liter(s)

CAS #	Compound	Spike Amount		Result		% Recovery		ALS		Data Qualifier
		LCS / DLCS µg/ml	LCS µg/ml	DLCS µg/ml	LCS	DLCS	Acceptance Limits	RPD	RPD Limit	
1066-40-6	Trimethylsilanol	11.7	9.93	10.3	<b>85</b>	<b>88</b>	73-112	3	13	
107-46-0	Hexamethyldisiloxane	12.6	12.9	13.3	<b>102</b>	<b>106</b>	92-123	4	11	
541-05-9	Hexamethylcyclotrisiloxane	12.7	13.3	13.4	<b>105</b>	<b>106</b>	90-119	1	10	
107-51-7	Octamethyltrisiloxane	12.3	12.9	13.3	<b>105</b>	<b>108</b>	93-123	3	10	
556-67-2	Octamethylcyclotetrasiloxane	12.7	13.6	13.7	<b>107</b>	<b>108</b>	94-123	0.9	10	
141-62-8	Decamethyltetrasiloxane	12.4	13.6	13.6	<b>110</b>	<b>110</b>	94-123	0	10	
541-02-6	Decamethylcyclopentasiloxane	12.0	13.3	13.5	<b>111</b>	<b>113</b>	94-123	2	10	
141-63-9	Dodecamethylpentasiloxane	12.0	13.0	13.0	<b>108</b>	<b>108</b>	92-126	0	12	
540-97-6	Dodecamethylcyclohexasiloxane	12.5	13.8	13.6	<b>110</b>	<b>109</b>	91-126	0.9	13	

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 1

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** KTLF 110818FL1  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P1806199-001

Test Code: ASTM D 5504-12  
 Instrument ID: Agilent 7890A/GC22/SCD  
 Analyst: Magaly Rodriguez  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:  
 Container ID: AS00727

Date Collected: 11/8/18  
 Time Collected: 11:11  
 Date Received: 11/12/18  
 Date Analyzed: 11/13/18  
 Time Analyzed: 10:40  
 Volume(s) Analyzed: 0.10 ml(s)

Container Dilution Factor: 3.52

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	130,000	250	92,000	180	
463-58-1	Carbonyl Sulfide	490	430	200	180	
74-93-1	Methyl Mercaptan	990	350	500	180	
75-08-1	Ethyl Mercaptan	ND	450	ND	180	
75-18-3	Dimethyl Sulfide	910	450	360	180	
75-15-0	Carbon Disulfide	ND	270	ND	88	
75-33-2	Isopropyl Mercaptan	1,100	550	350	180	
75-66-1	tert-Butyl Mercaptan	ND	650	ND	180	
107-03-9	n-Propyl Mercaptan	ND	550	ND	180	
624-89-5	Ethyl Methyl Sulfide	ND	550	ND	180	
110-02-1	Thiophene	ND	610	ND	180	
513-44-0	Isobutyl Mercaptan	ND	650	ND	180	
352-93-2	Diethyl Sulfide	ND	650	ND	180	
109-79-5	n-Butyl Mercaptan	ND	650	ND	180	
624-92-0	Dimethyl Disulfide	ND	340	ND	88	
616-44-4	3-Methylthiophene	ND	710	ND	180	
110-01-0	Tetrahydrothiophene	ND	630	ND	180	
638-02-8	2,5-Dimethylthiophene	ND	810	ND	180	
872-55-9	2-Ethylthiophene	ND	810	ND	180	
110-81-6	Diethyl Disulfide	ND	440	ND	88	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 1

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Method Blank  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181113-MB

Test Code: ASTM D 5504-12  
 Instrument ID: Agilent 7890A/GC22/SCD  
 Analyst: Magaly Rodriguez  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Time Collected: NA  
 Date Received: NA  
 Date Analyzed: 11/13/18  
 Time Analyzed: 09:34  
 Volume(s) Analyzed: 1.0 ml(s)

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	ND	7.0	ND	5.0	
463-58-1	Carbonyl Sulfide	ND	12	ND	5.0	
74-93-1	Methyl Mercaptan	ND	9.8	ND	5.0	
75-08-1	Ethyl Mercaptan	ND	13	ND	5.0	
75-18-3	Dimethyl Sulfide	ND	13	ND	5.0	
75-15-0	Carbon Disulfide	ND	7.8	ND	2.5	
75-33-2	Isopropyl Mercaptan	ND	16	ND	5.0	
75-66-1	tert-Butyl Mercaptan	ND	18	ND	5.0	
107-03-9	n-Propyl Mercaptan	ND	16	ND	5.0	
624-89-5	Ethyl Methyl Sulfide	ND	16	ND	5.0	
110-02-1	Thiophene	ND	17	ND	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	ND	9.6	ND	2.5	
616-44-4	3-Methylthiophene	ND	20	ND	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

