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# INVESTIGATION SUMMARY Red Hills North, Unit #603 Produced Water Spill

Lea County, New Mexico

LAI Project No. 16-0106-01

March 14, 2016

Prepared for:

EOG Resources, Inc. 5509 Champions Drive Midland, TX 79706

Prepared by:

Larson & Associates, Inc. 507 North Marienfeld Street, Suite 205 Midland, Texas 79701



Mark J. Larson, P.G. CPG #10490

Hukaba

Kimberly M. Huckaba Staff Geologist

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#### Introduction

This investigation summary is prepared on behalf of EOG Resources, Inc. (EOG) by Larson & Associates, Inc. (LAI) for submittal to the New Mexico Oil Conservation Division (OCD) and surface owner, U.S. Bureau of Land Management (BLM), for a produced water spill at the EOG Red Hills North Unit #603 (Site) in Unit M (SW/4, SE/4), Section 6, Township 25 South, Range 34 East, in Lea County, New Mexico. The release occurred on January 30, 2016 due to overpressure of an underground 3" poly line (RHNU #601 going to the RHNU #606 WIW). Between 5 and 10 barrels (bbl) of produced water was released with 0 bbl recovered. The geodetic position is north 32° 09' 12.8431" and west 103° 30' 53.1399". The affected area covers approximately 8,100 square feet or about 0.18 acre. The release was reported to the OCD District 1 on February 4, 2016 which issued remediation project (RP) number 1RP-4150.Figure 1 presents a topographic map. Figure 2 presents an aerial map. Figure 3 presents a Site drawing. Attachment A presents the initial C-141.

#### Setting

The setting is as follows:

- The surface elevation is about 3,450 feet above mean sea level (MSL);
- The topography is slightly undulating and slopes to the southwest;
- The nearest surface water feature is intermittent drainage located about 2 miles northeast of the Site that flows northwest;
- The soils are designated as "Simona-Upton Association, 0 to 3 percent slopes", consisting of well drained fine to gravely sandy loam soils and underlain by cemented material (caliche);
- The upper geologic unit is the Tertiary-age Ogallala Formation and is underlain by the Triassicage Chinle formation of the Dockum group;
- Groundwater occurs at about 185 feet bgs according to records from the New Mexico Office of the State Engineer (NMOSE);
- The nearest well (NMOSE POD #02373S) is located about 1.75 miles southwest of the Site and is used for rig supply.

#### **Remediation Action Levels**

Remediation action levels (RRAL) were calculated for benzene, BTEX and TPH based on the following criteria established by the OCD (*Guidelines for Remediation of Leaks, Spills and Releases, August 13,* 1993):

Criteria	Result	Score
Depth-to-Groundwater	>100 feet	0
Wellhead Protection Area	No	0
Distance to Surface Water Body	200 - 1000 Horizontal Feet	0

The following RRAL apply to the release for ranking score: 0

- Benzene 10 mg/Kg
- BTEX 50 mg/Kg
- TPH 5,000 mg/Kg

#### Soil Investigation

On February 3, 2016, LAI personnel used a direct push rig to collect soil samples at four (4) locations (DP-1 through DP-4). Soil sampling terminated between approximately 1.5 (DP-4) and 4 (DP-3) feet below ground surface (bgs) due to caliche. Permian Basin Environmental Laboratory (PBEL) in Midland, Texas, analyzed the samples for total petroleum hydrocarbons (TPH) by EPA SW-846 method 8015M and chloride by method 300. Table 1 presents the laboratory analytical data summary. Figure 3 presents the sample location map. Attachment B presents the laboratory report.

Referring to Table 1, samples from 0 to 1 foot bgs were analyzed for TPH and reported concentrations below the analytical method reporting limit (RL) except sample DP-3 which reported TPH at 34.2 milligrams per kilogram (mg/Kg) and below the RRAL. Chloride exceeded 250 mg/Kg in the deepest samples and ranged between 561 mg/Kg (DP-1, 1 to 2 feet bgs) to 24,700 mg/Kg (DP-3, 2 to 3 feet bgs).

On February 26, 2016, Scarborough Drilling, Inc. (Scarborough) used an air rotary rig and jam tube sampler to collect samples at DP-3 between approximately 5 feet and 40 feet bgs. The samples were analyzed for chloride by method 300. Chloride decreased to 300 mg/Kg in sample DP-3, 40 feet bgs. Figure 3 presents the boring location. Table 1 presents the laboratory analytical data summary. Attachment B presents the laboratory report.

