NTO1423251161

1RP-3256

Chevron Special Projects

Closure w/Approval Signature

VGSAU 16

12/2/2019

Chevron

Luke Welch
Project Manager

Upstream Business Unit
Environmental Management Company
1400 Smith Street
Room 07069B
Houston, Texas 77002
Tel 713-372-0292
Luke.Welch@chevron.com

December 5, 2014

Mr. Tomas Oberding
Environmental Specialist
New Mexico Oil Conservation Division
1625 N. French Dr.
Hobbs, New Mexico 88240

Re : Chevron Special Projects – VGSAU 16 (RP# 3256)

Dear Mr. Oberding,

Please find enclosed for your records, a copy of the final report documenting the final closure activities at the Vacuum Grayburg San Andres Unit No. 16 (RP #3256).

The report was prepared by Arcadis US, Inc. (Arcadis) on behalf of Chevron Environmental Management Company (CEMC) to document remedial activities performed for CEMC at the above referenced site. Please note in the report, Arcadis states the depth to groundwater is less than 100 feet, however this information was obtained from NMOSE records dating back over twenty years ago. Chevron has several environmental projects in the immediate vicinity and has measured groundwater depths in the last year ranging from 120 – 140 feet below grade surface.

The assessment did not identify any residual impacts in soils above regulatory limits and as such, CEMC now considers project activities to be complete and respectfully requests the NMOCD to grant a no further action status. Should you have any questions regarding the content of the report, please do not hesitate to contact me by phone at 713-372-0292 or via e-mail at luke.welch@chevron.com.

Sincerely,

Luke Welch
Environmental Project Manager

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

OPERATOR

☐ Initial Report ☒ Final Report

Name of Company: CHEVRON U.S.A. Inc.	Contact: Luke Welch
Address: 56 Texas Camp Road, Lovington, NM 88260	Telephone No.: Office: (713) 372-0292 Mobile: (832) 627-9171
Facility Name: Vacuum Grayburg San Andres Unit #16	Facility Type: Water Injection Well

Surface Owner:	Mineral Owner:	API No. 3002534944

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
I	02	18.0S	34.0E					Lea

Latitude 32.77345715° **Longitude** -103.5268596°

NATURE OF RELEASE

Type of Release: Flare	Volume of Release 12.354 bbls of produced water ~40,000 Chlorides	Volume Recovered: 12 bbls
Source of Release: Flare	Date and Hour of Occurrence: 11/10/11 9:30	Date and Hour of Discovery: 11/10/11 9:45
Was Immediate Notice Given? ☐ Yes ☒ No ☐ Not Required	If YES, To Whom?	
By Whom? David Pagano	Date and Hour:	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*
N/A

Describe Cause of Problem and Remedial Action Taken.*

Internal Corrosion on tubing collar caused pinhole leak. Immediately ordered vacuum truck to be onsite to contain and contacted 3rd party to plug leak and repair.

Describe Area Affected and Cleanup Action Taken.*

Spill contained, liquid was vacuumed, excavated down to 2 ft bgs, and impacted soil was disposed. Vacuum truck recovered 12 bbls of fluid.

Five discrete soil confirmation samples were collected from the base of the excavation. These sampling results indicated the presence of hydrocarbon and chloride concentrations in shallow soils at levels of regulatory concern.

In response to the sampling results, an additional site assessment was conducted to confirm the extent of soil impacts. Results of the additional assessment are provided in the attached report.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature: Luke Welch	OIL CONSERVATION DIVISION	
Printed Name: Luke Welch	Approved by Environmental Specialist: Bradford Billings	
Title: Project Manager	Approval Date: 12/2/2019	Expiration Date:
E-mail Address: LWelch@chevron.com	Conditions of Approval:	Attached ☐
Date: 11-19-14 Phone: (713) 372-0292		

* Attach Additional Sheets If Necessary

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ENVIRONMENT

Mr. Luke Welch
Project Manager
Chevron Environmental Management Company
1400 Smith Street, Room 07069B
Houston, Texas 77002

Subject:
Site Assessment Report
Vacuum Grayburg San Andres Unit 16
Lea County, New Mexico

Date:
December 2, 2014

Contact:
Jonathan Olsen

Phone:
713.953.4874

Email:
Jonathan.Olsen@arcadis-us.com

Our ref:
B0048601.0000

Dear Mr. Welch:

On behalf of Chevron Environmental Management Company (CEMC), ARCADIS U.S., Inc. (ARCADIS) prepared this Site Assessment Report (report) to document cleanup actions and soil sampling activities at the Vacuum Grayburg San Andres Unit 16 (VGSAU #16) located in Lea County, New Mexico (site; Figure 1). These activities were conducted in response to a release of approximately 12.35 barrels (bbls) of produced water that occurred on November 10, 2011.

To evaluate the potential for this release to impact groundwater, ARCADIS developed a Site Conceptual Model (SCM; Attachment 1). Based on the SCM, potential impacts to groundwater are not considered possible due to the following:

- The small volume of material released (12.35 total bbls).
- Response activities included removal of liquids and impacted surface soil.
- Local conditions include low rainfall and high evapotranspiration, which minimize potential infiltration.
- The presence of a caliche layer impedes the vertical migration of liquids.
- Groundwater is encountered at significant depth (96 feet below ground surface [bgs]).
- Geochemical modeling using the United States Environmental Protection Agency (USEPA) Multimedia Exposure Assessment Model (MULTIMED) Version 2.0

(USEPA 1996) indicates that a significantly larger release would be necessary to cause an exceedance of regulatory criteria in groundwater.

This report describes spill response activities for the November 10, 2011 release and follow-up soil assessment activities that occurred on May 20, 2013.

Background Information

This section summarizes the site location and description, as well as the regional setting including geology, hydrogeology, nearby drinking water wells, surface water, and climate.

Site Location and Description

The site is located within the Chevron-operated Vacuum Unit, approximately 14 miles southwest of Lovington, New Mexico. New Mexico Highway 238 is located approximately 2 miles east of the site.

The site is located in the western edge of the Permian Basin, a 75,000-square-mile area in west Texas and New Mexico that is populated by numerous oil and gas production wells. In New Mexico, the Permian Basin extends to Roosevelt County to the north and Chaves County to the west. Lovington (the closest town) is located approximately 14 miles northeast of the site and the closest agricultural area is located approximately 9 miles northeast of the site.

The site is located southeast of the VGSAU #16 wellhead. The release described in the following sections occurred in the field next to the well pad. A photo log of the site is included as Attachment 2.

Nearby Water Wells and Surface Water

Based on satellite imagery, no surface-water bodies were identified within 3 miles of the site (GoogleEarth 2014).In May 2013, ARCADIS field verified that no surface-water bodies are located within 1,000 feet of the site.

In September 2014, ARCADIS reviewed information obtained from the New Mexico Office of the State Engineer (NMOSE) online database (NMOSE 2011), which indicates that no water-supply wells are located within 1,000 feet of the site. The NMOSE online database identified 298 water-supply wells within a 5-mile radius of the site (NMOSE 2011). A petroleum-industry-related water-supply well, located

approximately 1,700 feet southeast (i.e., hydraulically downgradient) of the site, was identified as the closest designated-use well to the site.

Climate

Monthly average temperatures near the site vary from a minimum of 27.9 degrees Fahrenheit (°F) in January to a maximum of 93.9°F in July (Western Regional Climate Center [WRCC] Hobbs, New Mexico [294026] weather station). Total average precipitation in the area of the site recorded from the available WRCC period of record between 1912 and 2013 was approximately 15.75 inches per year (WRCC 2014a).

Due to the arid climate, the site experiences low precipitation and high evapotranspiration rates. The total average evapotranspiration from the available WRCC period of record between 1914 and 2005 was approximately 87.68 inches per year (WRCC 2014b).

Regional Geology and Hydrogeology

The site elevation is approximately 4,010 feet above mean sea level. The site is located in the Querecho Plains immediately west of the Mescalero Ridge, which demarcates the western boundary of the (Miocene to Pliocene) High Plains Ogallala Formation (Reeves 1972). A rapid drop in elevation of 200 to 250 feet occurs west of the northwest-trending Mescalero Ridge. The Ogallala Formation east of the ridge is predominantly composed of unconsolidated alluvial fan deposits of sand and gravel near the base, overlain by interbedded sand and clay in the upper portion (Seni 1980). Repeated depositional events on the High Plains surface beginning approximately 7 million years ago, followed by aerial exposure, generated a thick sequence of caliche horizons that are competent enough to act as a cliff for the expression of Mescalero Ridge. These hard caliche deposits form the upper portion of the stratigraphic sequence. In the site area, the Ogallala Formation is underlain by red beds of the Upper Triassic-age Dockum Group. The nearest area where the Ogallala is underlain by the Cretaceous-age Trinity Group is approximately 45 miles to the northwest of the site (Fallin 1988).

The Querecho Plain is 80 percent covered by a moderately stable dune field (Reeves 1972) that is deposited on top of Triassic Dockum red beds. The red bed surface, which is 400,000 to 500,000 years old, is relatively flat with minor erosional incisions and a 3- to 13-foot-thick near-surface caliche layer (Bachman 1980). Deposition of sand and the formation of the dune field began 60,000 years ago, with additional development beginning 9,000 years ago (Hall 2002). The surface and interior of

these dunes do not contain caliche; however, a 1-foot layer of caliche is common at the bottom of the dunes at the contact with the red bed surface. Groundwater in the area is in the Dockum Group at a depth of approximately 100 feet (Summers 1972). Compared to the Ogallala Formation to the west of the site, the Dockum Group groundwater is not a major resource in the area, with poor potential water production rates and elevated natural dissolved solids.

Water-supply wells located on the southern High Plains east of Mescalero Ridge in central Lea County and near the site, as discussed in the Nearby Water Wells and Surface Water section of this report, are completed in the High Plains Aquifer (HPA). The HPA consists primarily of the Ogallala Formation, and in localized areas, alluvial sediment of Quaternary age. Near the site, the HPA is present directly above the Triassic-age Dockum Group, which occurs at a depth of approximately 140 feet bgs (Ash 1963, Fahlquist 2003, Nativ 1988, Nicholson and Clebsch 1961, Tillery 2008). The regional groundwater flow direction is to the east-southeast (Tillery 2008).

Groundwater near the site is encountered at a depth of approximately 96 feet bgs (NMOSE 2014; Attachment 3).

Initial Release Response Activities

A release of approximately 12.35 bbls of produced water occurred at the site on November 10, 2011 due to a pinhole leak in a tubing collar. Chevron personnel from the Mid-Continent Business Unit (MCBU) stopped the release and recovered approximately 12 bbls of fluids using a vacuum truck. Chevron MCBU personnel excavated visually impacted soil in the area to a depth of approximately 2 feet bgs and collected five discrete confirmation soil samples from the base of the excavation on November 17, 2011. Information regarding the disposal of the excavated soil was not provided. After collecting the soil samples, the excavated area was reportedly backfilled with imported soil.

Pursuant to New Mexico Oil Conservation Division (NMOCD) requirements (NMOCD 1993), David Pagano (Chevron MCBU) submitted a Notification of Release and Correction (Form C-141) detailing the location, volume of release, and initial and planned cleanup efforts taken for the site. The original and updated C-141 forms are included as Attachment 4.

Confirmation Soil Sampling

Five discrete confirmation soil samples were collected from the base of the excavation on November 17, 2011. As reported in the laboratory analytical report

(Attachment 5), soil sample containers were transported on ice, under chain of custody procedures to Cardinal Laboratories Environmental Analytical Services for the following analyses:

- Benzene, toluene, ethylbenzene, and total xylenes (BTEX) by USEPA Method 8021B
- Total petroleum hydrocarbons as gasoline range organics (TPH-GRO) and total petroleum hydrocarbons as diesel range organics (TPH-DRO) by USEPA Method 8015M
- Chloride by USEPA Method SM4500Cl-B.

Confirmation soil sample results are presented in Table 1. The complete laboratory analytical results with chain of custody documentation are included in Attachment 5.

Data Evaluation Approach

Chevron MCBU personnel compared data from the five November 2011 confirmation soil samples to regulatory criteria to provide context for the concentrations of analytes detected and to evaluate the need for additional sampling. The regulatory criteria selected are based on potential receptors near the site and consist of the following:

- NMOCD risk-based soil remediation action levels (SRALs) for benzene, total BTEX, and total petroleum hydrocarbons (TPH) for leaks, spills, and releases (NMOCD 1993). SRALs were calculated using the NMOCD criteria presented in the tables below.

Criteria	Site-Specific Result	Ranking Score
Depth to groundwater	50 to 99 feet	10
Wellhead protection area	No	0
Distance to surface-water body	>1,000 feet	0
Total Ranking Score		**10**

SRALs	Benzene (mg/kg)	Total BTEX (mg/kg)	TPH (mg/kg)
	10	50	1,000

Note:
mg/kg = milligrams per kilogram

- New Mexico Administrative Code (NMAC) closure criteria for soil beneath belowgrade tanks, drying pads associated with closed-loop systems, and pits where contents are removed (NMAC 2009).

Criteria	Site-Specific Result	Chloride (mg/kg)
Depth below bottom of pit to groundwater	50 to 100 feet	500

Confirmation Soil Sample Results

The analytical results for BTEX, TPH-GRO, TPH-DRO, and chloride for the five discrete confirmation soil samples collected in November 2011 are provided in Table 1 and summarized below:

- Of the five confirmation soil samples collected, ethylbenzene and total xylenes were detected above the laboratory reporting limits (LRLs) in only one soil sample collected at VGSAU #16 SP#5 (0.272 and 0.625 mg/kg, respectively). Benzene and BTEX were not detected above the SRALs of 10 and 50 mg/kg, respectively in any of the five confirmation soil samples.

- TPH-GRO was detected above LRLs in only one of the five soil samples collected (VGSAU #16 SP#5 at 24.4 mg/kg).

- TPH-DRO was detected above LRLs in all five soil samples collected at concentrations ranging from 32.5 mg/kg (VGSAU#16 SP#1) to 1,450 mg/kg (VGSAU#16 SP#4).