**ALS ENVIRONMENTAL**

LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 1

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Lab Control Sample  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
ALS Sample ID: P181113-LCS

Test Code: ASTM D 5504-12  
Instrument ID: Agilent 7890A/GC22/SCD  
Analyst: Magaly Rodriguez  
Sample Type: 6.0 L Silonite Canister  
Test Notes:

Date Collected: NA  
Date Received: NA  
Date Analyzed: 11/13/18  
Volume(s) Analyzed: NA ml(s)

CAS #	Compound	Spike Amount ppbV	Result ppbV	% Recovery	ALS	Data Qualifier
					Acceptance Limits	
7783-06-4	Hydrogen Sulfide	989	<b>884</b>	<b>89</b>	81-141	
463-58-1	Carbonyl Sulfide	1,050	<b>965</b>	<b>92</b>	81-147	
74-93-1	Methyl Mercaptan	1,050	<b>919</b>	<b>88</b>	80-144	



# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** KTLF 110818FL1  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P1806199-001

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:  
 Container ID: AS00727

Date Collected: 11/8/18  
 Date Received: 11/12/18  
 Date Analyzed: 12/4 - 12/5/18  
 Volume(s) Analyzed: 0.055 Liter(s)  
 0.020 Liter(s)

Container Dilution Factor: 3.52

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	10,000	92	5,800	53	D
75-71-8	Dichlorodifluoromethane (CFC 12)	2,600	33	520	6.7	
74-87-3	Chloromethane	ND	32	ND	16	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	33	ND	4.7	
75-01-4	Vinyl Chloride	4,900	34	1,900	13	
106-99-0	1,3-Butadiene	ND	33	ND	15	
74-83-9	Bromomethane	ND	32	ND	8.2	
75-00-3	Chloroethane	360	33	140	12	
64-17-5	Ethanol	26,000	330	14,000	170	
75-05-8	Acetonitrile	260	33	160	20	
107-02-8	Acrolein	ND	64	ND	28	
67-64-1	Acetone	4,200	350	1,800	150	
75-69-4	Trichlorofluoromethane (CFC 11)	440	34	78	6.0	
67-63-0	2-Propanol (Isopropyl Alcohol)	7,500	130	3,000	55	
107-13-1	Acrylonitrile	ND	33	ND	15	
75-35-4	1,1-Dichloroethene	42	35	10	8.7	
75-09-2	Methylene Chloride	730	35	210	10	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	34	ND	11	
76-13-1	Trichlorotrifluoroethane (CFC 113)	130	34	16	4.4	
75-15-0	Carbon Disulfide	110	70	36	23	
156-60-5	trans-1,2-Dichloroethene	88	34	22	8.6	
75-34-3	1,1-Dichloroethane	170	33	42	8.2	
1634-04-4	Methyl tert-Butyl Ether	ND	35	ND	9.6	
108-05-4	Vinyl Acetate	ND	340	ND	96	
78-93-3	2-Butanone (MEK)	2,800	64	950	22	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 2 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** KTLF 110818FL1  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P1806199-001

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:  
 Container ID: AS00727

Date Collected: 11/8/18  
 Date Received: 11/12/18  
 Date Analyzed: 12/4 - 12/5/18  
 Volume(s) Analyzed: 0.055 Liter(s)  
 0.020 Liter(s)

Container Dilution Factor: 3.52

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	1,500	34	370	8.6	
141-78-6	Ethyl Acetate	1,500	70	420	20	
110-54-3	n-Hexane	6,500	35	1,800	9.8	
67-66-3	Chloroform	ND	35	ND	7.1	
109-99-9	Tetrahydrofuran (THF)	3,100	34	1,000	12	
107-06-2	1,2-Dichloroethane	200	34	50	8.4	
71-55-6	1,1,1-Trichloroethane	ND	35	ND	6.3	
71-43-2	Benzene	1,100	33	350	10	
56-23-5	Carbon Tetrachloride	ND	33	ND	5.3	
110-82-7	Cyclohexane	2,000	64	580	19	
78-87-5	1,2-Dichloropropane	ND	35	ND	7.5	
75-27-4	Bromodichloromethane	ND	34	ND	5.1	
79-01-6	Trichloroethene	ND	34	ND	6.3	
123-91-1	1,4-Dioxane	ND	34	ND	9.4	
80-62-6	Methyl Methacrylate	ND	70	ND	17	
142-82-5	n-Heptane	2,700	35	670	8.4	
10061-01-5	cis-1,3-Dichloropropene	ND	36	ND	7.9	
108-10-1	4-Methyl-2-pentanone	40	34	9.9	8.3	
10061-02-6	trans-1,3-Dichloropropene	ND	34	ND	7.5	
79-00-5	1,1,2-Trichloroethane	36	35	6.6	6.3	
108-88-3	Toluene	2,200	34	590	9.0	
591-78-6	2-Hexanone	ND	35	ND	8.4	
124-48-1	Dibromochloromethane	ND	35	ND	4.1	
106-93-4	1,2-Dibromoethane	ND	35	ND	4.5	
123-86-4	n-Butyl Acetate	ND	35	ND	7.3	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