Groundwater was not observed and the boring was plugged with bentonite. The soil boring log was prepared according to the Unified Soil Classification System (USCS). Attachment C presents the boring log. Attachment D presents the photo documentation.

#### **Remediation Plan**

LAI recommends the following remedial actions:

- Excavate soil to approximately 4 feet bgs in the vicinity of the spill area;
- Install 20 mil thickness poly liner in bottom of the excavation;
- Backfill excavation with clean topsoil and seed to BLM requirements;
- Dispose contaminated soil at OCD approved landfill; and
- Prepare final report for submission to OCD and BLM.

Figure 4 presents the approximate excavation area.

TABLES

#### Table 1

## Investigation Soil Sample Analytical Data Summary EOG Resources, Inc., Red Hills North, Unit #603 Spill Unit M (SW/4, SE/4), Section 6, Township 25 South, Range 34 East Lea County, New Mexico 1RP-4150

Sample	Depth	Collection	Status	C6 - C12	>C12 - C28	>C28 - C35	ТРН	Chloride
	(Feet)	Date		(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
OCD RRAL:							5,000	*250
DP-1	0 - 1	2/3/2016	In-Situ	<27.8	<27.8	<27.8	<27.8	52.5
	1 - 2	2/3/2016	In-Situ					561
DP-2	0 - 1	2/3/2016	In-Situ	<30.9	<30.9	<30.9	<30.9	14,200
	1 - 2	2/3/2016	In-Situ					21,400
	2 - 3	2/3/2016	In-Situ					14,500
DP-3	0 - 1	2/3/2016	In-Situ	<29.4	34.2	<29.4	34.2	14,600
	1 - 2	2/3/2016	In-Situ					15,500
	2 - 3	2/3/2016	In-Situ					24,700
	3 - 4	2/3/2016	In-Situ					16,800
SB-1	5	2/26/2016	In-Situ					17,000
	10	2/26/2016	In-Situ					7,790
	15	2/26/2016	In-Situ					2,190
	20	2/26/2016	In-Situ					11,100
	25	2/26/2016	In-Situ					1,360
	30	2/26/2016	In-Situ					953
	35	2/26/2016	In-Situ					378
	40	2/26/2016	In-Situ					300
DP-4	0 - 1	2/3/2016	In-Situ	<28.4	<28.4	<28.4	<28.4	15,400
	1 - 1.5	2/3/2016	In-Situ					15,300

Notes: laboratory analysis performed by Permian Basin Environmental Lab, Midland, Texas, by EPA SW-846 method 8015M (TPH) and 300.0 (chloride)

Depth in feet below ground surface (bgs)

mg/Kg: milligrams per kilogram equivalent to parts per million (ppm)

\*: OCD delineation limit

RRAL: Remediation action level calculated from OCD guidence document (August 13, 1993)

FIGURES



Figure 1 - Topographic Map





Figure 3 - Site Map Showing Spill Area and Sample Locations



Attachment A

Initial C-141

# State of New Mexico Energy Minerals and Natural Resources

Form C-141 Revised August 8, 2011 opy to appropriate District Office in

Oil Conservation Division 1220 South St. Francis Dr. Santa Fe, NM 87505 Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

# **Release Notification and Corrective Action**

	<b>OPER</b>	Initial Report	Final Report				
Name of Company EOG Resources, Inc.	Contact	Zane Kurtz					
Address 5509 Champions Drive, Midland, TX 79706		No. 432-425-2023					
Facility Name Red Hills Nash Unit #603		pe Oil Well					
NORTA							
Surface Owner EOG Resources	Mineral Owner EOG Re	sources	API No. 30-025-3	2680			

#### LOCATION OF RELEASE

Unit Letter M	Section 6	Township 25S	Range 34E	Feet from the 510	North/South Line South	Feet from the 660	East/West Line West	County Lea

Latitude 32 09' 12.8431" Longitude -103 30' 53.1399"