- TPH (TPH-DRO and TPH-GRO) was detected in all five confirmation samples, at concentrations ranging from 32.5 mg/kg (VGSAU #16 SP#1) to 1,474.4 mg/kg (VGSAU #16 SP#5). TPH was detected above the SRAL of 1,000 mg/kg in soil sample VGSAU #16 SP#5.

- Chloride was detected in all five confirmation samples collected, at concentrations ranging from 5,760 mg/kg (VGSAU#16 SP#1) to 14,000 mg/kg (VGSAU#16 SP#2). Chloride was detected above the NMAC closure criterion of 500 mg/kg in all five samples collected.

The complete laboratory analytical results with chain of custody documentation are included in Attachment 5.

TPH concentrations in confirmation soil sample VGSAU #16 SP#5 and chloride concentrations in all five confirmation soil samples were above the regulatory criteria, which prompted additional site assessment activities.

Site Assessment Activities

In May 2013, ARCADIS conducted site assessment activities to characterize the lateral and vertical extents of potential soil impacts at the site. Soil boring locations were selected based on the results of confirmation soil sampling completed at the site in November 2011, locations of pipelines and other equipment at the site, and the extent of the release as documented by Chevron MCBU personnel during the initial response activities. The site assessment activities and results are discussed below.

Pre-Field Activities

Prior to initiating field activities, ARCADIS updated the site-specific Health and Safety Plan in accordance with state and federal requirements. Prior to initiating drilling activities, underground utilities and other potential subsurface obstructions near the proposed boring locations were located and marked. A New Mexico One Call ticket was issued for the site, and a private third-party utility locator cleared all proposed boring locations for potential on- and off-site utilities that were not otherwise identified. Finally, ARCADIS staff conducted a visual inspection of the site to identify potential utility lines. Boring locations were flagged during the utility locate and coordinates were recorded using a Trimble® global positioning unit with differential capability.

Soil Sampling

To evaluate the potential extent of impacts to soil at the site, ARCADIS advanced seven soil borings (VGSAU 16-01, VGSAU 16-02, VGSAU 16-03, VGSAU 16-04, VGSAU 16-05, VGSAU 16-06, and VGSAU 16-07) on May 20, 2013. Soil sample locations are shown on Figure 2.

Prior to conducting drilling activities, each boring location was cleared for subsurface utilities with an air knife. The air knife could not be advanced more than 2 to 3 inches bgs due to the presence of a thick caliche layer. Each soil boring was then advanced to a total depth of approximately 30 feet bgs using air rotary drilling equipment.

Soil was continuously logged for stratigraphic characteristics. The soil samples were field screened for the presence of volatile organic compounds using a photo

ionization detector (PID) in combination with visual and olfactory screening methods for evidence of petroleum hydrocarbons. The PID used during this investigation was calibrated daily with fresh air and isobutylene gas. Field personnel recorded PID readings, soil types, and other pertinent geologic data on the boring logs (Attachment 6). No staining or elevated PID readings were observed.

Lithologic data indicate that the subsurface material primarily consists of caliche (soil carbonate) profiles including “caprock,” nodular, and sandy caliche layers from approximately 0 to 30 feet bgs (Attachment 6).

Soil Assessment Sampling

Seven soil samples were collected from each boring location (for a total of 49 soil samples) beginning at a depth of 2 feet bgs (the approximate depth of the soil excavation in the initial release response activities) and continuing at 5-foot intervals from 5 to 30 feet bgs.

The assessment soil samples were retained in clean, laboratory-supplied glass jars, labeled, placed in an ice-chilled cooler, and submitted under appropriate chain of custody protocols to TestAmerica Laboratories.

Soil samples collected from boring locations VGSAU 16-05, VGSAU 16-06, and VGSAU 16-07 were placed on hold pending analytical results from the other sample locations. Based on the analytical results, one soil sample collected from boring location VGSAU 16-05 at a depth of 2 feet bgs, one soil sample collected from boring location VGSAU 16-06 at a depth of 2 feet bgs, and three soil samples collected from boring location VGSAU 16-07 at depths of 20, 25, and 30 feet bgs were analyzed. A total of 33 out of the 49 soil assessment samples collected were analyzed.

Soil Assessment Sample Analysis

Soil samples collected from each boring were analyzed for one or more of the following constituents:

- BTEX by USEPA Method 8021B
- TPH-GRO by USEPA Method 8015B
- TPH-DRO by USEPA Method 8015B
- Chloride by USEPA Method 9056

Boring Abandonment

Following sampling, the boreholes were filled with soil cuttings from the total depth to ground surface. The ground surface was restored to match the surrounding conditions.

Soil Assessment Comparison Criteria

To support site closure, ARCADIS developed a site-specific soil screening level (SSL) for chloride by simulating unsaturated zone flow, transport, and saturated zone mixing of chloride using the MULTIMED model Version 2.0 (USEPA 1996). The NMAC chloride standard for domestic water supply of 250 milligrams per liter (NMAC 2001) was used to estimate a maximum allowable concentration of chloride in soil that would not leach to groundwater above the standard. The NMAC chloride standard is consistent with the National Secondary Drinking Water Standard for chloride, addressing taste and odor concerns (USEPA 2010).

Conservative site-specific input parameters were used in the MULTIMED (USEPA 1996) simulations compared to actual site and release conditions. Specifically:

- Modeled source lengths and areas modeled are generally significantly larger than the actual chloride-impacted soil areas.
- Chloride-impacted soil was modeled as having a uniform chloride concentration for the entire volume (i.e., area x depth) of specified soil.
- A reduction in chloride concentrations in subsurface soil due to soil chemical transformation or adsorption mechanisms was not included in the model calculations.

Based on the depth to groundwater and the aerial and vertical extents of each of the MULTIMED (USEPA 1996) simulations, with these conservative site-specific input parameters, modeled peak chloride concentrations will reach groundwater in approximately 540 to 860 years.

A memo, Chloride MULTIMED Simulated Soil Screening Levels for the Protection of Groundwater, is included as Attachment 7. The site-specific SSL was calculated using the input parameters presented in the table below.

Site-Specific Input Parameters	
Source length (m)	45
Source area (m^2)	2,000
Source depth (m)	0 to 1
Depth to groundwater (m)	20
Chloride SSL (mg/kg)	**38,000[1]**

[1] A chloride SSL of 38,800 mg/kg was calculated using MUTLTIMED (USEPA 1996)
m = meter
m^2 = square meter

Soil Assessment Sample Results

The analytical results for BTEX, TPH-GRO, TPH-DRO, and chloride for the 33 soil assessment samples are provided in Table 1 and summarized below:

- Benzene, ethylbenzene, and total xylenes were not detected above LRLs in any of soil assessment samples. Toluene was detected in 26 of the 28 soil assessment samples that were analyzed for BTEX at concentrations ranging from 0.011 mg/kg (VGSAU 16-02 at 10 feet bgs) to 0.025 mg/kg (VGSAU 16-02 at 5 feet bgs).

- TPH-GRO was not detected above LRLs in any of the soil assessment samples.

- TPH-DRO was detected above LRLs in only one of the 28 soil assessment samples analyzed for TPH-DRO at a concentration of 28.7 mg/kg (VGSAU 16-01 at 25 feet bgs).

- Chloride was detected in all 33 soil assessment samples at concentrations ranging from 32 mg/kg (VGSAU 16-04 at 15 feet bgs) to 672 mg/kg (VGSAU 16-02 at 20 feet bgs).

Laboratory analytical results with chain of custody documentation are provided in Attachment 5.

Summary and Conclusions

A release of produced water occurred at the site on November 10, 2011 due to a pinhole leak in a tubing collar. Chevron MCBU personnel stopped the release and recovered approximately 12 bbls of fluids (primarily oil) using a vacuum truck. Visually impacted soil was excavated to a depth of approximately 2 feet bgs and five

discrete confirmation soil samples were collected from the base of the excavation in November 2011.

Based on confirmation soil sampling results for TPH and chloride above regulatory criteria, additional investigation was planned. In May 2013, additional soil samples were collected to assess soil impacts within the observed aerial extent of the release. Chloride concentrations in soil were below the site-specific SSL, which was calculated using the MULTIMED model (USEPA 1996).

All 33 soil assessment samples collected in May 2013, had chloride concentrations below the site-specific SSL (Attachment 7) and 1,000 mg/kg. Not all chloride concentrations were delineated to 250 mg/kg; however chloride impacts in shallow soil potentially associated with the release were delineated.

Potential migration of remaining petroleum hydrocarbons or chloride to groundwater is not expected due to the small size of the release, low precipitation (WRCC 2014a), high evapotranspiration rates (WRCC 2014b), and fine-grained nature of caliche layers present beneath the site. MULTIMED model results demonstrate that the remaining soil concentrations associated with the release do not pose significant risk to groundwater resources or other receptors.

Soil data presented in this report support a conclusion that impacted soil associated with the November 10, 2011 release at the site poses no significant threat to groundwater resources or other receptors. ARCADIS recommends that CEMC submit a request to the NMOCD that no further investigations or additional cleanup actions need to be performed at the site and that the NMOCD grant No Further Action status to the site.

If you have any questions or comments regarding the information presented in this report, please contact Jonathan Olsen at 713.953.4874 or at Jonathan.Olsen@arcadis-us.com, or Kathleen Abbott at 925.296.7827 or at Kathleen.Abbott@arcadis-us.com.

Sincerely,

ARCADIS U.S., Inc.

Jonathan Olsen
Certified Project Manager

Kathleen M. Abbott, PG
Program Manager

Enclosures:

Table 1	Soil Sampling Analytical Results
Figure 1	Site Location Map – VGSAU #16
Figure 2	Release and Soil Boring Locations – VGSAU #16

Attachments:

Attachment 1	Site Conceptual Model
Attachment 2	Photo Log
Attachment 3	New Mexico Office of the State Engineer – Depth to Water
Attachment 4	Release Notification and Corrective Action (C-141 Form)
Attachment 5	Laboratory Analytical Reports
Attachment 6	Boring Logs (May 2013)
Attachment 7	Chloride Multimedia Exposure Assessment Model Simulated Soil Screening Levels for the Protection of Groundwater Memo

References:

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ARCADIS

Table

Table 1
Soil Sampling Analytical Results

Site Assessment Report
Vacuum Grayburg San Andres Unit 16
Lea County, New Mexico

Boring Location ID	Sample Date	Sample Depth (feet bgs)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	Total BTEX (mg/kg)	TPH-GRO (mg/kg)	TPH-DRO (mg/kg)	Chloride (mg/kg)	% Moisture
		SRALs [a]	**10**	---	---	---	**50**	**1,000**		---	---
		NMAC Closure Criteria [b]	---	---	---	---	---	---	---	**250**	---
		MULTIMED Site-Specific SSL [c]	---	---	---	---	---	---	---	**38,800**	---
VGSAU#16 SP#1	11/17/2011	0	<0.050	<0.050	<0.050	<0.150	--	<10.0	32.5	5,760	--
VGSAU#16 SP#2	11/17/2011	0	<0.050	<0.050	<0.050	<0.150	--	<10.0	66.2	14,000	--
VGSAU#16 SP#3	11/17/2011	0	<0.050	<0.050	<0.050	<0.150	--	<10.0	63.5	9,000	--
VGSAU#16 SP#4	11/17/2011	0	<0.050	<0.050	<0.050	<0.150	--	<10.0	101	6,000	--
VGSAU#16 SP#5	11/17/2011	0	<0.050	<0.050	0.272	0.625	--	24.4	1450	6,720	--
VGSAU 16 - 01	5/20/2013	2	<0.052	0.019	<0.052	<0.156	0.019	<15.6	<15.6	112	3.6
	5/20/2013	5	<0.053	0.017	<0.053	<0.158	0.017	<15.8	<16.0	96	4.8
	5/20/2013	10	<0.053	0.021	<0.053	<0.158	0.021	<15.8	<15.8	144	5.2
	5/20/2013	15	<0.053	<0.053	<0.053	<0.160	<0.321	<16.0	<16.0	128	6.5
	5/20/2013	20	<0.056	0.023	<0.056	<0.169	0.023	<16.9	<16.9	80	11.4
	5/20/2013	25	<0.051	0.014	<0.051	<0.153	0.014	<15.3	28.7	64	1.7
	5/20/2013	30	<0.051	0.013	<0.051	<0.152	0.013	<15.2	<15.2	64	1.0
VGSAU 16 - 02	5/20/2013	2	<0.052	0.014	<0.052	<0.155	0.014	<15.5	<15.5	176	3.0
	5/20/2013	5	<0.053	0.017	<0.053	<0.159	0.017	<15.9	<15.9	176	5.5
	5/20/2013	10	<0.053	0.011	<0.053	<0.159	0.011	<15.9	<15.9	288	5.9
	5/20/2013	15	<0.051	0.016	<0.051	<0.153	0.016	<15.3	<15.3	192	2.0
	5/20/2013	20	<0.055	0.024	<0.055	<0.164	0.024	<16.4	<16.4	672	8.8
	5/20/2013	25	<0.054	<0.054	<0.054	<0.161	0.008	<16.1	<16.1	576	7.1
	5/20/2013	30	<0.059	0.020	<0.059	<0.177	0.020	<17.7	<17.7	160	15.3
VGSAU 16 - 03	5/20/2013	2	<0.053	0.015	<0.053	<0.158	0.015	<15.8	<15.8	288	5.3
	5/20/2013	5	<0.052	0.021	<0.052	<0.156	0.021	<15.6	<15.6	96	4.0
	5/20/2013	10	<0.056	0.018	<0.056	<0.169	0.018	<16.9	<16.9	240	11.2
	5/20/2013	15	<0.052	0.013	<0.052	<0.155	0.013	<15.5	<15.5	160	3.1
	5/20/2013	20	<0.055	0.016	<0.055	<0.164	0.016	<16.4	<16.4	224	8.5
	5/20/2013	25	<0.052	0.015	<0.052	<0.156	0.015	<15.6	<15.6	160	3.9
	5/20/2013	30	<0.054	0.015	<0.054	<0.163	0.015	<16.3	<16.3	64	7.8
VGSAU 16 - 04	5/20/2013	2	<0.052	0.023	<0.052	<0.157	0.023	<15.7	<15.7	560	4.4
	5/20/2013	5	<0.055	0.025	<0.055	<0.166	0.025	<16.6	<16.6	80	9.7
	5/20/2013	10	<0.053	0.014	<0.053	<0.160	0.014	<16.0	<16.0	48	6.5
	5/20/2013	15	<0.052	0.014	<0.052	<0.157	0.014	<15.7	<15.7	32	4.3
	5/20/2013	20	<0.056	0.012	<0.056	<0.168	0.012	<16.8	<16.8	80	10.6
	5/20/2013	25	<0.053	0.013	<0.053	<0.158	0.013	<15.8	<15.8	48	5.1
	5/20/2013	30	<0.051	0.014	<0.051	<0.152	0.014	<15.2	<15.2	96	1.4
VGSAU 16 - 05	5/20/2013	2	--	--	--	--	--	--	--	192	--
VGSAU 16 - 06	5/20/2013	2	--	--	--	--	--	--	--	48	--
VGSAU 16 - 07	5/20/2013	20	--	--	--	--	--	--	--	80	--
	5/20/2013	25	--	--	--	--	--	--	--	128	--
	5/20/2013	30	--	--	--	--	--	--	--	160	--