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**Client:** PBS Engineering and Environmental  
**Client Sample ID:** KTLF 110818FL1  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P1806199-001

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:  
 Container ID: AS00727

Date Collected: 11/8/18  
 Date Received: 11/12/18  
 Date Analyzed: 12/4 - 12/5/18  
 Volume(s) Analyzed: 0.055 Liter(s)  
 0.020 Liter(s)

Container Dilution Factor: 3.52

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	180	35	38	7.4	
127-18-4	Tetrachloroethene	50	34	7.4	5.0	
108-90-7	Chlorobenzene	ND	34	ND	7.4	
100-41-4	Ethylbenzene	78	33	18	7.7	
179601-23-1	m,p-Xylenes	ND	70	ND	16	
75-25-2	Bromoform	ND	34	ND	3.3	
100-42-5	Styrene	ND	34	ND	8.0	
95-47-6	o-Xylene	ND	34	ND	7.8	
111-84-2	n-Nonane	ND	35	ND	6.6	
79-34-5	1,1,2,2-Tetrachloroethane	ND	34	ND	4.9	
98-82-8	Cumene	ND	34	ND	6.9	
80-56-8	alpha-Pinene	ND	33	ND	6.0	
103-65-1	n-Propylbenzene	ND	35	ND	7.0	
622-96-8	4-Ethyltoluene	ND	34	ND	6.9	
108-67-8	1,3,5-Trimethylbenzene	ND	34	ND	6.9	
95-63-6	1,2,4-Trimethylbenzene	ND	34	ND	6.9	
100-44-7	Benzyl Chloride	ND	70	ND	14	
541-73-1	1,3-Dichlorobenzene	ND	35	ND	5.8	
106-46-7	1,4-Dichlorobenzene	ND	35	ND	5.8	
95-50-1	1,2-Dichlorobenzene	ND	35	ND	5.8	
5989-27-5	d-Limonene	ND	33	ND	5.9	
96-12-8	1,2-Dibromo-3-chloropropane	ND	33	ND	3.4	
120-82-1	1,2,4-Trichlorobenzene	ND	34	ND	4.6	
91-20-3	Naphthalene	ND	33	ND	6.2	
87-68-3	Hexachlorobutadiene	ND	34	ND	3.2	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Method Blank  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181204-MB

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/4/18  
 Volume(s) Analyzed: 1.00 Liter(s)

Container Dilution Factor: 1.00

CAS #	Compound	Result	MRL	Result	MRL	Data Qualifier
		µg/m <sup>3</sup>	µg/m <sup>3</sup>	ppbV	ppbV	
115-07-1	Propene	ND	0.52	ND	0.30	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	0.52	ND	0.11	
74-87-3	Chloromethane	ND	0.50	ND	0.24	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.51	ND	0.073	
75-01-4	Vinyl Chloride	ND	0.53	ND	0.21	
106-99-0	1,3-Butadiene	ND	0.52	ND	0.24	
74-83-9	Bromomethane	ND	0.50	ND	0.13	
75-00-3	Chloroethane	ND	0.51	ND	0.19	
64-17-5	Ethanol	ND	5.1	ND	2.7	
75-05-8	Acetonitrile	ND	0.52	ND	0.31	
107-02-8	Acrolein	ND	1.0	ND	0.44	
67-64-1	Acetone	ND	5.4	ND	2.3	
75-69-4	Trichlorofluoromethane (CFC 11)	ND	0.53	ND	0.094	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	2.1	ND	0.85	
107-13-1	Acrylonitrile	ND	0.52	ND	0.24	
75-35-4	1,1-Dichloroethene	ND	0.54	ND	0.14	
75-09-2	Methylene Chloride	ND	0.54	ND	0.16	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.53	ND	0.17	
76-13-1	Trichlorotrifluoroethane (CFC 113)	ND	0.53	ND	0.069	
75-15-0	Carbon Disulfide	ND	1.1	ND	0.35	
156-60-5	trans-1,2-Dichloroethene	ND	0.53	ND	0.13	
75-34-3	1,1-Dichloroethane	ND	0.52	ND	0.13	
1634-04-4	Methyl tert-Butyl Ether	ND	0.54	ND	0.15	
108-05-4	Vinyl Acetate	ND	5.3	ND	1.5	
78-93-3	2-Butanone (MEK)	ND	1.0	ND	0.34	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 2 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Method Blank  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181204-MB

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/4/18  
 Volume(s) Analyzed: 1.00 Liter(s)