#### NATURE OF RELEASE

Type of Release Produced Water Spill	Volume of Release 5-10 bb 5	Volume Recov	vered 0					
Source of Release Break in Pipeline (3, N.C.A. poly)	Date and Hour of Occurrence 1/30/2016	Date and Hour 1/30/2016	r of Discovery					
Was Immediate Notice Given?	If YES, To Whom?							
☐ Yes								
By Whom?	Date and Hour							
Was a Watercourse Reached?	If YES, Volume Impacting the Wa	tercourse.						
🗌 Yes 🖾 No								
If a Watercourse was Impacted, Describe Fully.*								
N/A								
Describe Cause of Problem and Remedial Action Taken.*								
Spill caused by break in 3" underground water transfer line (RHNU 601 g								
fusion weld. One call was made Monday, February 1, 2015. Spill area wa			and Associates, Inc. to					
delineate horizontal and vertical impacts. Sample results pending. A work	plan will be prepared to remediate in	npacted area.						
Describe Area Affected and Cleanup Action Taken.*								
I hereby certify that the information given above is true and complete to t	he best of my knowledge and underst	and that pursuant	to NMOCD rules and					
regulations all operators are required to report and/or file certain release n	otifications and perform corrective a	tions for releases	s which may endanger					
public health or the environment. The acceptance of a C-141 report by th	e NMOCD marked as "Final Report"	does not relieve t	the operator of hability					
should their operations have failed to adequately investigate and remediat or the environment. In addition, NMOCD acceptance of a C-141 report d	e contamination that pose a threat to	ground water, sur	lionae with only other					
federal, state, or local laws and/or regulations.	loes not relieve the operator of respon	sibility for compl	nance with any other					
Tederal, state, or local laws and/or regulations.	OIL CONSED		VISION					
	OIL CONSER	VATION DI	<u>v151011</u>					
Signature:								
Printed Name: Zane Kurtz Approved by Environmental Specialist:								
Title: Sr. Environmental Rep.	Approval Date:	Expiration Date	:					
The. St. Davidminental rep.			•					
E-mail Address: zane kurtz@eogresources.com	Conditions of Approval:							
		A	ttached					
Date: 2/4/2016 Phone: 432-425-2023								

\* Attach Additional Sheets If Necessary

Attachment B

Laboratory Reports

PERMIAN BASIN ENVIRONMENTAL LAB, LP 10014 SCR 1213 Midland, TX 79706



# Analytical Report

# **Prepared for:**

Mark Larson Larson & Associates, Inc. P.O. Box 50685 Midland, TX 79710

Project: Red Hills Pipeline Project Number: 16-0106-01 Location: New Mexico

Lab Order Number: 6B04003



NELAP/TCEQ # T104704156-13-3

Report Date: 02/09/16

#### Project: Red Hills Pipeline Project Number: 16-0106-01 Project Manager: Mark Larson

#### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
DP-4 (0-1)	6B04003-01	Soil	02/03/16 11:30	02-03-2016 16:10
DP-4 (1-1.5)	6B04003-02	Soil	02/03/16 11:30	02-03-2016 16:10
DP-3 (0-1)	6B04003-03	Soil	02/03/16 11:45	02-03-2016 16:10
DP-3 (1-2)	6B04003-04	Soil	02/03/16 11:45	02-03-2016 16:10
DP-3 (2-3)	6B04003-05	Soil	02/03/16 11:45	02-03-2016 16:10
DP-3 (3-4)	6B04003-06	Soil	02/03/16 11:45	02-03-2016 16:10
DP-1 (0-1)	6B04003-07	Soil	02/03/16 12:00	02-03-2016 16:10
DP-1 (1-2)	6B04003-08	Soil	02/03/16 12:00	02-03-2016 16:10
DP-2 (0-1)	6B04003-09	Soil	02/03/16 12:30	02-03-2016 16:10
DP-2 (1-2)	6B04003-10	Soil	02/03/16 12:30	02-03-2016 16:10
DP-2 (2-3)	6B04003-11	Soil	02/03/16 12:30	02-03-2016 16:10

#### DP-4 (0-1) 6B04003-01 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Pern	nian Basin F	nvironmen	ital Lab, I	L.P.				
General Chemistry Parameters by EPA / Sta	andard Metho	ds							
Chloride	15400	56.8	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	12.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	
Total Petroleum Hydrocarbons C6-C35 by I	EPA Method 8	015M							
C6-C12	ND	28.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C12-C28	ND	28.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C28-C35	ND	28.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: 1-Chlorooctane		104 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: o-Terphenyl		109 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Total Petroleum Hydrocarbon C6-C35	ND	28.4	mg/kg dry	1	[CALC]	02/05/16	02/05/16	calc	