Notes:

%	Percent
mg/kg	Miligram(s) per kilogram
<	Analyte was not detected above the specified method reporting limit
--*	Information regarding the depth of these samples is not available.
--	Not Analyzed/Not Listed
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
MULTIMED	Multimedia Exposure Assessment Model
NMAC	New Mexico Administrative Code
TPH-GRO	Total Petroleum Hydrocarbons as Gasoline Range Organics
TPH-DRO	Total Petroleum Hydrocarbons as Diesel Range Organics
SRAL	Soil remediation action level
SSL	Soil screening level

(a) SRALs, for leaks, spills, and releases, New Mexico Oil Conservation Division, August 1993
(b) Title 19, Chapter 15 of the NMAC concerning pits, closed-loop systems, below grade tanks and sumps, and other alternative methods, 19.15.17 NMAC, July 2009
(c) MULTIMED exposure assessment, 2.0 Beta, United States Environmental Protection Agency, October 1996

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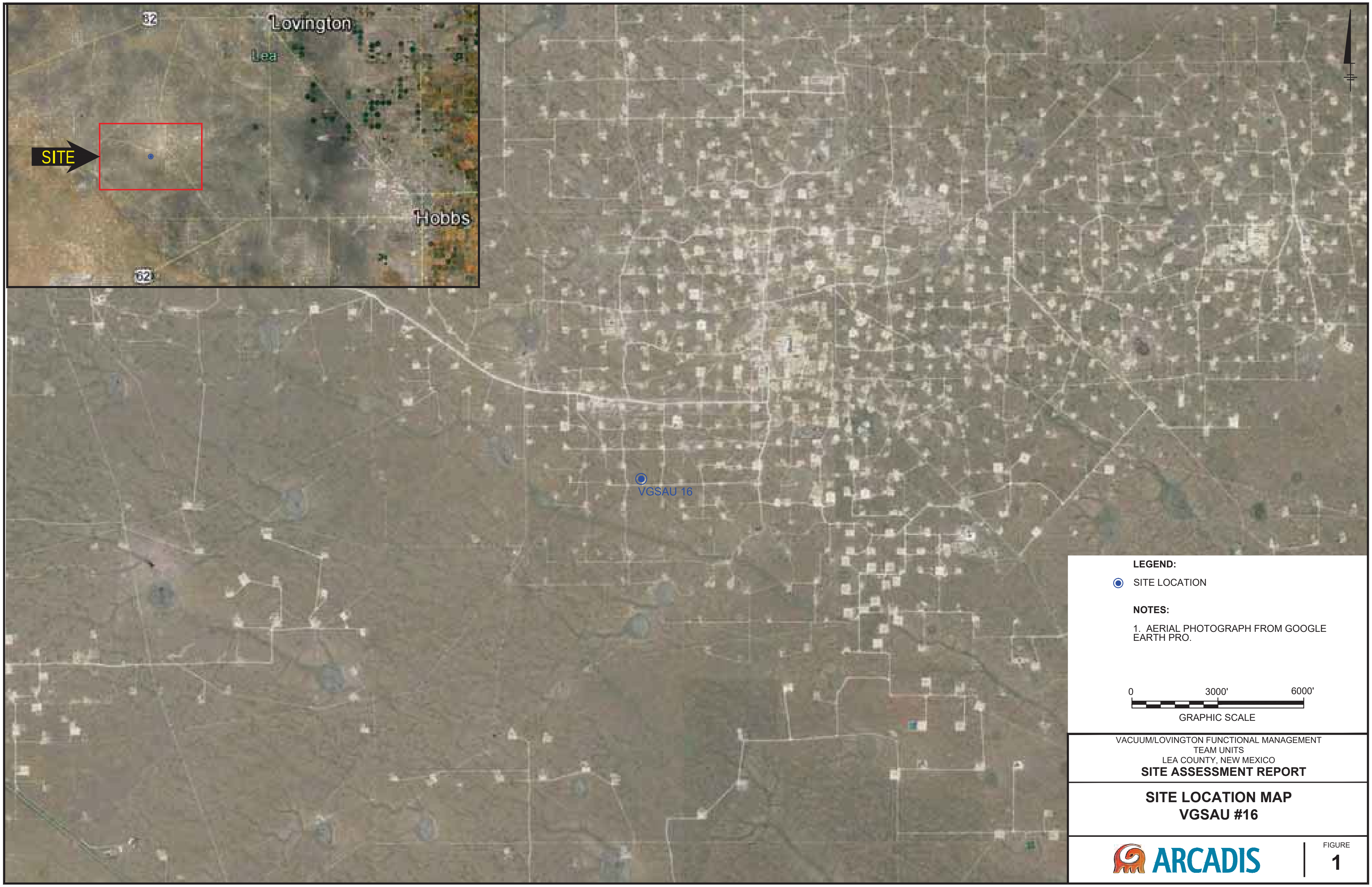
Figures



LEGEND:

SITE LOCATION

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO.

0 3000' 6000'

GRAPHIC SCALE

VACUUM/LOVINGTON FUNCTIONAL MANAGEMENT TEAM UNITS
LEA COUNTY, NEW MEXICO
SITE ASSESSMENT REPORT

SITE LOCATION MAP
VGSAU #16

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FIGURE
1

CITY: MANCHESTER DIV/GROUP: ENVCAD DB: B.SMALL PM: TM: LAYOUT: 1 SAVED: 4/30/2014 7:11 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 4/30/2014 7:11 PM BY: SMALL, BRIAN
G:\ENVCAD\Manchester\ACT\B0048615\0000\00002\B00486150000-VGSAU16.dwg

CITY: MANCHESTER DIV/GROUP: ENVCAD DB: B.SMALL PM: TM
G:\ENVCAD\Emeryville\RETURN-TO\Manchester-CT\B0048601\Final\B00486010000-B02.dwg LAYOUT: 1 SAVED: 11/15/2013 4:26 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 11/15/2013 4:27 PM BY: REYES, ALEC

LEGEND:

- MAY 2013 ASSESSMENT SOIL SAMPLING LOCATION
- 1 OCTOBER 2011 CONFIRMATION SOIL SAMPLING LOCATION
- UNDERGROUND UTILITY LINE
- ABOVE GROUND UTILITY LINE
- APPROXIMATE EXTENT OF SPILL

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO.
2. COORDINATES FOR ALL MAY 2013 SAMPLE LOCATIONS WERE COLLECTED USING A SUB-METER TRIMBLE GPS UNIT.
3. UTILITIES WERE IDENTIFIED USING GROUND PENETRATING RADAR, RADIO FREQUENCY SURVEY OR VISUAL MEANS.

0 40' 80'

GRAPHIC SCALE

VACUUM/LOVINGTON FUNCTIONAL MANAGEMENT TEAM UNITS
LEA COUNTY, NEW MEXICO
SITE ASSESSMENT REPORT

RELEASE AND SOIL BORING LOCATIONS VGSAU #16

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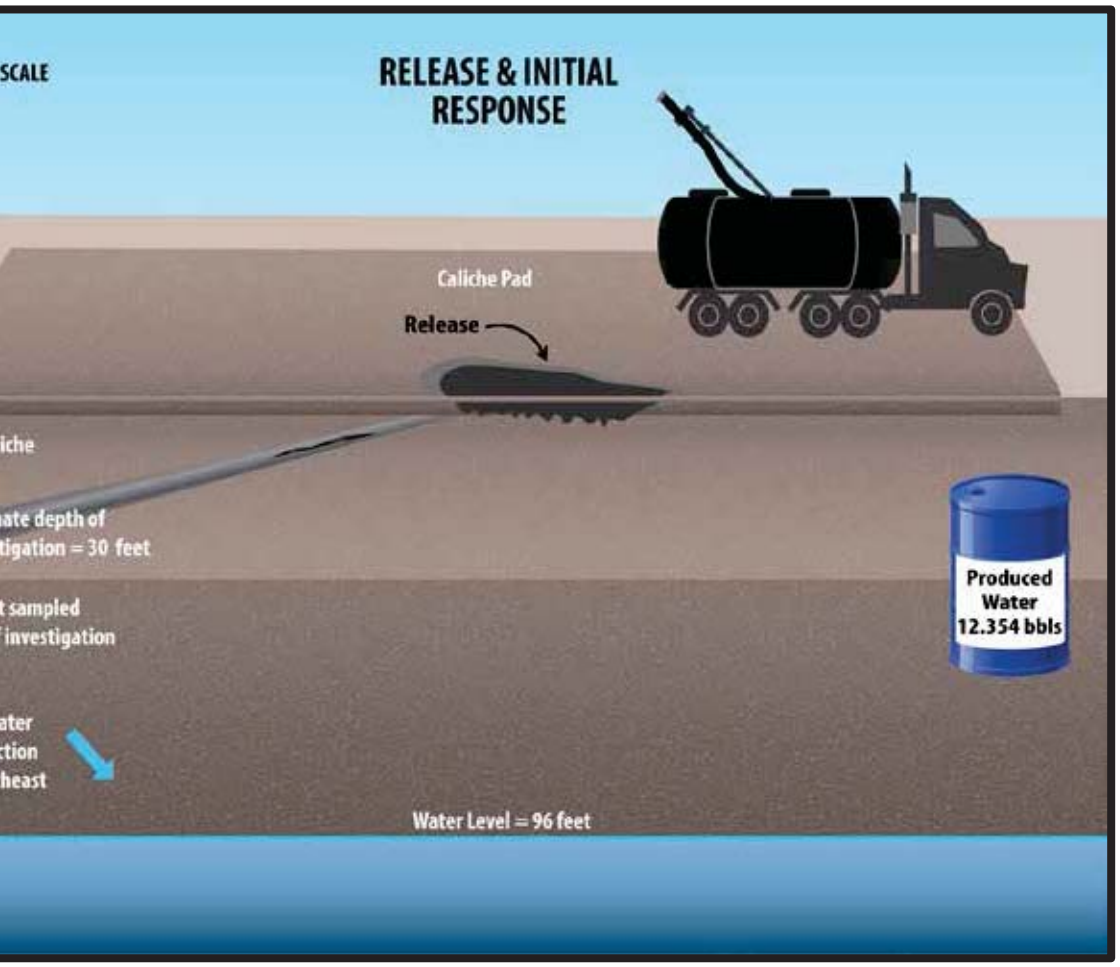
FIGURE
2

ARCADIS

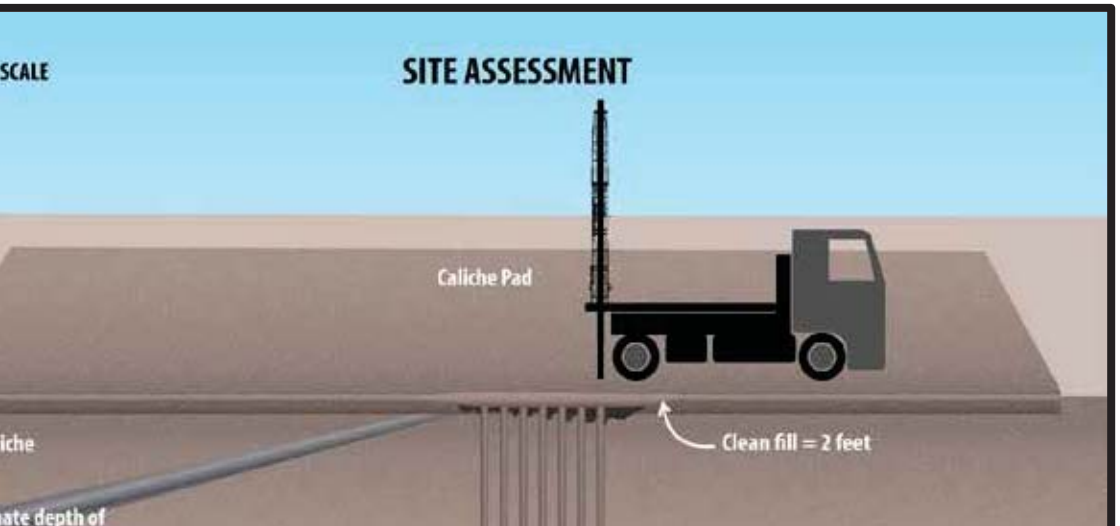
Attachment 1

Site Conceptual Model

precipitation and high evapotrans
rates. According to information ob
from the NMOSE online databas
groundwater near the site is enco
a depth of approximately 96 feet



A release of approximately 12.35
produced water occurred at the s
November 10, 2011 due to a pinh
an underground utility line. Chevr
personnel from the MidContinent
Unit (MCBU) stopped the release
recovered an approximately 12 b
using a vacuum truck. Chevron M
personnel excavated visually imp
in the area to a depth of approxim
feet bgs and collected five discre
confirmation soil samples from th
the excavation. Analyte concentr
one or more confirmation soil sam
above regulatory criteria, which p
additional site assessment activit



In May 2013, ARCADIS conduct
assessment activities to charact
lateral and vertical extents of soi
the site. Soil boring locations we
based on the results of confirma
sampling completed at the site in
2011, locations of pipelines and
equipment at the site, and the ex
release as documented by Chev
personnel during the initial respo
activities. Analyte concentrations
collected during the 2013 assess
reported below site-specific crit
assessment activities demonstra