Container Dilution Factor: 1.00

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	0.53	ND	0.13	
141-78-6	Ethyl Acetate	ND	1.1	ND	0.31	
110-54-3	n-Hexane	ND	0.54	ND	0.15	
67-66-3	Chloroform	ND	0.54	ND	0.11	
109-99-9	Tetrahydrofuran (THF)	ND	0.53	ND	0.18	
107-06-2	1,2-Dichloroethane	ND	0.53	ND	0.13	
71-55-6	1,1,1-Trichloroethane	ND	0.54	ND	0.099	
71-43-2	Benzene	ND	0.52	ND	0.16	
56-23-5	Carbon Tetrachloride	ND	0.52	ND	0.083	
110-82-7	Cyclohexane	ND	1.0	ND	0.29	
78-87-5	1,2-Dichloropropane	ND	0.54	ND	0.12	
75-27-4	Bromodichloromethane	ND	0.53	ND	0.079	
79-01-6	Trichloroethene	ND	0.53	ND	0.099	
123-91-1	1,4-Dioxane	ND	0.53	ND	0.15	
80-62-6	Methyl Methacrylate	ND	1.1	ND	0.27	
142-82-5	n-Heptane	ND	0.54	ND	0.13	
10061-01-5	cis-1,3-Dichloropropene	ND	0.56	ND	0.12	
108-10-1	4-Methyl-2-pentanone	ND	0.53	ND	0.13	
10061-02-6	trans-1,3-Dichloropropene	ND	0.53	ND	0.12	
79-00-5	1,1,2-Trichloroethane	ND	0.54	ND	0.099	
108-88-3	Toluene	ND	0.53	ND	0.14	
591-78-6	2-Hexanone	ND	0.54	ND	0.13	
124-48-1	Dibromochloromethane	ND	0.54	ND	0.063	
106-93-4	1,2-Dibromoethane	ND	0.54	ND	0.070	
123-86-4	n-Butyl Acetate	ND	0.54	ND	0.11	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 3 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Method Blank  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181204-MB

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/4/18  
 Volume(s) Analyzed: 1.00 Liter(s)

Container Dilution Factor: 1.00

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.54	ND	0.12	
127-18-4	Tetrachloroethene	ND	0.53	ND	0.078	
108-90-7	Chlorobenzene	ND	0.53	ND	0.12	
100-41-4	Ethylbenzene	ND	0.52	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.1	ND	0.25	
75-25-2	Bromoform	ND	0.53	ND	0.051	
100-42-5	Styrene	ND	0.53	ND	0.12	
95-47-6	o-Xylene	ND	0.53	ND	0.12	
111-84-2	n-Nonane	ND	0.54	ND	0.10	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.53	ND	0.077	
98-82-8	Cumene	ND	0.53	ND	0.11	
80-56-8	alpha-Pinene	ND	0.52	ND	0.093	
103-65-1	n-Propylbenzene	ND	0.54	ND	0.11	
622-96-8	4-Ethyltoluene	ND	0.53	ND	0.11	
108-67-8	1,3,5-Trimethylbenzene	ND	0.53	ND	0.11	
95-63-6	1,2,4-Trimethylbenzene	ND	0.53	ND	0.11	
100-44-7	Benzyl Chloride	ND	1.1	ND	0.21	
541-73-1	1,3-Dichlorobenzene	ND	0.54	ND	0.090	
106-46-7	1,4-Dichlorobenzene	ND	0.54	ND	0.090	
95-50-1	1,2-Dichlorobenzene	ND	0.54	ND	0.090	
5989-27-5	d-Limonene	ND	0.51	ND	0.092	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.52	ND	0.054	
120-82-1	1,2,4-Trichlorobenzene	ND	0.53	ND	0.071	
91-20-3	Naphthalene	ND	0.51	ND	0.097	
87-68-3	Hexachlorobutadiene	ND	0.53	ND	0.050	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Method Blank  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181205-MB

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/5/18  
 Volume(s) Analyzed: 1.00 Liter(s)

Container Dilution Factor: 1.00

CAS #	Compound	Result	MRL	Result	MRL	Data Qualifier
		µg/m <sup>3</sup>	µg/m <sup>3</sup>	ppbV	ppbV	
115-07-1	Propene	ND	0.52	ND	0.30	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	0.52	ND	0.11	
74-87-3	Chloromethane	ND	0.50	ND	0.24	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.51	ND	0.073	
75-01-4	Vinyl Chloride	ND	0.53	ND	0.21	
106-99-0	1,3-Butadiene	ND	0.52	ND	0.24	
74-83-9	Bromomethane	ND	0.50	ND	0.13	
75-00-3	Chloroethane	ND	0.51	ND	0.19	
64-17-5	Ethanol	ND	5.1	ND	2.7	
75-05-8	Acetonitrile	ND	0.52	ND	0.31	
107-02-8	Acrolein	ND	1.0	ND	0.44	
67-64-1	Acetone	ND	5.4	ND	2.3	
75-69-4	Trichlorofluoromethane (CFC 11)	ND	0.53	ND	0.094	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	2.1	ND	0.85	
107-13-1	Acrylonitrile	ND	0.52	ND	0.24	
75-35-4	1,1-Dichloroethene	ND	0.54	ND	0.14	
75-09-2	Methylene Chloride	ND	0.54	ND	0.16	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.53	ND	0.17	
76-13-1	Trichlorotrifluoroethane (CFC 113)	ND	0.53	ND	0.069	
75-15-0	Carbon Disulfide	ND	1.1	ND	0.35	
156-60-5	trans-1,2-Dichloroethene	ND	0.53	ND	0.13	
75-34-3	1,1-Dichloroethane	ND	0.52	ND	0.13	
1634-04-4	Methyl tert-Butyl Ether	ND	0.54	ND	0.15	
108-05-4	Vinyl Acetate	ND	5.3	ND	1.5	
78-93-3	2-Butanone (MEK)	ND	1.0	ND	0.34	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 2 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Method Blank  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181205-MB