Project: Red Hills Pipeline Project Number: 16-0106-01 Project Manager: Mark Larson Fax: (432) 687-0456

# DP-4 (1-1.5)

### 6B04003-02 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Permian Basin Environmental Lab, L.P.									
<b>General Chemistry Parameters by EI</b>	General Chemistry Parameters by EPA / Standard Methods								
Chloride	15300	57.5	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	13.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	

#### Project: Red Hills Pipeline Project Number: 16-0106-01 Project Manager: Mark Larson

## DP-3 (0-1)

#### 6B04003-03 (Soil)

									ſ
Ampleto	Result	Reporting Limit	Units	Dilution	Batch	Dranarad	Analyzad	Method	Notos
Analyte	Kesuit	Liiiit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Perm	ian Basin F	Environmen	tal Lab,	L.P.				
General Chemistry Parameters by EP	A / Standard Method	S							
Chloride	14600	58.8	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	15.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	
Total Petroleum Hydrocarbons C6-C.	35 by EPA Method 80	15M							
C6-C12	ND	29.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C12-C28	34.2	29.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C28-C35	ND	29.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: 1-Chlorooctane		94.6 %	70-1.	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: o-Terphenyl		97.5 %	70-1.	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Total Petroleum Hydrocarbon	34.2	29.4	mg/kg dry	1	[CALC]	02/05/16	02/05/16	calc	
C6-C35									

Larson & Associates, Inc. P.O. Box 50685 Midland TX, 79710		Proje Project Numb Project Manag	er: 16-01					Fax: (432) 6	587-0456
			-3 (1-2) 03-04 (Se						
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Perm	ian Basin Ei	vironme	ental Lab, L	.P.				
General Chemistry Parameters by E	PA / Standard Method	S							

58.1 mg/kg dry

%

0.1

50

1

P6B0803

P6B0502

02/05/16

02/05/16

02/08/16

02/05/16

15500

14.0

Permian Basin Environmental Lab, L.P.

Chloride

% Moisture

The results in this report apply to the samples analyzed in accordance with the samples received in the laboratory. This analytical report must be reproduced in its entirety, with written approval of Permian Basin Environmental Lab.

EPA 300.0

% calculation

Larson & Associates, Inc. P.O. Box 50685 Midland TX, 79710		Proje Project Numb Project Manag	er: 16-010			Fax: (432) 6	87-0456		
			P-3 (2-3) 003-05 (So	il)					
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Perm	ian Basin E	nvironme	ntal Lab, I	L.P.				
General Chemistry Parameters by I									
Chloride	24700	61.0	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	

%

1

P6B0502

02/05/16

02/05/16

% calculation

0.1

18.0

% Moisture

Larson & Associates, Inc. P.O. Box 50685 Midland TX, 79710		Proje Project Numb roject Manag	er: 16-010					Fax: (432) 6	587-0456
			2-3 (3-4) 003-06 (So	il)					
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		an Basin E	nvironme	ntal Lab, I	<b>P</b> .				
General Chemistry Parameters by Chloride	EPA / Standard Methods 16800	57.5	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	

%

1

P6B0502

02/05/16

02/05/16

% calculation

0.1

13.0

% Moisture

#### Project: Red Hills Pipeline Project Number: 16-0106-01 Project Manager: Mark Larson

# DP-1 (0-1)

#### 6B04003-07 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Perm	ian Basin F	Cnvironmer	ntal Lab, I	L.P.				
General Chemistry Parameters by EPA / S	standard Method	s							
Chloride	52.5	1.11	mg/kg dry	1	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	10.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	
Total Petroleum Hydrocarbons C6-C35 by	EPA Method 80	15M							
C6-C12	ND	27.8	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C12-C28	ND	27.8	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C28-C35	ND	27.8	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: 1-Chlorooctane		98.3 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: o-Terphenyl		102 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Total Petroleum Hydrocarbon C6-C35	ND	27.8	mg/kg dry	1	[CALC]	02/05/16	02/05/16	calc	

Larson & Associates, Inc. P.O. Box 50685 Midland TX, 79710		Proje Project Numb roject Manag	er: 16-010				Fax: (432) 6	87-0456	
			P-1 (1-2) 003-08 (So	il)					
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Permi	an Basin E	nvironme	ntal Lab, I	<b>P</b> .				
General Chemistry Parameters by F	PA / Standard Methods								
Chloride	561	1.10	mg/kg dry	1	P6B0803	02/05/16	02/08/16	EPA 300.0	

%

1

P6B0502

02/05/16

02/05/16

% calculation

0.1

9.0

Permian Basin Environmental Lab, L.P.