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Attachment 2

Photolog

Photograph 1 – Vacuum Grayburg San Andres Unit #16; Facing Northwest

Photograph 2 – Vacuum Grayburg San Andres Unit #16 release area; Facing Northeast

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Attachment 3

New Mexico Office of the State Engineer – Depth to Water

New Mexico Office of the State Engineer
Water Column/Average Depth to Water

(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is closed)

(quarters are 1=NW 2=NE 3=SW 4=SE)
(quarters are smallest to largest)

(NAD83 UTM in meters)

(In feet)

POD Number	POD Sub-basin	County	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Distance	Depth Well	Depth Water	Water Column
L 04160	L	LE		3	3	01	18S	34E	638585	3626911*	627	165	100	65
L 02722 S3	L	LE		4	3	02	18S	34E	637374	3626892*	663			
L 05788 POD11	L	LE	2	3	2	02	18S	34E	637862	3627802*	689	240	95	145
L 05788 POD16	L	LE	2	3	2	02	18S	34E	637862	3627802*	689	240	96	144
L 05788 POD6	L	LE	2	3	2	02	18S	34E	637862	3627802*	689	240	94	146
L 05788 POD9	L	LE	2	3	2	02	18S	34E	637862	3627802*	689	250	95	155
L 05788 POD10	L	LE	4	4	1	02	18S	34E	637459	3627596*	713	240	100	140
L 05788 POD17	L	LE	4	4	1	02	18S	34E	637459	3627596*	713	240	97	143

Average Depth to Water: **96 feet**

Minimum Depth: **94 feet**

Maximum Depth: **100 feet**

Record Count: 8

UTMNAD83 Radius Search (in meters):

Easting (X): 637995.5 **Northing (Y):** 3627125.56 **Radius:** 750

***UTM location was derived from PLSS - see Help**

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Attachment 4

Release Notification and Corrective Action (C-141 Form)

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

OPERATOR

☐ Initial Report ☒ Final Report

Name of Company Chevron USA Inc.	Contact David A. Pagano
Address 15 Smith Rd., Midland, TX, 79705	Telephone No. wk: 575-396-4414X275 cell: 505-787-9816
Facility Name Vacuum Grayburg San Andres Unit #16	Facility Type Water Injection Well

Surface Owner	Mineral Owner	API No. 3002524308

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
I	02	18.0S	34E					Lea

VGSAU 016 Latitude: 32.77345715 Longitude; -103.5268596

NATURE OF RELEASE

Type of Release Flare	Volume of Release 12.354 bbls of produced water ~40,000 Chlorides	Volume Recovered 12bbls
Source of Release Flare	Date and Hour of Occurrence 11/10/11 9:30	Date and Hour of Discovery 11/10/11 9:45
Was Immediate Notice Given? ☐ Yes ☒ No ☐ Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

N/A

Describe Cause of Problem and Remedial Action Taken.*

Internal Corrosion on tubing collar caused pinhole leak. Immediately had Vacuum Truck to be onsite to contain and contacted 3rd party to plug leak and repair.

Describe Area Affected and Cleanup Action Taken.*

12bbls of fluid recovered with vacuum truck and initiated back hoe to pickup and dispose of contaminated soil (top 2ft of soil).

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature: David A	OIL CONSERVATION DIVISION	
Printed Name: David A. Pagano	Approved by Environmental Specialist:	
Title: Health & Environmental Specialist	Approval Date:	Expiration Date:
E-mail Address: dpgn@chevron.com	Conditions of Approval:	Attached ☐
Date: 10/6/11 Phone: 505-787-9816		

* Attach Additional Sheets If Necessary

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

OPERATOR

☐ Initial Report ☒ Final Report

Name of Company: CHEVRON U.S.A. Inc.	Contact: Luke Welch
Address: 56 Texas Camp Road, Lovington, NM 88260	Telephone No.: Office: (713) 372-0292 Mobile: (832) 627-9171
Facility Name: Vacuum Grayburg San Andres Unit #16	Facility Type: Water Injection Well

Surface Owner:	Mineral Owner:	API No. 3002534944

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
I	02	18.0S	34.0E					Lea

Latitude 32.77345715° **Longitude** -103.5268596°

NATURE OF RELEASE

Type of Release: Flare	Volume of Release 12.354 bbls of produced water ~40,000 Chlorides	Volume Recovered: 12 bbls
Source of Release: Flare	Date and Hour of Occurrence: 11/10/11 9:30	Date and Hour of Discovery: 11/10/11 9:45
Was Immediate Notice Given? ☐ Yes ☒ No ☐ Not Required	If YES, To Whom?	
By Whom? David Pagano	Date and Hour:	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*
N/A

Describe Cause of Problem and Remedial Action Taken.*

Internal Corrosion on tubing collar caused pinhole leak. Immediately ordered vacuum truck to be onsite to contain and contacted 3rd party to plug leak and repair.

Describe Area Affected and Cleanup Action Taken.*

Spill contained, liquid was vacuumed, excavated down to 2 ft bgs, and impacted soil was disposed. Vacuum truck recovered 12 bbls of fluid.

Five discrete soil confirmation samples were collected from the base of the excavation. These sampling results indicated the presence of hydrocarbon and chloride concentrations in shallow soils at levels of regulatory concern.

In response to the sampling results, an additional site assessment was conducted to confirm the extent of soil impacts. Results of the additional assessment are provided in the attached report.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature: Luke Welch	OIL CONSERVATION DIVISION	
Printed Name: Luke Welch	Approved by Environmental Specialist:	
Title: Project Manager	Approval Date:	Expiration Date:
E-mail Address: LWelch@chevron.com	Conditions of Approval:	Attached ☐
Date: 11-19-14 Phone: (713) 372-0292		

* Attach Additional Sheets If Necessary

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Attachment 5

Laboratory Analytical Reports

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

November 28, 2011

DAVID PAGANO

Chevron - Lovington

HCR 60 Box 423

Lovington, NM 88260

RE: SOIL SAMPLES

Enclosed are the results of analyses for samples received by the laboratory on 11/18/11 12:00.

Cardinal Laboratories is accredited through Texas NELAP for:

Method SW-846 8021	Benzene, Toluene, Ethyl Benzene, and Total Xylenes
Method SW-846 8260	Benzene, Toluene, Ethyl Benzene, and Total Xylenes
Method TX 1005	Total Petroleum Hydorcarbons

Certificate number T104704398-08-TX. Accreditation applies to solid and chemical materials and non-potable water matrices.

Cardinal Laboratories is accreditated through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2	Haloacetic Acids (HAA-5)
Method EPA 524.2	Total Trihalomethanes (TTHM)
Method EPA 524.4	Regulated VOCs (V2, V3)

Accreditation applies to public drinking water matrices.

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Celey D. Keene

Celey D. Keene

Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

Chevron - Lovington
DAVID PAGANO
HCR 60 Box 423
Lovington NM, 88260
Fax To: None

Received:	11/18/2011	Sampling Date:	11/17/2011
Reported:	11/28/2011	Sampling Type:	Soil
Project Name:	SOIL SAMPLES	Sampling Condition:	Cool & Intact
Project Number:	NONE GIVEN	Sample Received By:	Jodi Henson
Project Location:	NOT GIVEN		

Sample ID: VGSAU #16 SP #1 (H102517-01)

BTEX 8021B mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/22/2011	ND	2.09	104	2.00	0.977	
Toluene*	<0.050	0.050	11/22/2011	ND	1.98	99.2	2.00	0.795	
Ethylbenzene*	<0.050	0.050	11/22/2011	ND	2.26	113	2.00	0.221	
Total Xylenes*	<0.150	0.150	11/22/2011	ND	6.51	109	6.00	0.0467	

Surrogate: 4-Bromofluorobenzene (PIL *109 %* *64.4-134*

Chloride, SM4500Cl-B mg/kg **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**5760**	16.0	11/22/2011	ND	432	108	400	3.64	

TPH 8015M mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/19/2011	ND	217	108	200	6.01	
DRO >C10-C28	**32.5**	10.0	11/19/2011	ND	188	94.2	200	8.91	

Surrogate: 1-Chlorooctane *80.1 %* *55.5-154*

Surrogate: 1-Chlorooctadecane *103 %* *57.6-158*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

Chevron - Lovington
DAVID PAGANO
HCR 60 Box 423
Lovington NM, 88260
Fax To: None

Received:	11/18/2011	Sampling Date:	11/17/2011
Reported:	11/28/2011	Sampling Type:	Soil
Project Name:	SOIL SAMPLES	Sampling Condition:	Cool & Intact
Project Number:	NONE GIVEN	Sample Received By:	Jodi Henson
Project Location:	NOT GIVEN		

Sample ID: VGSAU #16 SP #2 (H102517-02)

BTEX 8021B mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/22/2011	ND	2.09	104	2.00	0.977	
Toluene*	<0.050	0.050	11/22/2011	ND	1.98	99.2	2.00	0.795	
Ethylbenzene*	<0.050	0.050	11/22/2011	ND	2.26	113	2.00	0.221	
Total Xylenes*	<0.150	0.150	11/22/2011	ND	6.51	109	6.00	0.0467	

Surrogate: 4-Bromofluorobenzene (PIL *105 %* *64.4-134*

Chloride, SM4500Cl-B mg/kg **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**14000**	16.0	11/22/2011	ND	432	108	400	3.64	

TPH 8015M mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/19/2011	ND	217	108	200	6.01	
DRO >C10-C28	**66.2**	10.0	11/19/2011	ND	188	94.2	200	8.91	

Surrogate: 1-Chlorooctane *75.3 %* *55.5-154*

Surrogate: 1-Chlorooctadecane *96.2 %* *57.6-158*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

Chevron - Lovington
DAVID PAGANO
HCR 60 Box 423
Lovington NM, 88260
Fax To: None

Received:	11/18/2011	Sampling Date:	11/17/2011
Reported:	11/28/2011	Sampling Type:	Soil
Project Name:	SOIL SAMPLES	Sampling Condition:	Cool & Intact
Project Number:	NONE GIVEN	Sample Received By:	Jodi Henson
Project Location:	NOT GIVEN		

Sample ID: VGSAU #16 SP #3 (H102517-03)

BTEX 8021B mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/22/2011	ND	2.09	104	2.00	0.977	
Toluene*	<0.050	0.050	11/22/2011	ND	1.98	99.2	2.00	0.795	
Ethylbenzene*	<0.050	0.050	11/22/2011	ND	2.26	113	2.00	0.221	
Total Xylenes*	<0.150	0.150	11/22/2011	ND	6.51	109	6.00	0.0467	

Surrogate: 4-Bromofluorobenzene (PIL *106 %* *64.4-134*

Chloride, SM4500Cl-B mg/kg **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**9000**	16.0	11/22/2011	ND	432	108	400	3.64	

TPH 8015M mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/19/2011	ND	217	108	200	6.01	
DRO >C10-C28	**63.5**	10.0	11/19/2011	ND	188	94.2	200	8.91	

Surrogate: 1-Chlorooctane *83.9 %* *55.5-154*

Surrogate: 1-Chlorooctadecane *107 %* *57.6-158*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

Chevron - Lovington
DAVID PAGANO
HCR 60 Box 423
Lovington NM, 88260
Fax To: None

Received:	11/18/2011	Sampling Date:	11/17/2011
Reported:	11/28/2011	Sampling Type:	Soil
Project Name:	SOIL SAMPLES	Sampling Condition:	Cool & Intact
Project Number:	NONE GIVEN	Sample Received By:	Jodi Henson
Project Location:	NOT GIVEN		

Sample ID: VGSAU #16 SP #4 (H102517-04)

BTEX 8021B mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/22/2011	ND	2.09	104	2.00	0.977	
Toluene*	<0.050	0.050	11/22/2011	ND	1.98	99.2	2.00	0.795	
Ethylbenzene*	<0.050	0.050	11/22/2011	ND	2.26	113	2.00	0.221	
Total Xylenes*	<0.150	0.150	11/22/2011	ND	6.51	109	6.00	0.0467	

Surrogate: 4-Bromofluorobenzene (PIL *106 %* *64.4-134*

Chloride, SM4500Cl-B mg/kg **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**6000**	16.0	11/22/2011	ND	432	108	400	3.64	

TPH 8015M mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/19/2011	ND	217	108	200	6.01	
DRO >C10-C28	**101**	10.0	11/19/2011	ND	188	94.2	200	8.91	

Surrogate: 1-Chlorooctane *76.2 %* *55.5-154*

Surrogate: 1-Chlorooctadecane *99.4 %* *57.6-158*

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Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

Chevron - Lovington
DAVID PAGANO
HCR 60 Box 423
Lovington NM, 88260
Fax To: None

Received:	11/18/2011	Sampling Date:	11/17/2011
Reported:	11/28/2011	Sampling Type:	Soil
Project Name:	SOIL SAMPLES	Sampling Condition:	Cool & Intact
Project Number:	NONE GIVEN	Sample Received By:	Jodi Henson
Project Location:	NOT GIVEN		

Sample ID: VGSAU #16 SP #5 (H102517-05)

BTEX 8021B mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/23/2011	ND	2.09	104	2.00	0.977	
Toluene*	<0.050	0.050	11/23/2011	ND	1.98	99.2	2.00	0.795	
Ethylbenzene*	**0.272**	0.050	11/23/2011	ND	2.26	113	2.00	0.221	
Total Xylenes*	**0.625**	0.150	11/23/2011	ND	6.51	109	6.00	0.0467	

Surrogate: 4-Bromofluorobenzene (PIL *131 %* *64.4-134*

Chloride, SM4500Cl-B mg/kg **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**6720**	16.0	11/22/2011	ND	432	108	400	3.64	

TPH 8015M mg/kg **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**24.4**	10.0	11/19/2011	ND	217	108	200	6.01	
DRO >C10-C28	**1450**	10.0	11/19/2011	ND	188	94.2	200	8.91	

Surrogate: 1-Chlorooctane *82.5 %* *55.5-154*

Surrogate: 1-Chlorooctadecane *112 %* *57.6-158*

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Notes and Definitions

ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C
	Samples reported on an as received basis (wet) unless otherwise noted on report

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Marland, Hobbs, NM 88240
(575) 393-2326 FAX (575) 393-2476