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/5/18  
 Volume(s) Analyzed: 1.00 Liter(s)

Container Dilution Factor: 1.00

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	0.53	ND	0.13	
141-78-6	Ethyl Acetate	ND	1.1	ND	0.31	
110-54-3	n-Hexane	ND	0.54	ND	0.15	
67-66-3	Chloroform	ND	0.54	ND	0.11	
109-99-9	Tetrahydrofuran (THF)	ND	0.53	ND	0.18	
107-06-2	1,2-Dichloroethane	ND	0.53	ND	0.13	
71-55-6	1,1,1-Trichloroethane	ND	0.54	ND	0.099	
71-43-2	Benzene	ND	0.52	ND	0.16	
56-23-5	Carbon Tetrachloride	ND	0.52	ND	0.083	
110-82-7	Cyclohexane	ND	1.0	ND	0.29	
78-87-5	1,2-Dichloropropane	ND	0.54	ND	0.12	
75-27-4	Bromodichloromethane	ND	0.53	ND	0.079	
79-01-6	Trichloroethene	ND	0.53	ND	0.099	
123-91-1	1,4-Dioxane	ND	0.53	ND	0.15	
80-62-6	Methyl Methacrylate	ND	1.1	ND	0.27	
142-82-5	n-Heptane	ND	0.54	ND	0.13	
10061-01-5	cis-1,3-Dichloropropene	ND	0.56	ND	0.12	
108-10-1	4-Methyl-2-pentanone	ND	0.53	ND	0.13	
10061-02-6	trans-1,3-Dichloropropene	ND	0.53	ND	0.12	
79-00-5	1,1,2-Trichloroethane	ND	0.54	ND	0.099	
108-88-3	Toluene	ND	0.53	ND	0.14	
591-78-6	2-Hexanone	ND	0.54	ND	0.13	
124-48-1	Dibromochloromethane	ND	0.54	ND	0.063	
106-93-4	1,2-Dibromoethane	ND	0.54	ND	0.070	
123-86-4	n-Butyl Acetate	ND	0.54	ND	0.11	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.



# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 3 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Method Blank  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181205-MB

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/5/18  
 Volume(s) Analyzed: 1.00 Liter(s)

Container Dilution Factor: 1.00

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.54	ND	0.12	
127-18-4	Tetrachloroethene	ND	0.53	ND	0.078	
108-90-7	Chlorobenzene	ND	0.53	ND	0.12	
100-41-4	Ethylbenzene	ND	0.52	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.1	ND	0.25	
75-25-2	Bromoform	ND	0.53	ND	0.051	
100-42-5	Styrene	ND	0.53	ND	0.12	
95-47-6	o-Xylene	ND	0.53	ND	0.12	
111-84-2	n-Nonane	ND	0.54	ND	0.10	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.53	ND	0.077	
98-82-8	Cumene	ND	0.53	ND	0.11	
80-56-8	alpha-Pinene	ND	0.52	ND	0.093	
103-65-1	n-Propylbenzene	ND	0.54	ND	0.11	
622-96-8	4-Ethyltoluene	ND	0.53	ND	0.11	
108-67-8	1,3,5-Trimethylbenzene	ND	0.53	ND	0.11	
95-63-6	1,2,4-Trimethylbenzene	ND	0.53	ND	0.11	
100-44-7	Benzyl Chloride	ND	1.1	ND	0.21	
541-73-1	1,3-Dichlorobenzene	ND	0.54	ND	0.090	
106-46-7	1,4-Dichlorobenzene	ND	0.54	ND	0.090	
95-50-1	1,2-Dichlorobenzene	ND	0.54	ND	0.090	
5989-27-5	d-Limonene	ND	0.51	ND	0.092	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.52	ND	0.054	
120-82-1	1,2,4-Trichlorobenzene	ND	0.53	ND	0.071	
91-20-3	Naphthalene	ND	0.51	ND	0.097	
87-68-3	Hexachlorobutadiene	ND	0.53	ND	0.050	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