% Moisture

#### Project: Red Hills Pipeline Project Number: 16-0106-01 Project Manager: Mark Larson

## DP-2 (0-1)

#### 6B04003-09 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Perm	ian Basin F	Invironmen	ital Lab, I	L.P.				
General Chemistry Parameters by EPA / S	Standard Method	S							
Chloride	14200	61.7	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	19.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	
Total Petroleum Hydrocarbons C6-C35 by	EPA Method 80	15M							
C6-C12	ND	30.9	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C12-C28	ND	30.9	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C28-C35	ND	30.9	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: 1-Chlorooctane		99.3 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: o-Terphenyl		103 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Total Petroleum Hydrocarbon C6-C35	ND	30.9	mg/kg dry	1	[CALC]	02/05/16	02/05/16	calc	

Larson & Associates, Inc. P.O. Box 50685 Midland TX, 79710		Proje roject Numb roject Manag	er: 16-010					Fax: (432) 6	587-0456
			P-2 (1-2) 03-10 (So	il)					
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Permia	an Basin E	nvironme	ntal Lab, I	<b>P.</b>				
General Chemistry Parameters by E	<b>CPA / Standard Methods</b>								
Chloride	21400	64.1	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	

%

1

P6B0502

02/05/16

02/05/16

% calculation

0.1

22.0

% Moisture

Larson & Associates, Inc. P.O. Box 50685 Midland TX, 79710		Project: Red Hills Pipeline Project Number: 16-0106-01 Project Manager: Mark Larson							87-0456
			P-2 (2-3) 003-11 (So	il)					
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Permi	ian Basin E	Invironme	ntal Lab, I	L.P.				
General Chemistry Parameters by F	PA / Standard Methods	5							
Chloride	14500	60.2	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	17.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	

Permian Basin Environmental Lab, L.P.

#### General Chemistry Parameters by EPA / Standard Methods - Quality Control

#### Permian Basin Environmental Lab, L.P.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
	Result	Linit	emo	Lever	Result	/mee	Linus	IU D	Linit	110105
Batch P6B0502 - *** DEFAULT PREP ***										
Blank (P6B0502-BLK1)				Prepared &	k Analyzed	1: 02/05/16				
% Moisture	ND	0.1	%							
Duplicate (P6B0502-DUP1)	Sour	ce: 6B03009-	04	Prepared &	k Analyzed	1: 02/05/16				
% Moisture	3.0	0.1	%		3.0			0.00	20	
Duplicate (P6B0502-DUP2)	Sour	ce: 6B04001-	01	Prepared &	k Analyzed	1: 02/05/16				
% Moisture	9.0	0.1	%		9.0			0.00	20	
Batch P6B0803 - *** DEFAULT PREP ***										
				D 1 (			100/16			
Blank (P6B0803-BLK1)	ND	1.00		Prepared: (	02/05/16 A	Analyzed: 02	2/08/16			
Chloride	ND	1.00	mg/kg wet							
LCS (P6B0803-BS1)				Prepared: (	02/05/16 A	Analyzed: 02	2/08/16			
Chloride	208	1.00	mg/kg wet	200		104	80-120			
LCS Dup (P6B0803-BSD1)				Prepared: (	02/05/16 A	Analyzed: 02	2/08/16			
Chloride	208	1.00	mg/kg wet	200		104	80-120	0.389	20	
Duplicate (P6B0803-DUP1)	Sour	ce: 6B03010-	03	Prepared: (	02/05/16 A	Analyzed: 02	2/08/16			
Chloride	6710	25.8	mg/kg dry	1	6750			0.525	20	
Duplicate (P6B0803-DUP2)	Sour	·ce: 6B04003-	09	Prepared (	)2/05/16 A	Analyzed: 02	2/08/16			
Chloride	14100		mg/kg dry		14200			0.972	20	
M-4-1- S-1- (D(D0002 M01)	<b>S</b>		0.2	Dronarad: (	02/05/16	nalwadi 00	0/09/16			
Matrix Spike (P6B0803-MS1)		ce: 6B03010-		1		Analyzed: 02				
Chloride	19200	25.8	mg/kg dry	11300	6750	110	80-120			

Permian Basin Environmental Lab, L.P.