Company Name:	Chevron
Project Manager:	David Pagano
Address:	56 Texas Camp Rd.
City:	Lovington State: NM Zip: 88260
Phone #:	505-787-9816 Fax #:
Project #:	Project Owner:
Project Name:	
Project Location:	
Sampler Name:	

BILL TO

P.O. #:	
Company:	Chevron
Attn:	Nick Moschetti
Address:	56 Texas Camp Rd.
City:	Lovington
State:	NM Zip: 88260
Phone #:	575-396-4414 x201
Fax #:	

ANALYSIS REQUEST

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRESERV.: ACID/BASE:	ICE / COOL	OTHER:	SAMPLING: DATE	TIME	TPH	BTEX	Chlorides
H102517																	
1	VGSAU #16 SP #1	✓	1			✓					✓		8/17/11	16:35	✓	✓	✓
2	VGSAU #16 SP #2	✓	1			✓							8/17/11	16:40	✓	✓	✓
3	VGSAU #16 SP #3	✓	1			✓							8/17/11	16:45	✓	✓	✓
4	VGSAU #16 SP #4	✓	1			✓							8/17/11	16:50	✓	✓	✓
5	VGSAU #16 SP #5	✓	1			✓				None			8/17/11	16:55	✓	✓	✓

Relinquished By:	Date: 8/18/11	Received By:	
	Time: 12:00		
Relinquished By:	Date:	Received By:	
	Time:		

Phone Result: ☐ Yes ☐ No Add'l Phone #:
Fax Result: ☐ Yes ☐ No Add'l Fax #:
REMARKS: email results to dpgn@chevron.com

Delivered By: (Circle One)
Sampler - UPS - Bus - Other: -1°C

Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No

CHECKED BY: (Initials)

† Cardinal cannot accept verbal changes. Please fax written changes to 505-393-2476

#26

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

June 28, 2013

JONATHAN OLSEN

ARCADIS U.S., INC. - HOUSTON

630 PLAZA DRIVE, SUITE 600

HIGHLANDS RANCH, CO 80129

RE: CHEVRON BUCKEYE FMT

Enclosed are the results of analyses for samples received by the laboratory on 05/21/13 17:00.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-11-3. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

Cardinal Laboratories is accreditated through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2	Haloacetic Acids (HAA-5)
Method EPA 524.2	Total Trihalomethanes (TTHM)
Method EPA 524.4	Regulated VOCs (V1, V2, V3)

Accreditation applies to public drinking water matrices.

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Celey D. Keene

Celey D. Keene

Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
VGSAU 16-05 (2')	H301221-01	Soil	20-May-13 14:02	21-May-13 17:00
VGSAU 16-06 (2')	H301221-08	Soil	20-May-13 16:32	21-May-13 17:00
VGSAU 16-04 (2')	H301221-15	Soil	20-May-13 15:12	21-May-13 17:00
VGSAU 16-04 (5')	H301221-16	Soil	20-May-13 15:16	21-May-13 17:00
VGSAU 16-04 (10')	H301221-17	Soil	20-May-13 15:20	21-May-13 17:00
VGSAU 16-04 (15')	H301221-18	Soil	20-May-13 15:28	21-May-13 17:00
VGSAU 16-04 (20')	H301221-19	Soil	20-May-13 15:40	21-May-13 17:00
VGSAU 16-04 (25')	H301221-20	Soil	20-May-13 15:58	21-May-13 17:00
VGSAU 16-04 (30')	H301221-21	Soil	20-May-13 16:20	21-May-13 17:00
VGSAU 16-07 (20')	H301221-26	Soil	20-May-13 10:10	21-May-13 17:00
VGSAU 16-07 (25')	H301221-27	Soil	20-May-13 10:15	21-May-13 17:00
VGSAU 16-07 (30')	H301221-28	Soil	20-May-13 10:20	21-May-13 17:00
VGSAU 16-03 (2')	H301221-29	Soil	20-May-13 10:30	21-May-13 17:00
VGSAU 16-03 (5')	H301221-30	Soil	20-May-13 10:35	21-May-13 17:00
VGSAU 16-03 (10')	H301221-31	Soil	20-May-13 10:40	21-May-13 17:00
VGSAU 16-03 (15')	H301221-32	Soil	20-May-13 10:50	21-May-13 17:00
VGSAU 16-03 (20')	H301221-33	Soil	20-May-13 11:00	21-May-13 17:00
VGSAU 16-03 (25')	H301221-34	Soil	20-May-13 11:15	21-May-13 17:00
VGSAU 16-03 (30')	H301221-35	Soil	20-May-13 11:35	21-May-13 17:00
VGSAU 16-01 (2')	H301221-36	Soil	20-May-13 12:45	21-May-13 17:00
VGSAU 16-01 (5')	H301221-37	Soil	20-May-13 12:50	21-May-13 17:00
VGSAU 16-01 (10')	H301221-38	Soil	20-May-13 12:55	21-May-13 17:00
VGSAU 16-01 (15')	H301221-39	Soil	20-May-13 13:00	21-May-13 17:00
VGSAU 16-01 (20')	H301221-40	Soil	20-May-13 13:25	21-May-13 17:00
VGSAU 16-01 (25')	H301221-41	Soil	20-May-13 13:40	21-May-13 17:00
VGSAU 16-01 (30')	H301221-42	Soil	20-May-13 13:50	21-May-13 17:00
VGSAU 16-02 (2')	H301221-43	Soil	20-May-13 11:42	21-May-13 17:00

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Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-02 (5')	H301221-44	Soil	20-May-13 11:48	21-May-13 17:00
VGSAU 16-02 (10')	H301221-45	Soil	20-May-13 11:57	21-May-13 17:00
VGSAU 16-02 (15')	H301221-46	Soil	20-May-13 12:15	21-May-13 17:00
VGSAU 16-02 (20')	H301221-47	Soil	20-May-13 12:20	21-May-13 17:00
VGSAU 16-02 (25')	H301221-48	Soil	20-May-13 12:25	21-May-13 17:00
VGSAU 16-02 (30')	H301221-49	Soil	20-May-13 12:38	21-May-13 17:00

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Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-05 (2')

H301221-01 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
Chloride	**192**	16.0	mg/kg	4	3061403	DW	14-Jun-13	4500-Cl-B	

Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-06 (2')

H301221-08 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
Chloride	**48.0**	16.0	mg/kg	4	3061403	DW	14-Jun-13	4500-Cl-B	

Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-04 (2')

H301221-15 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**4.42**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**95.6**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**560**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.7	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.7	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*88.8 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*97.1 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.023**	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.157	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.023**	0.314	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*109 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-04 (5')

H301221-16 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**9.69**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**90.3**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**80.0**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.6	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.6	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*83.6 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*91.0 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.055	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.025**	0.055	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.055	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.166	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.025**	0.332	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*110 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-04 (10')

H301221-17 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**6.47**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**93.5**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**48.0**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.0	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.0	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*91.7 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*100 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.053	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.014**	0.053	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.053	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.160	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.014**	0.321	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*109 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-04 (15')

H301221-18 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**4.25**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**95.8**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**32.0**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.7	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.7	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*100 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*114 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.014**	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.157	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.014**	0.313	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*108 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-04 (20')

H301221-19 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**10.6**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**89.4**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**80.0**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*93.5 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*100 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.056	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.012**	0.056	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.056	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.168	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.012**	0.336	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*110 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-04 (25')

H301221-20 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Solids	**94.9**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Moisture	**5.14**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**48.0**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*95.2 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*106 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.053	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.013**	0.053	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.053	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.158	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.013**	0.316	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*110 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-04 (30')

H301221-21 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**1.38**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**98.6**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**96.0**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.2	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.2	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*89.0 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*94.6 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.051	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.014**	0.051	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.051	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.152	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.014**	0.304	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*111 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-07 (20')

H301221-26 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
Chloride	**80.0**	16.0	mg/kg	4	3062705	AP	27-Jun-13	4500-Cl-B	I-02

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-07 (25')

H301221-27 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
Chloride	**128**	16.0	mg/kg	4	3061403	DW	14-Jun-13	4500-Cl-B	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-07 (30')

H301221-28 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
Chloride	**160**	16.0	mg/kg	4	3061403	DW	14-Jun-13	4500-Cl-B	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-03 (2')

H301221-29 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**5.28**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**94.7**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**288**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*86.3 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*95.1 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.053	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.015**	0.053	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.053	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.158	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.015**	0.317	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*111 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-03 (5')

H301221-30 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**4.03**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**96.0**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**96.0**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.6	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.6	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*93.0 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*105 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.021**	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.156	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.021**	0.313	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*110 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-03 (10')

H301221-31 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**11.2**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**88.8**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**240**	16.0	mg/kg	4	3052208	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.9	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.9	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*85.4 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*93.6 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.056	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.018**	0.056	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.056	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.169	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.018**	0.338	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*111 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-03 (15')

H301221-32 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**3.09**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**96.9**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**160**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.5	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.5	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*96.0 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*108 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.013**	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.052	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.155	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.013**	0.310	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*112 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-03 (20')

H301221-33 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**8.50**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**91.5**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**224**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.4	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.4	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*99.7 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*118 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.055	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Toluene*	**0.016**	0.055	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Ethylbenzene*	ND	0.055	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total Xylenes*	ND	0.164	mg/kg dry	50	3052210	AP	24-May-13	8021B	
Total BTEX	**0.016**	0.328	mg/kg dry	50	3052210	AP	24-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*112 %*	*89.4-126*		*3052210*	AP	*24-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-03 (25')

H301221-34 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**3.91**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**96.1**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**160**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.6	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.6	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*92.0 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*104 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.052	mg/kg dry	50	3052210	AP	25-May-13	8021B	
Toluene*	**0.015**	0.052	mg/kg dry	50	3052210	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.052	mg/kg dry	50	3052210	AP	25-May-13	8021B	
Total Xylenes*	ND	0.156	mg/kg dry	50	3052210	AP	25-May-13	8021B	
Total BTEX	**0.015**	0.312	mg/kg dry	50	3052210	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*112 %*	*89.4-126*		*3052210*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-03 (30')

H301221-35 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**7.78**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**92.2**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**64.0**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.3	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.3	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*97.6 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*106 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.054	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.015**	0.054	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.054	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.163	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.015**	0.325	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*112 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-01 (2')

H301221-36 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**3.56**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**96.4**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**112**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.6	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.6	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*95.1 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*107 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.052	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.019**	0.052	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.052	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.156	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.019**	0.311	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*112 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-01 (5')

H301221-37 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**4.80**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**95.2**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**96.0**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*112 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*122 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.017**	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.158	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.017**	0.315	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*113 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-01 (10')

H301221-38 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Solids	**94.8**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Moisture	**5.16**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**144**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.8	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*86.8 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*98.0 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.021**	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.158	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.021**	0.316	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*113 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-01 (15')

H301221-39 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Solids	**93.5**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Moisture	**6.47**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**128**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.0	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.0	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*88.9 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*98.7 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Ethylbenzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.160	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	ND	0.321	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Surrogate: 4-Bromofluorobenzene (PID)		*113 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-01 (20')

H301221-40 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**11.4**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**88.6**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**80.0**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.9	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.9	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*121 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*131 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	*S-GC*
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.056	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.023**	0.056	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.056	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.169	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.023**	0.338	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*113 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-01 (25')

H301221-41 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**1.69**	0.100	%	1	3052212	AP	24-May-13	D2216	
% Solids	**98.3**	0.100	%	1	3052212	AP	24-May-13	D2216	
Chloride	**64.0**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.3	mg/kg dry	1	3060310	CK	29-May-13	8015M	
DRO >C10-C28	**28.7**	15.3	mg/kg dry	1	3060310	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*99.2 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*107 %*	*70-130*		*3060310*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.051	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.014**	0.051	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.051	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.153	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.014**	0.305	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*113 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-01 (30')

H301221-42 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**1.04**	0.100	%	1	3052213	AP	24-May-13	D2216	
% Solids	**99.0**	0.100	%	1	3052213	AP	24-May-13	D2216	
Chloride	**64.0**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.2	mg/kg dry	1	3060312	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.2	mg/kg dry	1	3060312	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*92.3 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*98.8 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.051	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.013**	0.051	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.051	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.152	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.013**	0.303	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*113 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-02 (2')

H301221-43 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**2.97**	0.100	%	1	3052213	AP	24-May-13	D2216	
% Solids	**97.0**	0.100	%	1	3052213	AP	24-May-13	D2216	
Chloride	**176**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.5	mg/kg dry	1	3060312	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.5	mg/kg dry	1	3060312	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*93.1 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*105 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.052	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.014**	0.052	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.052	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.155	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.014**	0.309	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*114 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-02 (5')

H301221-44 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**5.50**	0.100	%	1	3052213	AP	24-May-13	D2216	
% Solids	**94.5**	0.100	%	1	3052213	AP	24-May-13	D2216	
Chloride	**176**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.9	mg/kg dry	1	3060312	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.9	mg/kg dry	1	3060312	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*93.7 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*103 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.017**	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.159	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.017**	0.317	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*113 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-02 (10')

H301221-45 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Moisture	**5.94**	0.100	%	1	3052213	AP	24-May-13	D2216	
% Solids	**94.1**	0.100	%	1	3052213	AP	24-May-13	D2216	
Chloride	**288**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.9	mg/kg dry	1	3060312	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.9	mg/kg dry	1	3060312	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*94.5 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*101 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.011**	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.053	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.159	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.011**	0.319	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*112 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-02 (15')

H301221-46 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Solids	**98.0**	0.100	%	1	3052213	AP	24-May-13	D2216	
% Moisture	**1.98**	0.100	%	1	3052213	AP	24-May-13	D2216	
Chloride	**192**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	15.3	mg/kg dry	1	3060312	CK	29-May-13	8015M	
DRO >C10-C28	ND	15.3	mg/kg dry	1	3060312	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*88.0 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*94.0 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.051	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.016**	0.051	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.051	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.153	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.016**	0.306	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*112 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-02 (20')

H301221-47 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Solids	**91.2**	0.100	%	1	3052213	AP	24-May-13	D2216	
% Moisture	**8.81**	0.100	%	1	3052213	AP	24-May-13	D2216	
Chloride	**672**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.4	mg/kg dry	1	3060312	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.4	mg/kg dry	1	3060312	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*103 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*113 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.055	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.024**	0.055	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.055	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.164	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.024**	0.329	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*114 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-02 (25')