# ALS ENVIRONMENTAL

## SURROGATE SPIKE RECOVERY RESULTS

Page 1 of 1

**Client:** PBS Engineering and Environmental  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister(s)  
 Test Notes:

Date(s) Collected: 11/8/18  
 Date(s) Received: 11/12/18  
 Date(s) Analyzed: 12/4 - 12/5/18

Client Sample ID	ALS Sample ID	1,2-Dichloroethane-d4	Toluene-d8	Bromofluorobenzene	Acceptance Limits	Data Qualifier
		Percent Recovered	Percent Recovered	Percent Recovered		
Method Blank	P181204-MB	103	99	101	70-130	
Method Blank	P181205-MB	101	100	101	70-130	
Lab Control Sample	P181204-LCS	100	98	102	70-130	
Lab Control Sample	P181205-LCS	99	98	101	70-130	
KTLF 110818FL1	P1806199-001	99	98	103	70-130	

Surrogate percent recovery is verified and accepted based on the on-column result.

Reported results are shown in concentration units and as a result of the calculation, may vary slightly from the on-column percent recovery.

# ALS ENVIRONMENTAL

## LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Lab Control Sample  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181204-LCS

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/4/18  
 Volume(s) Analyzed: 0.125 Liter(s)

CAS #	Compound	Spike Amount µg/m <sup>3</sup>	Result µg/m <sup>3</sup>	% Recovery	ALS	Data Qualifier
					Acceptance Limits	
115-07-1	Propene	211	175	83	54-133	
75-71-8	Dichlorodifluoromethane (CFC 12)	210	173	82	64-115	
74-87-3	Chloromethane	211	171	81	47-140	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	211	173	82	60-112	
75-01-4	Vinyl Chloride	214	176	82	63-127	
106-99-0	1,3-Butadiene	210	190	90	57-149	
74-83-9	Bromomethane	212	188	89	63-132	
75-00-3	Chloroethane	214	182	85	68-129	
64-17-5	Ethanol	1,020	954	94	62-131	
75-05-8	Acetonitrile	206	188	91	56-136	
107-02-8	Acrolein	205	185	90	60-132	
67-64-1	Acetone	1,060	925	87	63-124	
75-69-4	Trichlorofluoromethane (CFC 11)	211	177	84	65-113	
67-63-0	2-Propanol (Isopropyl Alcohol)	413	391	95	62-135	
107-13-1	Acrylonitrile	207	189	91	68-138	
75-35-4	1,1-Dichloroethene	218	184	84	72-118	
75-09-2	Methylene Chloride	217	181	83	67-116	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	216	202	94	61-143	
76-13-1	Trichlorotrifluoroethane (CFC 113)	216	184	85	68-113	
75-15-0	Carbon Disulfide	218	175	80	68-120	
156-60-5	trans-1,2-Dichloroethene	214	193	90	71-125	
75-34-3	1,1-Dichloroethane	216	183	85	68-118	
1634-04-4	Methyl tert-Butyl Ether	214	190	89	60-123	
108-05-4	Vinyl Acetate	1,060	1020	96	73-135	
78-93-3	2-Butanone (MEK)	208	190	91	70-129	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result. Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

# ALS ENVIRONMENTAL

## LABORATORY CONTROL SAMPLE SUMMARY

Page 2 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Lab Control Sample  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181204-LCS

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/4/18  
 Volume(s) Analyzed: 0.125 Liter(s)

CAS #	Compound	Spike Amount µg/m <sup>3</sup>	Result µg/m <sup>3</sup>	% Recovery	ALS	Data Qualifier
					Acceptance Limits	
156-59-2	cis-1,2-Dichloroethene	211	183	87	69-121	
141-78-6	Ethyl Acetate	436	456	105	66-140	
110-54-3	n-Hexane	216	197	91	61-124	
67-66-3	Chloroform	217	187	86	69-113	
109-99-9	Tetrahydrofuran (THF)	216	195	90	66-121	
107-06-2	1,2-Dichloroethane	215	185	86	62-120	
71-55-6	1,1,1-Trichloroethane	215	191	89	65-116	
71-43-2	Benzene	211	180	85	66-111	
56-23-5	Carbon Tetrachloride	212	193	91	64-122	
110-82-7	Cyclohexane	416	375	90	69-115	
78-87-5	1,2-Dichloropropane	216	189	88	69-121	
75-27-4	Bromodichloromethane	215	206	96	69-123	
79-01-6	Trichloroethene	213	190	89	69-112	
123-91-1	1,4-Dioxane	214	221	103	74-123	
80-62-6	Methyl Methacrylate	431	433	100	75-125	
142-82-5	n-Heptane	215	193	90	68-118	
10061-01-5	cis-1,3-Dichloropropene	214	211	99	74-129	
108-10-1	4-Methyl-2-pentanone	209	214	102	66-138	
10061-02-6	trans-1,3-Dichloropropene	213	225	106	75-130	
79-00-5	1,1,2-Trichloroethane	215	195	91	73-117	
108-88-3	Toluene	212	183	86	66-114	
591-78-6	2-Hexanone	214	217	101	58-146	
124-48-1	Dibromochloromethane	213	212	100	67-130	
106-93-4	1,2-Dibromoethane	216	201	93	70-127	
123-86-4	n-Butyl Acetate	219	215	98	62-140	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result. Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