#### Total Petroleum Hydrocarbons C6-C35 by EPA Method 8015M - Quality Control

#### Permian Basin Environmental Lab, L.P.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P6B0805 - TX 1005										
Blank (P6B0805-BLK1)				Prepared &	Analyzed:	02/05/16				
C6-C12	52.3	25.0	mg/kg wet							
>C12-C28	81.3	25.0	"							
>C28-C35	ND	25.0	"							
Surrogate: 1-Chlorooctane	91.6		"	100		91.6	70-130			
Surrogate: o-Terphenyl	46.9		"	50.0		93.8	70-130			
LCS (P6B0805-BS1)				Prepared &	Analyzed:	02/05/16				
C6-C12	17.7	25.0	mg/kg wet	1000		1.77	75-125			
>C12-C28	32.6	25.0	"	1000		3.26	75-125			
Surrogate: 1-Chlorooctane	110		"	100		110	70-130			
Surrogate: o-Terphenyl	56.7		"	50.0		113	70-130			
LCS Dup (P6B0805-BSD1)				Prepared &	Analyzed:	02/05/16				
C6-C12	27.4	25.0	mg/kg wet	1000		2.74	75-125	43.2	20	
>C12-C28	40.8	25.0	"	1000		4.08	75-125	22.4	20	
Surrogate: 1-Chlorooctane	91.2		"	100		91.2	70-130			
Surrogate: o-Terphenyl	47.5		"	50.0		94.9	70-130			
Matrix Spike (P6B0805-MS1)	Sou	rce: 6B04008	6-01	Prepared &	Analyzed:	02/05/16				
C6-C12	782	26.9	mg/kg dry	1080	ND	72.7	75-125			QM-05
>C12-C28	910	26.9	"	1080	178	68.1	75-125			QM-05
Surrogate: 1-Chlorooctane	121		"	108		112	70-130			
Surrogate: o-Terphenyl	53.3		"	53.8		99.2	70-130			
Matrix Spike Dup (P6B0805-MSD1)	Sou	-ce: 6B04008	8-01	Prepared &	Analyzed:	02/05/16				
C6-C12	811	26.9	mg/kg dry	1080	ND	75.4	75-125	3.71	20	
>C12-C28	940	26.9	"	1080	178	70.9	75-125	4.03	20	QM-0
Surrogate: 1-Chlorooctane	124		"	108		116	70-130			
Surrogate: o-Terphenyl	59.9		"	53.8		111	70-130			

QM-05

#### **Notes and Definitions**

The spike recovery was outside acceptance limits for the MS and/or MSD due to matrix interference. The LCS and/or LCSD were

within acceptance limits showing that the laboratory is in control and the data is acceptable.

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
LCS	Laboratory Control Spike
MS	Matrix Spike
Dup	Duplicate

Sun Barron

Report Approved By:

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2/9/2016

Date:

Brent Barron, Laboratory Director/Technical Director

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Permian Basin Environmental Lab, L.P.



PERMIAN BASIN ENVIRONMENTAL LAB, LP 10014 SCR 1213 Midland, TX 79706



# Analytical Report

# **Prepared for:**

Mark Larson Larson & Associates, Inc. P.O. Box 50685 Midland, TX 79710

Project: EOG Red Hills #603 Spill Project Number: 16-0106-01 Location: EOG Red Hills #603 Spill

Lab Order Number: 6B29002



NELAP/TCEQ # T104704156-13-3

Report Date: 03/04/16

#### Project: EOG Red Hills #603 Spill Project Number: 16-0106-01 Project Manager: Mark Larson

#### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SB-1, 5'	6B29002-01	Soil	02/26/16 10:15	02-29-2016 09:10
SB-1, 10'	6B29002-02	Soil	02/26/16 10:20	02-29-2016 09:10
SB-1, 15'	6B29002-03	Soil	02/26/16 10:24	02-29-2016 09:10
SB-1, 20'	6B29002-04	Soil	02/26/16 10:30	02-29-2016 09:10
SB-1, 25'	6B29002-05	Soil	02/26/16 10:38	02-29-2016 09:10
SB-1, 30'	6B29002-06	Soil	02/26/16 10:45	02-29-2016 09:10
SB-1, 35'	6B29002-07	Soil	02/26/16 10:50	02-29-2016 09:10
SB-1, 40'	6B29002-08	Soil	02/26/16 10:55	02-29-2016 09:10