H301221-48 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Solids	**92.9**	0.100	%	1	3052213	AP	24-May-13	D2216	
% Moisture	**7.11**	0.100	%	1	3052213	AP	24-May-13	D2216	
Chloride	**576**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	16.1	mg/kg dry	1	3060312	CK	29-May-13	8015M	
DRO >C10-C28	ND	16.1	mg/kg dry	1	3060312	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*107 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*117 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.054	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	ND	0.054	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Ethylbenzene*	ND	0.054	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.161	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.008**	0.323	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*113 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

VGSAU 16-02 (30')

H301221-49 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories									
Inorganic Compounds									
% Solids	**84.7**	0.100	%	1	3052213	AP	24-May-13	D2216	
% Moisture	**15.3**	0.100	%	1	3052213	AP	24-May-13	D2216	
Chloride	**160**	16.0	mg/kg	4	3052303	DW	23-May-13	4500-Cl-B	
Organic Compounds									**SUB-PBE**
GRO C6-C10	ND	17.7	mg/kg dry	1	3060312	CK	29-May-13	8015M	
DRO >C10-C28	ND	17.7	mg/kg dry	1	3060312	CK	29-May-13	8015M	
Surrogate: 1-Chlorooctane		*91.8 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Surrogate: o-Terphenyl		*96.2 %*	*70-130*		*3060312*	CK	*29-May-13*	*8015M*	
Volatile Organic Compounds by EPA Method 8021									
Benzene*	ND	0.059	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Toluene*	**0.020**	0.059	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Ethylbenzene*	ND	0.059	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total Xylenes*	ND	0.177	mg/kg dry	50	3052211	AP	25-May-13	8021B	
Total BTEX	**0.020**	0.354	mg/kg dry	50	3052211	AP	25-May-13	8021B	J
Surrogate: 4-Bromofluorobenzene (PID)		*114 %*	*89.4-126*		*3052211*	AP	*25-May-13*	*8021B*	

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

Inorganic Compounds - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3052208 - 1:4 DI Water										
Blank (3052208-BLK1)				Prepared & Analyzed: 22-May-13						
Chloride	ND	16.0	mg/kg							
LCS (3052208-BS1)				Prepared & Analyzed: 22-May-13						
Chloride	432	16.0	mg/kg	400		108	80-120			
LCS Dup (3052208-BSD1)				Prepared & Analyzed: 22-May-13						
Chloride	416	16.0	mg/kg	400		104	80-120	3.77	20	
Duplicate (3052208-DUP1)		**Source: H301220-34**		Prepared & Analyzed: 22-May-13						
Chloride	720	16.0	mg/kg		736			2.20	20	
Matrix Spike (3052208-MS1)		**Source: H301220-34**		Prepared & Analyzed: 22-May-13						
Chloride	1060	16.0	mg/kg	400	736	80.0	80-120			
Batch 3052212 - General Prep - Wet Chem										
Blank (3052212-BLK1)				Prepared: 23-May-13 Analyzed: 24-May-13						
% Solids	100	0.100	%							
% Moisture	ND	0.100	%							
Duplicate (3052212-DUP1)		**Source: H301221-15**		Prepared: 23-May-13 Analyzed: 24-May-13						
% Moisture	4.15	0.100	%		4.42			6.30	20	
% Solids	95.8	0.100	%		95.6			0.282	20	
Batch 3052213 - General Prep - Wet Chem										
Blank (3052213-BLK1)				Prepared: 23-May-13 Analyzed: 24-May-13						
% Moisture	ND	0.100	%							
% Solids	100	0.100	%							

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

Inorganic Compounds - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3052213 - General Prep - Wet Chem										
Duplicate (3052213-DUP1)		**Source: H301221-42**		Prepared: 23-May-13 Analyzed: 24-May-13						
% Moisture	1.15	0.100	%		1.04			10.0	20	
% Solids	98.8	0.100	%		99.0			0.111	20	
Batch 3052303 - 1:4 DI Water										
Blank (3052303-BLK1)				Prepared & Analyzed: 23-May-13						
Chloride	ND	16.0	mg/kg							
LCS (3052303-BS1)				Prepared & Analyzed: 23-May-13						
Chloride	448	16.0	mg/kg	400		112	80-120			
LCS Dup (3052303-BSD1)				Prepared & Analyzed: 23-May-13						
Chloride	432	16.0	mg/kg	400		108	80-120	3.64	20	
Duplicate (3052303-DUP1)		**Source: H301221-32**		Prepared & Analyzed: 23-May-13						
Chloride	144	16.0	mg/kg		160			10.5	20	
Matrix Spike (3052303-MS1)		**Source: H301221-32**		Prepared & Analyzed: 23-May-13						
Chloride	528	16.0	mg/kg	400	160	92.0	80-120			
Batch 3061403 - 1:4 DI Water										
Blank (3061403-BLK1)				Prepared & Analyzed: 14-Jun-13						
Chloride	ND	16.0	mg/kg							
LCS (3061403-BS1)				Prepared & Analyzed: 14-Jun-13						
Chloride	432	16.0	mg/kg	400		108	80-120			

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

Inorganic Compounds - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3061403 - 1:4 DI Water										
LCS Dup (3061403-BSD1)				Prepared & Analyzed: 14-Jun-13						
Chloride	416	16.0	mg/kg	400		104	80-120	3.77	20	
Duplicate (3061403-DUP1)		**Source: H301356-01**		Prepared & Analyzed: 14-Jun-13						
Chloride	29200	16.0	mg/kg		31200			6.62	20	
Matrix Spike (3061403-MS1)		**Source: H301356-01**		Prepared & Analyzed: 14-Jun-13						
Chloride	36000	16.0	mg/kg	400	31200	NR	80-120			QM-07
Batch 3062705 - 1:4 DI Water										
Blank (3062705-BLK1)				Prepared: 26-Jun-13 Analyzed: 27-Jun-13						
Chloride	ND	16.0	mg/kg							
LCS (3062705-BS1)				Prepared: 26-Jun-13 Analyzed: 27-Jun-13						
Chloride	400	16.0	mg/kg	400		100	80-120			
LCS Dup (3062705-BSD1)				Prepared: 26-Jun-13 Analyzed: 27-Jun-13						
Chloride	400	16.0	mg/kg	400		100	80-120	0.00	20	
Duplicate (3062705-DUP1)		**Source: H301484-01**		Prepared: 26-Jun-13 Analyzed: 27-Jun-13						
Chloride	ND	16.0	mg/kg		0.00				20	
Matrix Spike (3062705-MS1)		**Source: H301484-01**		Prepared: 26-Jun-13 Analyzed: 27-Jun-13						
Chloride	416	16.0	mg/kg	400	0.00	104	80-120			

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

Organic Compounds - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3060310 - General Prep										
Blank (3060310-BLK1)				Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	ND	15.0	mg/kg wet							
DRO >C10-C28	ND	15.0	mg/kg wet							
Surrogate: 1-Chlorooctane	*107*		mg/kg	*100*		*107*	*70-130*			
Surrogate: o-Terphenyl	*57.9*		mg/kg	*50.0*		*116*	*70-130*			
LCS (3060310-BS1)				Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	1080	15.0	mg/kg wet	1000		108	75-125			
DRO >C10-C28	876	15.0	mg/kg wet	1000		87.6	75-125			
Surrogate: 1-Chlorooctane	*117*		mg/kg	*100*		*117*	*70-130*			
Surrogate: o-Terphenyl	*52.4*		mg/kg	*50.0*		*105*	*70-130*			
LCS Dup (3060310-BSD1)				Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	1150	15.0	mg/kg wet	1000		115	75-125	6.28	20	
DRO >C10-C28	962	15.0	mg/kg wet	1000		96.2	75-125	9.36	20	
Surrogate: 1-Chlorooctane	*126*		mg/kg	*100*		*126*	*70-130*			
Surrogate: o-Terphenyl	*49.4*		mg/kg	*50.0*		*98.8*	*70-130*			
Matrix Spike (3060310-MS1)		**Source: H301221-41**		Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	1100	15.3	mg/kg dry	1020	ND	108	75-125			
DRO >C10-C28	938	15.3	mg/kg dry	1020	28.7	89.4	75-125			
Surrogate: 1-Chlorooctane	*121*		mg/kg	*100*		*121*	*70-130*			
Surrogate: o-Terphenyl	*50.6*		mg/kg	*50.0*		*101*	*70-130*			
Matrix Spike Dup (3060310-MSD1)		**Source: H301221-41**		Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	1110	15.3	mg/kg dry	1020	ND	109	75-125	0.922	20	
DRO >C10-C28	929	15.3	mg/kg dry	1020	28.7	88.5	75-125	1.01	20	
Surrogate: 1-Chlorooctane	*118*		mg/kg	*100*		*118*	*70-130*			
Surrogate: o-Terphenyl	*46.4*		mg/kg	*50.0*		*92.8*	*70-130*			

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Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

Organic Compounds - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3060312 - General Prep										
Blank (3060312-BLK1)				Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	ND	15.0	mg/kg wet							
DRO >C10-C28	ND	15.0	mg/kg wet							
Surrogate: 1-Chlorooctane	*114*		mg/kg	*100*		*114*	*70-130*			
Surrogate: o-Terphenyl	*62.2*		mg/kg	*50.0*		*124*	*70-130*			
LCS (3060312-BS1)				Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	1190	15.0	mg/kg wet	1000		119	75-125			
DRO >C10-C28	975	15.0	mg/kg wet	1000		97.5	75-125			
Surrogate: 1-Chlorooctane	*124*		mg/kg	*100*		*124*	*70-130*			
Surrogate: o-Terphenyl	*48.4*		mg/kg	*50.0*		*96.8*	*70-130*			
LCS Dup (3060312-BSD1)				Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	1120	15.0	mg/kg wet	1000		112	75-125	6.06	20	
DRO >C10-C28	974	15.0	mg/kg wet	1000		97.4	75-125	0.103	20	
Surrogate: 1-Chlorooctane	*129*		mg/kg	*100*		*129*	*70-130*			
Surrogate: o-Terphenyl	*52.8*		mg/kg	*50.0*		*106*	*70-130*			
Matrix Spike (3060312-MS1)		**Source: H301221-49**		Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	1350	17.7	mg/kg dry	1180	ND	114	75-125			
DRO >C10-C28	1150	17.7	mg/kg dry	1180	ND	97.0	75-125			
Surrogate: 1-Chlorooctane	*127*		mg/kg	*100*		*127*	*70-130*			
Surrogate: o-Terphenyl	*52.4*		mg/kg	*50.0*		*105*	*70-130*			
Matrix Spike Dup (3060312-MSD1)		**Source: H301221-49**		Prepared: 28-May-13 Analyzed: 29-May-13						
GRO C6-C10	1420	17.7	mg/kg dry	1180	ND	120	75-125	5.13	20	
DRO >C10-C28	1240	17.7	mg/kg dry	1180	ND	105	75-125	7.92	20	
Surrogate: 1-Chlorooctane	*106*		mg/kg	*100*		*106*	*70-130*			
Surrogate: o-Terphenyl	*54.7*		mg/kg	*50.0*		*109*	*70-130*			

Cardinal Laboratories

*=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

Volatile Organic Compounds by EPA Method 8021 - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3052210 - Volatiles										
Blank (3052210-BLK1)				Prepared: 22-May-13 Analyzed: 24-May-13						
Benzene	ND	0.050	mg/kg wet							
Toluene	0.010	0.050	mg/kg wet							J
Ethylbenzene	ND	0.050	mg/kg wet							
Total Xylenes	ND	0.150	mg/kg wet							
Total BTEX	0.010	0.300	mg/kg wet							J
Surrogate: 4-Bromofluorobenzene (PID)	*0.0547*		mg/kg wet	*0.0500*		*109*	*89.4-126*			
LCS (3052210-BS1)				Prepared: 22-May-13 Analyzed: 24-May-13						
Benzene	2.21	0.050	mg/kg wet	2.00		111	76.4-135			
Toluene	1.99	0.050	mg/kg wet	2.00		99.6	80.2-135			
Ethylbenzene	2.17	0.050	mg/kg wet	2.00		109	78.5-133			
Total Xylenes	6.29	0.150	mg/kg wet	6.00		105	80.1-135			
Surrogate: 4-Bromofluorobenzene (PID)	*0.0528*		mg/kg wet	*0.0500*		*106*	*89.4-126*			
LCS Dup (3052210-BSD1)				Prepared: 22-May-13 Analyzed: 24-May-13						
Benzene	2.34	0.050	mg/kg wet	2.00		117	76.4-135	5.67	16.4	
Toluene	2.10	0.050	mg/kg wet	2.00		105	80.2-135	5.35	16.6	
Ethylbenzene	2.30	0.050	mg/kg wet	2.00		115	78.5-133	5.48	16.1	
Total Xylenes	6.61	0.150	mg/kg wet	6.00		110	80.1-135	4.96	15.8	
Surrogate: 4-Bromofluorobenzene (PID)	*0.0532*		mg/kg wet	*0.0500*		*106*	*89.4-126*			
Batch 3052211 - Volatiles										
Blank (3052211-BLK1)				Prepared: 22-May-13 Analyzed: 25-May-13						
Benzene	ND	0.050	mg/kg wet							
Toluene	0.010	0.050	mg/kg wet							J
Ethylbenzene	ND	0.050	mg/kg wet							
Total Xylenes	ND	0.150	mg/kg wet							
Total BTEX	0.010	0.300	mg/kg wet							J
Surrogate: 4-Bromofluorobenzene (PID)	*0.0561*		mg/kg wet	*0.0500*		*112*	*89.4-126*			

Cardinal Laboratories

*=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

ARCADIS U.S., INC. - HOUSTON 630 PLAZA DRIVE, SUITE 600 HIGHLANDS RANCH CO, 80129	Project: CHEVRON BUCKEYE FMT Project Number: B0048601.0000.TAX03 Project Manager: JONATHAN OLSEN Fax To: (713) 977-4620	Reported: 28-Jun-13 16:38

