



November 22, 2016

Mr. Erik Mickelson
Senior HSE Representative
Kerr-McGee Oil & Gas Onshore LP
1099 18th Street, Suite 1800
Denver, Colorado 80202

**RE: Sump Closure Report
Piz 16-23
API# 05-123-22268
Facility# 332413
Remediation # 8961
SWSE Sec 23-T3N-R67W
Weld County, Colorado**

Dear Mr. Mickelson:

LT Environmental, Inc. (LTE) was contracted by Kerr-McGee Oil & Gas Onshore LP (Kerr-McGee) to conduct environmental oversight activities at the above-referenced site. The oversight activities included field-screening of soil, collecting confirmation soil samples from the sump excavation, documenting field activities, and reviewing laboratory analytical results.

The objective of the sampling was to determine if petroleum hydrocarbon impacts to the subsurface resulted from Kerr-McGee operating a produced water sump at the site. The sampling activities, laboratory analytical results, and conclusions are summarized below. The general site layout, soil sample location, and the sump excavation dimensions are depicted on the Excavation Site Map provided as Figure 1.

On August 24, 2016, following removal of the produced water sump, soil samples were collected from the sidewalls and base of the sump excavation at approximate depths of 3.5 feet and 5 feet below ground surface (bgs), respectively. The soil samples were field-screened for volatile organic compounds using a photoionization detector. Based on the field screening results, base soil sample (B01@5') was submitted for laboratory analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX) and total petroleum hydrocarbon (TPH)-gasoline range organics (GRO) by USEPA Method 8260C, TPH-diesel range organics (DRO) and TPH-oil range organics (ORO) by USEPA Method 8015C, pH by USEPA Method 9045D, and specific conductance (EC) by USEPA Method 9050A. The laboratory analytical results indicated BTEX, TPH, pH, and EC levels were compliant with Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 allowable levels. The soil sample analytical results are summarized in Table 1, and the laboratory analytical report is attached.



The sump excavation extent measured approximately 16 feet east to west by 17 feet north to south to an approximate depth of 5 feet bgs. No impacted soil was discovered within the excavation, and groundwater was not encountered. A liner was not present beneath the sump at this location. The produced water sump at this facility has been permanently removed, and the excavation area was backfilled and contoured to match pre-existing site conditions.

Please contact LTE at (303) 433-9788 if you have any questions regarding this Sump Closure Report or if you require additional information.

Sincerely,

LT ENVIRONMENTAL, INC.

A handwritten signature in black ink that reads "RYAN ZERNIS". The signature is stylized, with a large, looping "R" and "Z".

Ryan Zernis
Staff Geologist

A handwritten signature in black ink that reads "Justin Solomon". The signature is written in a cursive, flowing style.