#### SB-1, 5' 6B29002-01 (Soil)

		0027	002-01 (50	n)					
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Permian Basin Environmental Lab, L.P.									
<b>General Chemistry Parameter</b>	s by EPA / Standard Methods								
Chloride	17000	58.1	mg/kg dry	50	P6C0104	03/01/16	03/01/16	EPA 300.0	
% Moisture	14.0	0.1	%	1	P6C0110	03/01/16	03/01/16	% calculation	

Project: EOG Red Hills #603 Spill Project Number: 16-0106-01 Project Manager: Mark Larson Fax: (432) 687-0456

SB-1, 10	)'
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#### 6B29002-02 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes	
Permian Basin Environmental Lab, L.P.										
<b>General Chemistry Parameters</b>	by EPA / Standard Methods									
Chloride	7790	28.4	mg/kg dry	25	P6C0104	03/01/16	03/01/16	EPA 300.0		
% Moisture	12.0	0.1	%	1	P6C0110	03/01/16	03/01/16	% calculation		
Fax: (432) 687-0456

# 6B29002-03 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Permia	n Basin E	nvironmer	ıtal Lab, I	<b>P</b> .				
<b>General Chemistry Parameters</b>	by EPA / Standard Methods								
Chloride	2190	11.5	mg/kg dry	10	P6C0104	03/01/16	03/01/16	EPA 300.0	
% Moisture	13.0	0.1	%	1	P6C0110	03/01/16	03/01/16	% calculation	

Fax: (432) 687-0456

# 6B29002-04 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Permia	n Basin E	nvironmer	ıtal Lab, I	L.P.				
<b>General Chemistry Parameters</b>	by EPA / Standard Methods								
Chloride	11100	29.1	mg/kg dry	25	P6C0104	03/01/16	03/01/16	EPA 300.0	
% Moisture	14.0	0.1	%	1	P6C0110	03/01/16	03/01/16	% calculation	

Fax: (432) 687-0456

# 6B29002-05 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Permia	an Basin E	nvironmer	ıtal Lab, I	<b>P</b> .				
<u>General Chemistry Parameters b</u>	y EPA / Standard Methods								
Chloride	1360	5.26	mg/kg dry	5	P6C0104	03/01/16	03/01/16	EPA 300.0	
% Moisture	5.0	0.1	%	1	P6C0110	03/01/16	03/01/16	% calculation	

Fax: (432) 687-0456

# 6B29002-06 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Permia	ın Basin Eı	nvironmer	ıtal Lab, I	<b>P</b> .				
General Chemistry Parameters b	y EPA / Standard Methods								
Chloride	953	5.56	mg/kg dry	5	P6C0104	03/01/16	03/01/16	EPA 300.0	
% Moisture	10.0	0.1	%	1	P6C0110	03/01/16	03/01/16	% calculation	

Fax: (432) 687-0456

# 6B29002-07 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Permia	n Basin E	nvironmer	ıtal Lab, I	<b>P</b> .				
<b>General Chemistry Parameters</b>	by EPA / Standard Methods								
Chloride	378	1.14	mg/kg dry	1	P6C0104	03/01/16	03/01/16	EPA 300.0	
% Moisture	12.0	0.1	%	1	P6C0110	03/01/16	03/01/16	% calculation	

Fax: (432) 687-0456

SB-1, 40'
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# 6B29002-08 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Permia	n Basin E	nvironmer	ıtal Lab, I	<b>P.</b>				
<b>General Chemistry Parameters</b>	by EPA / Standard Methods								
Chloride	300	1.18	mg/kg dry	1	P6C0405	03/04/16	03/04/16	EPA 300.0	
% Moisture	15.0	0.1	%	1	P6C0401	03/04/16	03/04/16	% calculation	