Volatile Organic Compounds by EPA Method 8021 - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3052211 - Volatiles										
LCS (3052211-BS1)				Prepared: 22-May-13 Analyzed: 25-May-13						
Benzene	2.16	0.050	mg/kg wet	2.00		108	76.4-135			
Toluene	1.96	0.050	mg/kg wet	2.00		98.1	80.2-135			
Ethylbenzene	2.16	0.050	mg/kg wet	2.00		108	78.5-133			
Total Xylenes	6.27	0.150	mg/kg wet	6.00		104	80.1-135			
Surrogate: 4-Bromofluorobenzene (PID)	*0.0542*		mg/kg wet	*0.0500*		*108*	*89.4-126*			
LCS Dup (3052211-BSD1)				Prepared: 22-May-13 Analyzed: 25-May-13						
Benzene	2.28	0.050	mg/kg wet	2.00		114	76.4-135	5.43	16.4	
Toluene	2.06	0.050	mg/kg wet	2.00		103	80.2-135	4.80	16.6	
Ethylbenzene	2.26	0.050	mg/kg wet	2.00		113	78.5-133	4.75	16.1	
Total Xylenes	6.53	0.150	mg/kg wet	6.00		109	80.1-135	4.10	15.8	
Surrogate: 4-Bromofluorobenzene (PID)	*0.0543*		mg/kg wet	*0.0500*		*109*	*89.4-126*			

Cardinal Laboratories

*=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

Notes and Definitions

SUB-PBE	Analysis subcontracted to Permian Basin Environmental Lab, NELAP accreditation # T104704156-12-1.
S-GC	Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
I-02	This result was analyzed outside of the EPA recommended holding time.
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C
	Samples reported on an as received basis (wet) unless otherwise noted on report

Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Marland, Hobbs, NM 88240
(575) 393-2326 FAX (575) 393-2476

Company Name: ARCADIS-US
Project Manager: Jonathan Olson
Address: 2929 Briarpark Dr, Suite 300
City: Houston State: TX Zip: 77402
Phone #: 713.953.4824 Fax #:
Project #: B0048601.0000.TASK5 Project Owner: Chevron
Project Name: Chevron Buffalo FPT
Project Location: Buffalo oil field
Sampler Name: Ryan Nunez

BILL TO
P.O. #:
Company:
Attn:
Address:
City:
State: Zip:
Phone #:
Fax #:

ANALYSIS REQUEST

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRESERV.: ACID/BASE:	ICE / COOL	OTHER:	SAMPLING: DATE	TIME	Chlorides USEPA 300.1	Modified TPH 8015, BTEX 8021B	Hold		X C1 added 6/14									
H301221																											
1	VG94H16-05 (2')	6	2			X						X	5-20-13	1402	1	1	X		X								
2	VG94H16-05 (5')	6	2			X						X	5-20-13	1410	1	1	X										
3	VG94H16-05 (10')	6	2			X						X	5-20-13	1415	1	1	X										
4	VG94H16-05 (15')	6	2			X						X	5-20-13	1420	1	1	X										
5	VG94H16-05 (20')	6	2			X						X	5-20-13	1430	1	1	X										
6	VG94H16-05 (25')	6	2			X						X	5-20-13	1445	1	1	X										
7	VG94H16-05 (30')	6	2			X						X	5-20-13	1500	1	1	X										
8	VG94H16-06 (2')	6	2			X						X	5-20-13	1632	1	1	X		X								
9	VG94H16-06 (5')	6	2			X						X	5-20-13	1635	1	1	X										
10	VG94H16-06 (10')	6	2			X						X	5-20-13	1640	1	1	X										

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Relinquished By:	Date: 5-21-13	Received By: Jodi Henson	Phone Result: ☐ Yes ☐ No Add'l Phone #:
Relinquished By:	Time: 1700	Received By:	Fax Result: ☑ Yes ☐ No Add'l Fax #:
	Date:		REMARKS: Hold VG94H16-05 at VG94H16-06 5-ft-s,
	Time:		

Delivered By: (Circle One)
Sampler - UPS - Bus - Other:

6°C

Sample Condition		CHECKED BY: (Initials)
Cool	Intact	
☑ Yes ☐ No	☑ Yes ☐ No	

† Cardinal cannot accept verbal changes. Please fax written changes to (575) 393-2326

#54

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Marland, Hobbs, NM 88240
(575) 393-2326 FAX (575) 393-2476

Company Name:	ARCADIS-US
Project Manager:	Jonathan Clem
Address:	2929 Briarpark Dr., Suite 300
City: Houston	State: TX Zip: 77042
Phone #: 713.953.4824	Fax #:
Project #:	Project Owner: Chevron
Project Name:	Chevron Buckeye EMT
Project Location:	Buckeye oil field
Sampler Name:	

BILL TO

P.O. #:
Company:
Attn:
Address:
City:
State: Zip:
Phone #:
Fax #:

ANALYSIS REQUEST

Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER	ACID/BASE	ICE / COOL	OTHER	DATE	TIME	Chloride USEPA 300.1	Method TPH 8015, BTEX 8021B	
H301221																	
11	VGSAU16-06(15')	G	2			X						X	5-20-13	1645	1	1	X
12	VGSAU16-06(20')	G	2			X						X	5-20-13	1648	1	1	X
13	VGSAU16-06(25')	G	2			X						X	5-20-13	1655	1	1	X
14	VGSAU16-06(30')	G	2			X						X	5-20-13	1700	1	1	X
15	VGSAU16-04(2')	G	2			X						X	5-20-13	1512	1	1	
16	VGSAU16-04(5')	G	2			X						X	5-20-13	1516	1	1	
17	VGSAU16-04(10')	G	2			X						X	5-20-13	1520	1	1	
18	VGSAU16-04(15')	G	2			X						X	5-20-13	1528	1	1	
19	VGSAU16-04(20')	G	2			X						X	5-20-13	1540	1	1	
20	VGSAU16-04(25')	G	2			X						X	5-20-13	1558	1	1	

Relinquished By: [signature] Date: 5-21-13 Time: 1700 Received By: Jodi Henson

Relinquished By: Date: Time: Received By:

Delivered By: (Circle One)
Sampler - UPS - Bus - Other: 6°C

Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No

CHECKED BY: (Initials) JH

Phone Result: ☐ Yes ☐ No Add'l Phone #:
Fax Result: ☑ Yes ☐ No Add'l Fax #:
REMARKS: Hold VGSAU16-06 Samples

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CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Marland, Hobbs, NM 88240
(575) 393-2326 FAX (575) 393-2476

Company Name:	ARCADIS-US
Project Manager:	Jonathan Olson
Address:	2929 Briarpark Dr., Suite 300
City:	Houston State: TX Zip: 77042
Phone #:	713.953.4824 Fax #:
Project #:	B0048601.0002.TX07 Project Owner: Chevron
Project Name:	Chevron Buckeye FPT
Project Location:	Buckeye oil field
Sampler Name:	Ryan Nance

BILL TO

P.O. #:	
Company:	
Attn:	
Address:	
City:	
State:	Zip:
Phone #:	
Fax #:	

ANALYSIS REQUEST

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRESERV: ACID/BASE	ICE / COOL	OTHER:	SAMPLING DATE	TIME	Chlorides USE EPA 300.1	Volatiles TPH8015, BTEX 8021B	HOLD	Cl added 6/19	Cl added 6/24							
H301221																									
21	V64AU16-04 (30')	6	2			X						X	5-20-13	1620	1	1									
22	V64AU16-07 (2')	6	2			X						X	5-20-13	0948	1	1	X								
23	V64AU16-07 (5')	6	2			X						X	5-20-13	0953	1	1	X								
24	V64AU16-07 (10')	6	2			X						X	5-20-13	0958	1	1	X								
25	V64AU16-07 (15')	6	2			X						X	5-20-13	1005	1	1	X								
26	V64AU16-07 (20')	6	2			X						X	5-20-13	1010	1	1	X		X						
27	V64AU16-07 (25')	6	2			X						X	5-20-13	1015	1	1	X	X							
28	V64AU16-07 (30')	6	2			X						X	5-20-13	1020	1	1	X								
29	V64AU16-03 (2')	6	2			X						X	5-20-13	1030	1	1									
30	V64AU16-03 (5')	6	2			X						X	5-20-13	1035	1	1									

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Relinquished By:	Date: 5-21-13	Received By:	Jodi Henson
Relinquished By:	Time: 1700	Received By:	
	Date:		
	Time:		

Delivered By: (Circle One)
Sampler - UPS - Bus - Other:

Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No

CHECKED BY: (Initials)

Phone Result: ☐ Yes ☐ No Add'l Phone #:
Fax Result: ☑ Yes ☐ No Add'l Fax #:
REMARKS:
Hold V64AU16-07 samples.

† Cardinal cannot accept verbal changes. Please fax written changes to (575) 393-2326

#54

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Marland, Hobbs, NM 88240
(575) 393-2326 FAX (575) 393-2476

Company Name: ARCADIS-US
Project Manager: Jonathan Olson
Address: 2929 Briarpark Dr., Suite 300
City: Houston State: TX Zip: 77042
Phone #: 713.953.4874 Fax #:
Project #: B0048601.0000.TX03 Project Owner: Chevron
Project Name: Chevron Buckeye FMT
Project Location: Buckeye oil field
Sampler Name: Ryan Wanny

BILL TO
P.O. #:
Company:
Attn:
Address:
City:
State: Zip:
Phone #:
Fax #:

ANALYSIS REQUEST: Chlorides USEPA 300.1; Modified TPH 8015, BTEX 8021B

Lab I.D. (H301221)	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER	ACID/BASE	ICE / COOL	OTHER: Meoh	DATE	TIME	Chlorides USEPA 300.1	Modified TPH 8015, BTEX 8021B
31	V6SAU16-03(10')	G	2			X						X	5-20-13	1040	1	1
32	V6SAU16-03(15')	G	2			X						X	5-20-13	1050	1	1
33	V6SAU16-03(20')	G	2			X						X	5-20-13	1100	1	1
34	V6SAU16-03(25')	G	2			X						X	5-20-13	1115	1	1
35	V6SAU16-03(30')	G	2			X						X	5-20-13	1135	1	1
36	V6SAU16-01(2')	G	2			X						X	5-20-13	1245	1	1
37	V6SAU16-01(5')	G	2			X						X	5-20-13	1250	1	1
38	V6SAU16-01(10')	G	2			X						X	5-20-13	1255	1	1
39	V6SAU16-01(15')	G	2			X						X	5-20-13	1300	1	1
40	V6SAU16-01(20')	G	2			X						X	5-20-13	1325	1	1

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Relinquished By: [signature] Date: 5-21-13 Time: 1700
Received By: Jodi Henson
Relinquished By: Date: Time:
Received By:

Delivered By: (Circle One)
Sampler - UPS - Bus - Other: 6°C

Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No
CHECKED BY: (Initials) [initials]

Phone Result: ☐ Yes ☐ No Add'l Phone #:
Fax Result: ☑ Yes ☐ No Add'l Fax #:
REMARKS:

† Cardinal cannot accept verbal changes. Please fax written changes to (575) 393-2326

#54

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Marland, Hobbs, NM 88240
(575) 393-2326 FAX (575) 393-2476

		BILL TO	
Company Name:	ARCADIS-US	P.O. #:	
Project Manager:	Jonathan Olson	Company:	
Address:	2929 Briarpark Dr, Suite 300	Attn:	
City: Houston	State: TX Zip: 77402	Address:	
Phone #: 713.953.4874	Fax #:	City:	
Project #: B0048601.0000.TX03	Project Owner: Chevron	State:	Zip:
Project Name:	Chevron Buckeye FMT	Phone #:	
Project Location:	Buckeye Oil field	Fax #:	
Sampler Name:	[illegible]		

ANALYSIS REQUEST: Chlorides USEPA 300.1; TPH 8015, BTEX 8021B

Lab I.D. (FOR LAB USE ONLY) H301221	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID/BASE:	ICE / COOL	OTHER: [illegible]	DATE	TIME	Chlorides USEPA 300.1	TPH 8015, BTEX 8021B
41	V6SAU16-01(25')	G	2			X						X	5-20-13	1340	1	1
42	V6SAU16-01(30')	G	2			X						X	5-20-13	1350	1	1
43	V6SAU16-02 (2')	G	2			X						X	5-20-13	1142	1	1
44	V6SAU16-02 (5')	G	2			X						X	5-20-13	1148	1	1
45	V6SAU16-02(10')	G	2			X						X	5-20-13	1157	1	1
46	V6SAU16-02(15')	G	2			X						X	5-20-13	1215	1	1
47	V6SAU16-02(20')	G	2			X						X	5-20-13	1220	1	1
48	V6SAU16-02(25')	G	2			X						X	5-20-13	1225	1	1
49	V6SAU16-02(30')	G	2			X						X	5-20-13	1238	1	1

Relinquished By:	Date: 5-21-13 Time: 1700	Received By: Jodi Henson	Phone Result: ☐ Yes ☐ No Add'l Phone #:
			Fax Result: ☑ Yes ☐ No Add'l Fax #:
Relinquished By:	Date: Time:	Received By:	REMARKS:
Delivered By: (Circle One) Sampler - UPS - Bus - Other:	6°C	Sample Condition Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No	CHECKED BY: (Initials)

† Cardinal cannot accept verbal changes. Please fax written changes to (575) 393-2326

#54

ARCADIS

Attachment 6

Boring Logs (May 2013)

Date Start/Finish: 5/20/2013
Drilling Company: White Drilling/R Dallas

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 30' bgs
Descriptions By: R Nanny