Justin Solomon
Senior Environmental Scientist

Attachments

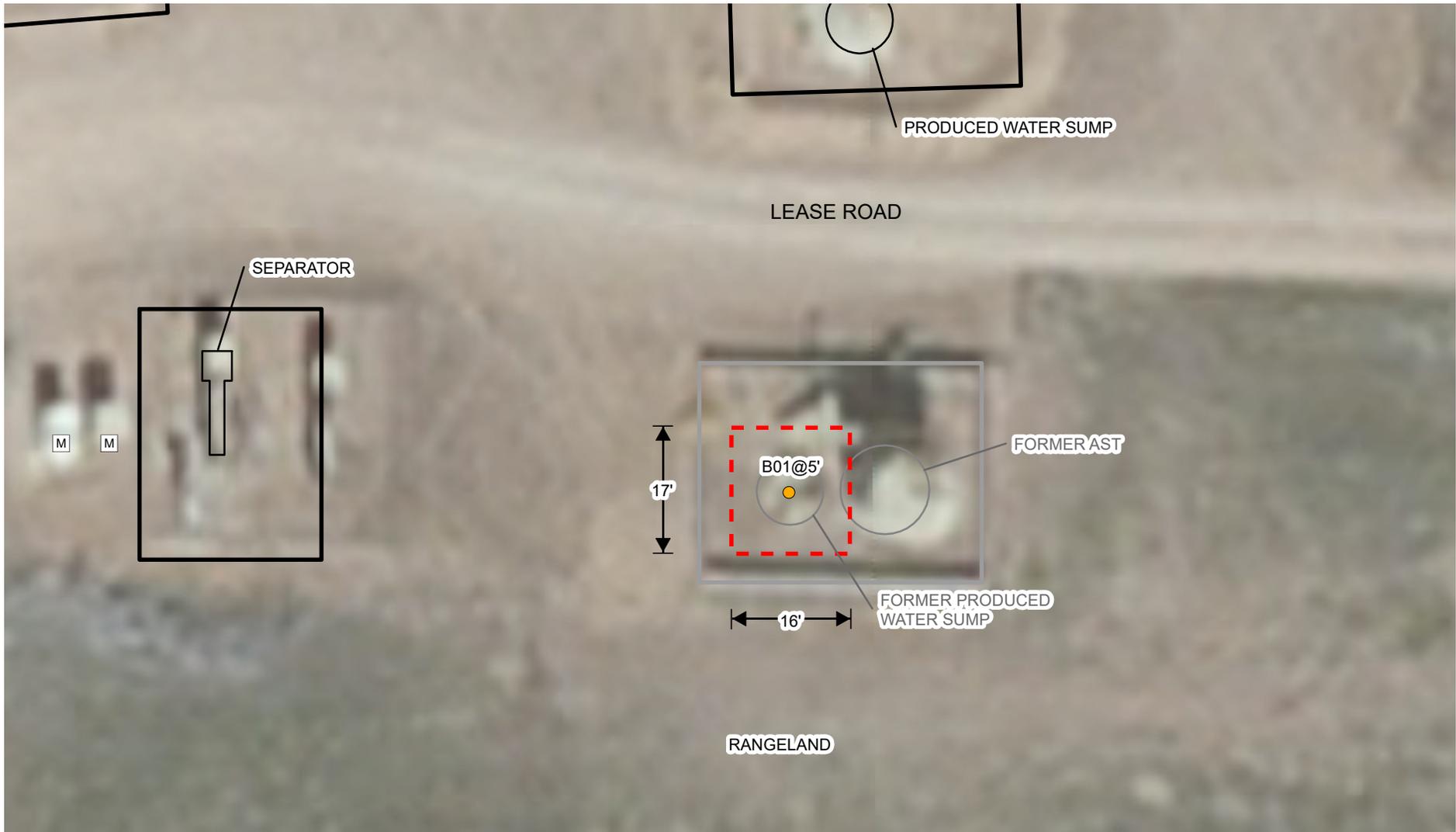


IMAGE COURTESY OF ESRI

LEGEND

- SOIL SAMPLE
- ▭ EXCAVATION EXTENT
- ▭ METER HOUSE
- ▭ BERM
- ▭ FORMER BERM
- AST: ABOVEGROUND STORAGE TANK

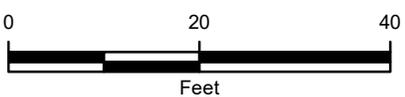


FIGURE 1
EXCAVATION SITE MAP
 PIZ 16-23
 SWSE SEC 23-T3N-R67W
 WELD COUNTY, COLORADO
 KERR-MCGEE OIL & GAS ONSHORE LP



TABLE 1
SOIL SAMPLE ANALYTICAL RESULTS
PIZ 16-23
WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP

Soil Sample ID	Depth (bgs)	Date	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	DRO (mg/kg)	GRO (mg/kg)	ORO (mg/kg)	pH (su)	Specific Conductance (mmhos/cm)
B01 @ 5'	5'	08/24/2016	<0.002	<0.002	<0.002	<0.002	33.5	<0.200	<100	8.05	0.145
COGCC Allowable Levels			0.17	85	100	175	500*	500*	500*	6-9	4

Notes: bgs - below ground surface
COGCC - Colorado Oil and Gas Conservation Commission
DRO - diesel range organics
GRO - gasoline range organics
mg/kg - milligrams per kilogram
mmhos/cm - millimhos per centimeter

NA - not analyzed/not available
ORO - oil range organics
su - standard units
* - Standard applies to combined DRO-GRO-ORO
< - less than laboratory reporting limit
Bold indicates result exceeds allowable level



August 25, 2016

LT Environmental, Inc.