### General Chemistry Parameters by EPA / Standard Methods - Quality Control

# Permian Basin Environmental Lab, L.P.

		Reporting		Spike	Source		%REC		RPD	
Analyte	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes
Batch P6C0104 - *** DEFAULT PREP ***										
Blank (P6C0104-BLK1)				Prepared &	& Analyzed	03/01/16				
Chloride	ND	1.00	mg/kg wet							
LCS (P6C0104-BS1)				Prepared &	& Analyzed	03/01/16				
Chloride	183	1.00	mg/kg wet	200		91.7	80-120			
LCS Dup (P6C0104-BSD1)				Prepared 8	k Analyzed	03/01/16				
Chloride	189	1.00	mg/kg wet	200		94.6	80-120	3.13	20	
Duplicate (P6C0104-DUP1)	Sou	ce: 6B29002	-01	Prepared &	k Analyzed	03/01/16				
Chloride	17200	58.1	mg/kg dry		17000			0.894	20	
Duplicate (P6C0104-DUP2)	Sou	ce: 6B17007	-20	Prepared &	k Analyzed	03/01/16				
Chloride	49.6	1.09	mg/kg dry		49.9			0.590	20	
Batch P6C0110 - *** DEFAULT PREP ***										
Blank (P6C0110-BLK1)				Prepared &	& Analyzed	03/01/16				
% Moisture	ND	0.1	%							
Duplicate (P6C0110-DUP1)	Sou	-ce: 6B29006	-01	Prepared &	& Analyzed	03/01/16				
% Moisture	6.0	0.1	%	-	6.0			0.00	20	
Duplicate (P6C0110-DUP2)	Sou	rce: 6B15001	-02	Prepared &	k Analyzed	03/01/16				
% Moisture	15.0	0.1	%		14.0			6.90	20	
Duplicate (P6C0110-DUP3)	Sou	-ce: 6B15003	-30	Prepared &	& Analyzed	03/01/16				
% Moisture	9.0	0.1	%		9.0			0.00	20	

Permian Basin Environmental Lab, L.P.

## General Chemistry Parameters by EPA / Standard Methods - Quality Control

# Permian Basin Environmental Lab, L.P.

					_					
Australia	Danult	Reporting	Units	Spike	Source	%REC	%REC Limits	RPD	RPD Limit	Neter
Analyte	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes
Batch P6C0401 - *** DEFAULT PREP ***										
Blank (P6C0401-BLK1)				Prepared &	Analyzed:	03/04/16				
% Moisture	ND	0.1	%							
Duplicate (P6C0401-DUP1)	Sou	ce: 6B19009	-04	Prepared &	Analyzed:	03/04/16				
% Moisture	5.0	0.1	%		17.0			109	20	
Duplicate (P6C0401-DUP2)	Sou	rce: 6C01005	-02	Prepared &	Analyzed:	03/04/16				
% Moisture	18.0	0.1	%		6.0			100	20	
Batch P6C0405 - *** DEFAULT PREP ***										
Blank (P6C0405-BLK1)				Prepared &	Analyzed:	03/04/16				
Chloride	ND	1.00	mg/kg wet							
LCS (P6C0405-BS1)				Prepared &	Analyzed:	03/04/16				
Chloride	205	1.00	mg/kg wet	200		102	80-120			
LCS Dup (P6C0405-BSD1)				Prepared &	Analyzed:	03/04/16				
Chloride	209	1.00	mg/kg wet	200		104	80-120	1.73	20	
Duplicate (P6C0405-DUP1)	Sou	rce: 6B19009	-03	Prepared &	Analyzed:	03/04/16				
Chloride	6190	30.5	mg/kg dry	*	6240			0.711	20	
Duplicate (P6C0405-DUP2)	Sou	ce: 6B25004	-18	Prepared &	Analyzed:	03/04/16				
Chloride	275	11.1	mg/kg dry		277			0.724	20	

#### Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
LCS	Laboratory Control Spike
MS	Matrix Spike
Dup	Duplicate

un Barron Report Approved By:

Date: 3/4/2016

Brent Barron, Laboratory Director/Technical Director

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Permian Basin Environmental Lab, L.P.

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Attachment C

Boring Log

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Attachment D

Photographs



Red Hills North Unit #603, Area of Leak, February 1, 2016



Red Hills North Unit #603 Spill Area, Viewing Southeast, February 1, 2016



Red Hills North Unit #603 Spill Area, Viewing Southeast, February 1, 2016



Red Hills North Unit #603 Spill Area, Viewing Southwest, February 1, 2016