# ALS ENVIRONMENTAL

## LABORATORY CONTROL SAMPLE SUMMARY

Page 3 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Lab Control Sample  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181204-LCS

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/4/18  
 Volume(s) Analyzed: 0.125 Liter(s)

CAS #	Compound	Spike Amount µg/m <sup>3</sup>	Result µg/m <sup>3</sup>	% Recovery	ALS	Data Qualifier
					Acceptance Limits	
111-65-9	n-Octane	217	197	91	65-121	
127-18-4	Tetrachloroethene	213	186	87	62-119	
108-90-7	Chlorobenzene	215	187	87	66-115	
100-41-4	Ethylbenzene	212	189	89	69-117	
179601-23-1	m,p-Xylenes	426	402	94	67-117	
75-25-2	Bromoform	213	231	108	67-135	
100-42-5	Styrene	212	213	100	70-128	
95-47-6	o-Xylene	214	199	93	67-118	
111-84-2	n-Nonane	215	199	93	61-127	
79-34-5	1,1,2,2-Tetrachloroethane	214	205	96	70-125	
98-82-8	Cumene	214	196	92	68-116	
80-56-8	alpha-Pinene	211	201	95	69-122	
103-65-1	n-Propylbenzene	218	205	94	70-118	
622-96-8	4-Ethyltoluene	214	202	94	69-124	
108-67-8	1,3,5-Trimethylbenzene	214	201	94	65-117	
95-63-6	1,2,4-Trimethylbenzene	215	230	107	67-124	
100-44-7	Benzyl Chloride	217	229	106	75-142	
541-73-1	1,3-Dichlorobenzene	216	214	99	70-124	
106-46-7	1,4-Dichlorobenzene	216	212	98	63-124	
95-50-1	1,2-Dichlorobenzene	216	228	106	66-125	
5989-27-5	d-Limonene	211	236	112	64-135	
96-12-8	1,2-Dibromo-3-chloropropane	209	206	99	73-136	
120-82-1	1,2,4-Trichlorobenzene	214	207	97	70-141	
91-20-3	Naphthalene	203	205	101	71-146	
87-68-3	Hexachlorobutadiene	209	205	98	63-126	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result. Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

# ALS ENVIRONMENTAL

## LABORATORY CONTROL SAMPLE SUMMARY

Page 1 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Lab Control Sample  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181205-LCS

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/5/18  
 Volume(s) Analyzed: 0.125 Liter(s)

CAS #	Compound	Spike Amount µg/m <sup>3</sup>	Result µg/m <sup>3</sup>	% Recovery	ALS	Data Qualifier
					Acceptance Limits	
115-07-1	Propene	211	174	82	54-133	
75-71-8	Dichlorodifluoromethane (CFC 12)	210	173	82	64-115	
74-87-3	Chloromethane	211	169	80	47-140	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	211	176	83	60-112	
75-01-4	Vinyl Chloride	214	176	82	63-127	
106-99-0	1,3-Butadiene	210	183	87	57-149	
74-83-9	Bromomethane	212	186	88	63-132	
75-00-3	Chloroethane	214	183	86	68-129	
64-17-5	Ethanol	1,020	943	92	62-131	
75-05-8	Acetonitrile	206	188	91	56-136	
107-02-8	Acrolein	205	187	91	60-132	
67-64-1	Acetone	1,060	930	88	63-124	
75-69-4	Trichlorofluoromethane (CFC 11)	211	180	85	65-113	
67-63-0	2-Propanol (Isopropyl Alcohol)	413	392	95	62-135	
107-13-1	Acrylonitrile	207	192	93	68-138	
75-35-4	1,1-Dichloroethene	218	187	86	72-118	
75-09-2	Methylene Chloride	217	183	84	67-116	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	216	203	94	61-143	
76-13-1	Trichlorotrifluoroethane (CFC 113)	216	188	87	68-113	
75-15-0	Carbon Disulfide	218	179	82	68-120	
156-60-5	trans-1,2-Dichloroethene	214	193	90	71-125	
75-34-3	1,1-Dichloroethane	216	182	84	68-118	
1634-04-4	Methyl tert-Butyl Ether	214	189	88	60-123	
108-05-4	Vinyl Acetate	1,060	1030	97	73-135	
78-93-3	2-Butanone (MEK)	208	190	91	70-129	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result. Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