John Cocroft

4600 West 60th Avenue

Arvada CO 80003

Project Name - KMG - Piz 16-23

Project Number - 014216

Attached are your analytical results for KMG - Piz 16-23 received by Origins Laboratory, Inc. August 24, 2016. This project is associated with Origins project number X608253-05.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com



LT Environmental, Inc.
4600 West 60th Avenue
Arvada CO 80003

John Cocroft
Project Number: 014216
Project: KMG - Piz 16-23

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
B01 @ 5'	X608253-05	Soil	August 24, 2016 14:55	08/24/2016 17:40

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

LT Environmental, Inc.
 4600 West 60th Avenue
 Arvada CO 80003

John Cocroft
 Project Number: 014216
 Project: KMG - Piz 16-23

Origins Laboratory

F-012207-01-R1
 Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: X608253

Client: LTE

Client Project ID: Piz 16-23

Checklist Completed by: Jeff Smith

Shipped Via: H/D
 (UPS, FedEx, Hand Delivered, Pick-up, etc.)

Date/time completed: 8/24/16

Airbill #: NA

Matrix(s) Received: (Check all that apply): Soil/Solid Water Other: _____

Cooler Number/Temperature: 1 / 3.1 °C / _____ °C / _____ °C (Describe)

Thermometer ID: TD03

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C ⁽¹⁾ ?	X			
Is there ice present (document if blue ice is used)	X			
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		1		
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)		1		
Were all samples received intact ⁽¹⁾ ?	1			
Was adequate sample volume provided ⁽¹⁾ ?	1			
Are short holding time analytes or samples with HTs due within 48 hours present ⁽¹⁾ ?	1			PH
Is a chain-of-custody (COC) present and filled out completely ⁽¹⁾ ?	X			
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	1			
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	1			
Is the COC properly relinquished by the client with date and time recorded ⁽¹⁾ ?	1			
For volatiles in water – is there headspace (> ¼ inch bubble) present? If yes, contact client and note in narrative.			1	
Are samples preserved that require preservation and was it checked ⁽¹⁾ ? (note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity) / (pH <2 for samples preserved with HNO ₃ , HCL, H ₂ SO ₄) / (pH >10 for samples preserved with NaAsO ₂ +NaOH, ZnAc+NaOH)			1	
Additional Comments (if any):				

⁽¹⁾ If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.

Jeff Smith
 Reviewed by (Project Manager)

8/24/16
 Date/Time Reviewed

Origins Laboratory, Inc.



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LT Environmental, Inc.
 4600 West 60th Avenue
 Arvada CO 80003

John Cocroft
 Project Number: 014216
 Project: KMG - Piz 16-23

B01 @ 5'
8/24/2016 2:55:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.
X608253-05 (Soil)

DRO/RRO by EPA8015C

Diesel (C10-C28)	33.5	25.0	mg/kg	1	B6H2408	08/24/2016	08/25/2016	
Residual Range Organics (C28-C40)	ND	100	"	"	"	"	"	U

Surrogate: *o*-Terphenyl 78.1 % 59-131 " " "

GBTEX by EPA 8260C

Gasoline Range Hydrocarbons	ND	0.200	mg/kg	1	B6H2407	08/24/2016	08/25/2016	U
Benzene	ND	0.002	"	"	"	"	"	U
Toluene	ND	0.002	"	"	"	"	"	U
Ethylbenzene	ND	0.002	"	"	"	"	"	U
Xylenes, total	ND	0.002	"	"	"	"	"	U

Surrogate: 1,2-Dichloroethane-d4 105 % 70-130 " " "
 Surrogate: Toluene-d8 95.7 % 70-130 " " "
 Surrogate: 4-Bromofluorobenzene 109 % 70-130 " " "

pH in Soil by EPA 9045D

pH	8.05		pH Units	1	B6H2405	08/24/2016	08/24/2016	
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Specific Conductance by Modified 9050A

Specific Conductance (EC)	0.145		mmhos/cm	"	B6H2406	"	08/24/2016	
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Origins Laboratory, Inc.



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LT Environmental, Inc.
 4600 West 60th Avenue
 Arvada CO 80003

John Cocroft
 Project Number: 014216
 Project: KMG - Piz 16-23

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6H2407 - EPA 5030 (soil)										
Blank (B6H2407-BLK1)										
					Prepared: 08/24/2016 Analyzed: 08/24/2016					
Gasoline Range Hydrocarbons	ND	0.200	mg/kg							U
Benzene	ND	0.002	"							U
Toluene	ND	0.002	"							U
Ethylbenzene	ND	0.002	"							U
Xylenes, total	ND	0.002	"							U
Surrogate: 1,2-Dichloroethane-d4	67		ug/kg	62.5		108	70-130			
Surrogate: Toluene-d8	59		"	62.5		95.0	70-130			
Surrogate: 4-Bromofluorobenzene	68		"	62.5		109	70-130			

Origins Laboratory, Inc.



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LT Environmental, Inc.
 4600 West 60th Avenue
 Arvada CO 80003

John Cocroft
 Project Number: 014216
 Project: KMG - Piz 16-23

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B6H2407 - EPA 5030 (soil)

LCS (B6H2407-BS1)

Prepared: 08/24/2016 Analyzed: 08/24/2016

Benzene	0.099	0.002	mg/kg	0.100		98.9	77.1-124			
Toluene	0.093	0.002	"	0.100		92.6	74.5-128			
Ethylbenzene	0.096	0.002	"	0.100		96.4	66.4-127			
m,p-Xylene	0.193	0.004	"	0.200		96.6	76.6-124			
o-Xylene	0.098	0.002	"	0.100		97.8	76.6-124			
Surrogate: 1,2-Dichloroethane-d4	68		ug/kg	62.5		109	70-130			
Surrogate: Toluene-d8	60		"	62.5		95.9	70-130			
Surrogate: 4-Bromofluorobenzene	68		"	62.5		109	70-130			

Origins Laboratory, Inc.



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 Arvada CO 80003

John Cocroft
 Project Number: 014216
 Project: KMG - Piz 16-23

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B6H2407 - EPA 5030 (soil)

Matrix Spike (B6H2407-MS1)	Source: X608231-01			Prepared: 08/24/2016 Analyzed: 08/24/2016						
Benzene	0.157	0.002	mg/kg	0.200	ND	78.6	71.8-126			
Toluene	0.147	0.002	"	0.200	ND	73.3	65.1-130			
Ethylbenzene	0.148	0.002	"	0.200	ND	74.2	62.2-130			
m,p-Xylene	0.297	0.004	"	0.400	ND	74.3	46.5-137			
o-Xylene	0.153	0.002	"	0.200	ND	76.6	54.2-134			
Surrogate: 1,2-Dichloroethane-d4	73		ug/kg	62.5		116	70-130			
Surrogate: Toluene-d8	60		"	62.5		95.4	70-130			
Surrogate: 4-Bromofluorobenzene	70		"	62.5		111	70-130			

Origins Laboratory, Inc.