# ALS ENVIRONMENTAL

## LABORATORY CONTROL SAMPLE SUMMARY

Page 2 of 3

**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Lab Control Sample  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181205-LCS

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/5/18  
 Volume(s) Analyzed: 0.125 Liter(s)

CAS #	Compound	Spike Amount µg/m <sup>3</sup>	Result µg/m <sup>3</sup>	% Recovery	ALS	Data Qualifier
					Acceptance Limits	
156-59-2	cis-1,2-Dichloroethene	211	183	87	69-121	
141-78-6	Ethyl Acetate	436	454	104	66-140	
110-54-3	n-Hexane	216	197	91	61-124	
67-66-3	Chloroform	217	186	86	69-113	
109-99-9	Tetrahydrofuran (THF)	216	194	90	66-121	
107-06-2	1,2-Dichloroethane	215	183	85	62-120	
71-55-6	1,1,1-Trichloroethane	215	190	88	65-116	
71-43-2	Benzene	211	181	86	66-111	
56-23-5	Carbon Tetrachloride	212	194	92	64-122	
110-82-7	Cyclohexane	416	376	90	69-115	
78-87-5	1,2-Dichloropropane	216	186	86	69-121	
75-27-4	Bromodichloromethane	215	203	94	69-123	
79-01-6	Trichloroethene	213	187	88	69-112	
123-91-1	1,4-Dioxane	214	217	101	74-123	
80-62-6	Methyl Methacrylate	431	427	99	75-125	
142-82-5	n-Heptane	215	192	89	68-118	
10061-01-5	cis-1,3-Dichloropropene	214	209	98	74-129	
108-10-1	4-Methyl-2-pentanone	209	212	101	66-138	
10061-02-6	trans-1,3-Dichloropropene	213	225	106	75-130	
79-00-5	1,1,2-Trichloroethane	215	197	92	73-117	
108-88-3	Toluene	212	181	85	66-114	
591-78-6	2-Hexanone	214	215	100	58-146	
124-48-1	Dibromochloromethane	213	213	100	67-130	
106-93-4	1,2-Dibromoethane	216	201	93	70-127	
123-86-4	n-Butyl Acetate	219	213	97	62-140	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result. Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

# ALS ENVIRONMENTAL

## LABORATORY CONTROL SAMPLE SUMMARY

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**Client:** PBS Engineering and Environmental  
**Client Sample ID:** Lab Control Sample  
**Client Project ID:** Knott Landfill - Flare Sampling / 80429.010 Phase 005

ALS Project ID: P1806199  
 ALS Sample ID: P181205-LCS

Test Code: EPA TO-15 Modified  
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8  
 Analyst: Raneem Sahtah  
 Sample Type: 6.0 L Silonite Canister  
 Test Notes:

Date Collected: NA  
 Date Received: NA  
 Date Analyzed: 12/5/18  
 Volume(s) Analyzed: 0.125 Liter(s)

CAS #	Compound	Spike Amount µg/m <sup>3</sup>	Result µg/m <sup>3</sup>	% Recovery	ALS	Data Qualifier
					Acceptance Limits	
111-65-9	n-Octane	217	195	90	65-121	
127-18-4	Tetrachloroethene	213	186	87	62-119	
108-90-7	Chlorobenzene	215	186	87	66-115	
100-41-4	Ethylbenzene	212	188	89	69-117	
179601-23-1	m,p-Xylenes	426	399	94	67-117	
75-25-2	Bromoform	213	229	108	67-135	
100-42-5	Styrene	212	211	100	70-128	
95-47-6	o-Xylene	214	198	93	67-118	
111-84-2	n-Nonane	215	198	92	61-127	
79-34-5	1,1,2,2-Tetrachloroethane	214	204	95	70-125	
98-82-8	Cumene	214	195	91	68-116	
80-56-8	alpha-Pinene	211	197	93	69-122	
103-65-1	n-Propylbenzene	218	203	93	70-118	
622-96-8	4-Ethyltoluene	214	204	95	69-124	
108-67-8	1,3,5-Trimethylbenzene	214	200	93	65-117	
95-63-6	1,2,4-Trimethylbenzene	215	228	106	67-124	
100-44-7	Benzyl Chloride	217	224	103	75-142	
541-73-1	1,3-Dichlorobenzene	216	213	99	70-124	
106-46-7	1,4-Dichlorobenzene	216	211	98	63-124	
95-50-1	1,2-Dichlorobenzene	216	227	105	66-125	
5989-27-5	d-Limonene	211	233	110	64-135	
96-12-8	1,2-Dibromo-3-chloropropane	209	204	98	73-136	
120-82-1	1,2,4-Trichlorobenzene	214	206	96	70-141	
91-20-3	Naphthalene	203	202	100	71-146	
87-68-3	Hexachlorobutadiene	209	203	97	63-126	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result.  
 Reported results are shown in concentration units and as a result of the calculation, may vary slightly.