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LT Environmental, Inc.
 4600 West 60th Avenue
 Arvada CO 80003

John Cocroft
 Project Number: 014216
 Project: KMG - Piz 16-23

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B6H2407 - EPA 5030 (soil)

Matrix Spike Dup (B6H2407-MSD1)	Source: X608231-01			Prepared: 08/24/2016 Analyzed: 08/24/2016						
Benzene	0.142	0.002	mg/kg	0.200	ND	71.2	71.8-126	9.75	11.3	QM-07
Toluene	0.132	0.002	"	0.200	ND	65.8	65.1-130	10.9	15.4	
Ethylbenzene	0.129	0.002	"	0.200	ND	64.4	62.2-130	14.2	19.6	
m,p-Xylene	0.258	0.004	"	0.400	ND	64.4	46.5-137	14.3	19.2	
o-Xylene	0.132	0.002	"	0.200	ND	65.8	54.2-134	15.1	17.9	
Surrogate: 1,2-Dichloroethane-d4	73		ug/kg	62.5		116	70-130			
Surrogate: Toluene-d8	60		"	62.5		95.4	70-130			
Surrogate: 4-Bromofluorobenzene	67		"	62.5		107	70-130			

Origins Laboratory, Inc.



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 4600 West 60th Avenue
 Arvada CO 80003

John Cocroft
 Project Number: 014216
 Project: KMG - Piz 16-23

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Extractable Petroleum Hydrocarbons by 8015C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B6H2408 - EPA 3580

Blank (B6H2408-BLK1)

Prepared: 08/24/2016 Analyzed: 08/24/2016

Diesel (C10-C28)	ND	50.0	mg/kg							U
Residual Range Organics (C28-C40)	ND	200	"							U
Surrogate: o-Terphenyl	46		"	50.0		91.0	59-131			

LCS (B6H2408-BS1)

Prepared: 08/24/2016 Analyzed: 08/24/2016

Diesel (C10-C28)	885	50.0	mg/kg	1000		88.5	64-121			
Residual Range Organics (C28-C40)	887	200	"	1000		88.7	58-124			
Surrogate: o-Terphenyl	41		"	50.0		82.7	59-131			

Matrix Spike (B6H2408-MS1)

Source: X608231-01

Prepared: 08/24/2016 Analyzed: 08/24/2016

Diesel (C10-C28)	944	50.0	mg/kg	1000	16.0	92.8	53-125			
Residual Range Organics (C28-C40)	961	200	"	1000	ND	96.1	47-133			
Surrogate: o-Terphenyl	46		"	50.0		91.5	59-131			

Matrix Spike Dup (B6H2408-MSD1)

Source: X608231-01

Prepared: 08/24/2016 Analyzed: 08/24/2016

Diesel (C10-C28)	853	50.0	mg/kg	1000	16.0	83.7	53-125	10.3	20	
Residual Range Organics (C28-C40)	840	200	"	1000	ND	84.0	47-133	13.5	20	
Surrogate: o-Terphenyl	43		"	50.0		85.6	59-131			

Origins Laboratory, Inc.



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LT Environmental, Inc.
 4600 West 60th Avenue
 Arvada CO 80003

John Cocroft
 Project Number: 014216
 Project: KMG - Piz 16-23

Classical Chemistry Parameters - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6H2405 - NO PREP										
Duplicate (B6H2405-DUP1)		Source: X608234-01			Prepared: 08/24/2016 Analyzed: 08/24/2016					
pH	8.51		pH Units		8.69			2.09	25	
Batch B6H2406 - NO PREP										
Blank (B6H2406-BLK1)		Prepared: 08/24/2016 Analyzed: 08/24/2016								
Specific Conductance (EC)	0.00290		mmhos/cm							
Duplicate (B6H2406-DUP1)		Source: X608234-01			Prepared: 08/24/2016 Analyzed: 08/24/2016					
Specific Conductance (EC)	1.20		mmhos/cm		1.25			3.83	25	

Origins Laboratory, Inc.



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LT Environmental, Inc.
4600 West 60th Avenue
Arvada CO 80003

John Cocroft
Project Number: 014216
Project: KMG - Piz 16-23

Notes and Definitions

U Sample is Non-Detect.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

ND Analyte NOT DETECTED at or above the reporting limit

RPD Relative Percent Difference

All soil results are reported at a wet weight basis.

Origins Laboratory, Inc.



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Jen Pellegrini For Noelle Doyle Mathis, President