Well/Boring ID: VGSAU16 - 01

Client: Chevron EMC
Location: Vacuum Grayburg San Andres Unit Well 16

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0							SANDY CLAY (Topsoil), Brown (10YR4/3), very fine to fine grained, subangular, poorly sorted, dry, friable, mostly clay, roots in sample.
		1	AR	2	4.4	☒		CAPROCK CALICHE, Very Pale Brown (10YR8/3 to 10YR7/3), indurated, laminated, showing trace pisolites, trace sand, silt to very fine grained, subrounded, poorly sorted, dry, fractured.
			AR	3				
5	-5				4.0	☒		SILTY/SANDY CALICHE, Very Pale Brown (10YR8/3), soft, arenaceous, dry, mostly caliche, powdery, silt to fine grained, subangular to subrounded, poorly sorted, loose.
		2	AR	5				CAPROCK CALICHE, Very Pale Brown (10YR8/3 to 10YR7/3), indurated, laminated, contains pisolites, trace sand, very fine grained, subrounded, poorly sorted, siliceous.
10	-10	3	AR	5	6.3	☒		SANDY CALICHE, Very Pale Brown (10TR7/3), soft, slightly moist, very fine to fine grained, subrounded, poorly sorted, loose. Formation contains concretionary sandy siliceous nodules, some Pale Brown (10YR6/3) indurated, 0.5 cm to 1 cm, well sorted.
15	-15	4	AR	5	6.3	☒		CLAYEY CALICHE, Very Pale Brown (10YR8/2), soft, dry, powdery, argillaceous, trace sand as descrived above.
20	-20	5	AR	5	3.0	☒		CALCAREOUS SAND, Very Pale Brown (10YR7/3), very fine to fine grained, subangular to subrounded, poorly sorted, loose, dry, contains concretionary siliceous nodules, Light Brown (10YR6/3). indurated, rounded, sandy, poorly sorted, 0.3 cm to 1 cm.
25	-25	6	AR	5	4.5	☒		SANDSTONE, Light Brownish Gray (10YR6/2), very fine to fine grained, subrounded, poorly sorted, siliceous, indurated, dry.
30	-30				7.9	☒		

Remarks: ags = above ground surface; AK = air knife; amsl = above mean sea level; AR = air rotary; bgs = below ground surface; ppm = parts per million; cm = centimeter;

Date Start/Finish: 5/20/2013
Drilling Company: White Drilling/R Dallas

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 30' bgs
Descriptions By: R Nanny

Well/Boring ID: VGSAU16 - 02

Client: Chevron EMC
Location: Vacuum Grayburg San Andres Unit Well 16

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	AR	2	2.3	☒		CALICHE PAD, indurated caliche at surface, Pink (7.5YR7/3 to 7.5YR8/2), firm to indurated, fractured, slightly brecciated, contains birdseye (pisoliths) caliche, laminated, dry.
			AR	3				
5	-5				3.3	☒		SANDY/CLAYEY CALICHE, Very Pale Brown (10YR8/3), soft to slightly firm, arenaceous, dry, mostly caliche, some sand, very fine to fine grained, subangular, poorly sorted, trace concretionary caliche, nodular, Very Pale Brown (10YR7/3), indurated, rounded, caclium carbonate cemented, 0.2 to 0.5 cm.
		2	AR	5				CAPROCK CALICHE, Brown (7.5YR5/4), indurated, laminated, contains pisoliths, dry, siliceous, contains some sand, silt to fine grained, subrounded, poorly sorted.
10	-10				6.7	☒		SILTY/SANDY/CLAYEY CALICHE, Very Pale Brown (10YR8/2), soft, dry, powdery, argillaceous, contains traces silt to very fine grains, subrounded, poorly sorted, sand. Formation also contains caliche, Very Pale Brown (10YR8/2 to 10YR7/2), concretions, firm, slightly friable to blocky, nodular, trace, 0.1 cm to 0.5 cm.
		3	AR	5				
15	-15				13.4	☒		Same as above, formation began showing some siliceous nodules, Light Yellowish Brown (10YR6/4), indurated, rounded.
		4	AR	5				SANDSTONE, Light Brownish Gray (2.5YR6/2), fine grained, subrounded, poorly sorted, indurated, very siliceous.
20	-20				4.8	☒		CALCAREOUS SAND, Very Pale Brown (10YR7/3), fine grained, subrounded, poorly sorted, loose, dry. Formation contains concretionary siliceous nodules, Light Brown (10YR6/3), indurated, rounded, sandy, very fine to fine grained, subrounded.
		5	AR	5				
25	-25				8.1	☒		
		6	AR	5				SANDSTONE, Light Brownish Gray (10YR6/2), very fine to fine grained, subrounded, poorly sorted, siliceous, indurated.
30	-30				5.2	☒		

Remarks: ags = above ground surface; AK = air knife; amsl = above mean sea level; AR = air rotary; bgs = below ground surface; ppm = parts per million; cm = centimeter;

Date Start/Finish: 5/20/2013
Drilling Company: White Drilling/R Dallas

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 30' bgs
Descriptions By: R Nanny

Well/Boring ID: VGSAU16 - 03

Client: Chevron EMC
Location: Vacuum Grayburg San Andres Unit Well 16

Chevron

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	AR	2	4.7	☒		SILTY CALICHE, Pale Yellow (2.5YR8/2), indurated caliche at surface, calcium carbonate cementation, dry.
5	-5		AR	3	5.2	☒		SANDY/CLAYEY CALICHE, Very Pale Brown (10YR8/3), soft to slightly firm, arenaceous, dry, mostly caliche, some sand, very fine to fine grained, subangular, poorly sorted, trace concretionary caliche, nodular, Very Pale Brown (10YR7/3), indurated, rounded, calcium carbonate cemented, 0.3 to 1.5 cm Same as above, concretions turned siliceous.
		2	AR	5				CAPROCK CALICHE, Brown (7.5YR5/4), indurated, laminated, siliceous, dry, contains some sand, silt to fine grained, subrounded, poorly sorted.
10	-10	3	AR	5	4.8	☒		SILTY/SANDY/CLAYEY CALICHE, Very Pale Brown (10YR8/2), soft, moist, argillaceous, contains traces silt to very fine grains, subrounded, poorly sorted, sand. Formation also contains concretionary caliche, Very Pale Brown (10YR8/2 to 10YR7/2), firm, friable, trace, 0.1 cm to 0.5 cm.
15	-15	4	AR	5	5.4	☒		Same as above, formation began showing more nodules.
20	-20	5	AR	5	4.4	☒		CALCAREOUS SAND, Very Pale Brown (10YR8/2), very fine to fine grained, subangular to subrounded, poorly sorted, loose, dry, contains trace concretionary siliceous nodules, indurated, Light Brownish Gray (10YR6/2), nodules contain sand, some silt to fine grained, 0.5 cm to 3 cm.
25	-25	6	AR	5	5.4	☒		SANDSTONE, Brown (10YR5/3) to Light Gray (10YR7/2), very fine to fine grained, subrounded, poorly sorted, siliceous, indurated.
30	-30				3.2	☒		

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Remarks: ags = above ground surface; AK = air knife; amsl = above mean sea level; AR = air rotary; bgs = below ground surface; ppm = parts per million; cm = centimeter;

Date Start/Finish: 5/20/2013
Drilling Company: White Drilling/R Dallas

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 30' bgs
Descriptions By: R Nanny

Well/Boring ID: VGSAU16 - 04

Client: Chevron EMC
Location: Vacuum Grayburg San Andres Unit Well 16

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	AR	2	10.1	☒		SANDY CLAY (Topsoil), Brown (10YR4/3), friable, dry, mostly clay, some sand, very fine to fine grained, subangular, poorly sorted, arenaceous.
			AR	3				CAPROCK CALICHE, Very Pale Brown (10YR8/3 to 10YR7/3), laminated, indurated, showing pisolites. Formation is silty, fractured, weathered, then becomes solid at 1 feet bgs.
5	-5				9.1	☒		CALCAREOUS SANDY CLAY, Very Pale Brown (10YR7/4), soft, arenaceous, slightly moist, very fine to fine grained, subrounded, poorly sorted. Formation contains concretionary caliche nodules, Very Pale Brown (10YR8/2), indurated, 0.3 to 0.7 cm.
		2	AR	5				CAPROCK CALICHE, Light Brown (7.5YR6/4), indurated, trace sand, fine grained, subrounded, poorly sorted, some sand, formation is laminated and shows some pisolites.
10	-10				4.9	☒		SANDY CALICHE, Very Pale Brown (10YR7/3), soft, slightly moist, half caliche argillaceous, some sand, very fine to fine grained, subrounded, poorly sorted, loose. Formation contains some concretionary, caliche nodules. Very Pale Brown (10YR8/2), very fine to indurated, some arenaceous, very fine to fine grained, subrounded, moderately sorted, some argillaceous, blocky, 0.5 cm to 1.5 cm.
		3	AR	5				SILICEOUS CALICHE, Light Brown (7.5YR6/4), indurated, trace sand, fine grained, subrounded, poorly sorted.
15	-15				9.1	☒		SANDY CALICHE, Very Pale Brown (10YR8/2), soft, dry, arenaceous, some caliche, some sand, fine grained, subrounded, poorly sorted, loose, concretionary, siliceous, nodules, Pink (7.5YR7/3), indurated, silty, 0.2 to 0.5 cm.
		4	AR	5				
20	-20				7.1	☒		CALCAREOUS SAND, Very Pale Brown (10YR7/3), very fine to fine grained, subangular, poorly sorted, loose, dry. Formation contains trace concretinary calcite, nodules, Pale Yellow (2.5YR8/2), firm, rounded, 0.2 to 0.5 cm.
		5	AR	5				
25	-25				6.0	☒		SANDSTONE, Light Brownish Gray (10YR6/2), very fine to fine grained, subrounded, poorly sorted, siliceous, indurated, dry.
		6	AR	5				
30	-30				9.7	☒		

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Remarks: ags = above ground surface; AK = air knife; amsl = above mean sea level; AR = air rotary; bgs = below ground surface; ppm = parts per million; cm = centimeter;

Date Start/Finish: 5/20/2013
Drilling Company: White Drilling/R Dallas

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 30' bgs
Descriptions By: R Nanny

Well/Boring ID: VGSAU16 - 05

Client: Chevron EMC
Location: Vacuum Grayburg San Andres Unit Well 16

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	AR	2	4.8	☒		SANDY CLAY (Topsoil), Brown (10YR4/3), friable, dry, mostly clay, some sand, very fine to fine grained, subangular, poorly sorted, roots in sample.
								CAPROCK CALICHE, Very Pale Brown (10YR8/3 to 10YR7/3), laminated, indurated, trace sand, silt to very fine grained, subangular to subrounded, poorly sorted, dry, fractured, weathered.
5	-5		AR	3	11.0	☒		SILTY/SANDY CALICHE, Very Pale Brown (10YR8/3), soft, arenaceous, dry, mostly caliche, powdery, some sand, silt to fine grained, subangular to subrounded, poorly sorted, loose, trace, indurated, silica intermixed with calcium carbonate cementation, 0.3 to 0.5 cm.
10	-10	2	AR	5	9.2	☒		SILICEOUS CALICHE, Light Brown (7.5YR8/4), indurated, trace sand, fine grained, subrounded, poorly sorted.
								Same as above, some formation becomes fractured.
15	-15	3	AR	5	6.3	☒		CLAYEY CALICHE, Very Pale Brown (10YR8/3), soft, powdery, contains concretionary siliceous, nodules, 0.3 to 1 cm, nodules are silty.
20	-20	4	AR	5	6.5	☒		Same as above, formation becomes arenaceous.
		5	AR	5				
25	-25	6	AR	5	7.3	☒		SANDSTONE, Light Brownish Gray (10YR6/2), very fine to fine grained, subrounded, poorly sorted, siliceous, indurated, dry.
30	-30				7.2	☒		

Remarks: ags = above ground surface; AK = air knife; amsl = above mean sea level; AR = air rotary; bgs = below ground surface; ppm = parts per million; cm = centimeter;

Date Start/Finish: 5/20/2013
Drilling Company: White Drilling/R Dallas

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 30' bgs
Descriptions By: R. Nanny

Well/Boring ID: VGSAU16 - 06

Client: Chevron EMC
Location: Vacuum Grayburg San Andres Unit Well 16

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	AR	2	6.3	☒		SANDY CLAY (Topsoil), Brown (10YR4/3), friable, dry, mostly clay, some sand, very fine to fine grained, subangular to subrounded, poorly sorted, arenaceous, roots in sample.
			AR	3				CAPROCK CALICHE, Very Pale Brown (10YR8/3 to 10YR7/3), laminated, indurated, showing pisolites, contains silica and calcium carbonate cementation. Formation is silty, fractured, weathered, becomes solid at 1 feet bgs.
5	-5	2	AR	5	3.6	☒		CLAYEY CALICHE, Very Pale Brown (10YR8/3), soft, powdery, argillaceous, mostly caliche, some sand, very fine to fine grained, subangular to subrounded, poorly sorted, loose, slight moisture in formation. Formation contains trace concretionary caliche nodules, Pale Yellow (2.5YR8/3), indurated, rounded, 0.2 cm to 0.5 cm.
10	-10	3	AR	5	5.6	☒		CAPROCK CALICHE, Light Brown (7.5YR6/4), laminated, indurated, showing pisolites, trace sand, fine grained, subrounded, poorly sorted, some sand.
15	-15	4	AR	5	6.1	☒		SANDY CALICHE, Very Pale Brown (10YR8/2), slightly firm, dry, half caliche, some sand, very fine to fine grained, subrounded, poorly sorted, loose, some concretionary caliche, nodules, Very Pale Brown (10YR7/3), indurated, 0.3 to 0.5 cm, rounded.
20	-20	5	AR	5	5.1	☒		CALCAREOUS SAND, Very Pale Brown (10YR8/2), very fine to fine grains, subangular to subrounded, poorly sorted, loose, calcareous, intergrainular clay is powdery, dry. Formation contains trace concretionary caliche nodules as described above, 0.1 cm to 0.4 cm.
25	-25	6	AR	5	6.2	☒		SANDSTONE, Light Brownish Gray (10YR6/2), very fine to fine grained, subrounded, poorly sorted, siliceous, indurated, dry.
30	-30				9.2	☒		

Remarks: ags = above ground surface; AK = air knife; amsl = above mean sea level; AR = air rotary; bgs = below ground surface; ppm = parts per million; cm = centimeter;

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Date Start/Finish: 5/20/2013
Drilling Company: White Drilling/R Dallas

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 30' bgs
Descriptions By: R. Nanny

Well/Boring ID: VGSAU16 - 07

Client: Chevron EMC
Location: Vacuum Grayburg San Andres Unit Well 16

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0		AR	2	1.8			CALICHE PAD, Pink (7.5YR7/3 to 7.5YR8/2), firm, fractured, slightly brecciated, dry, mixed indurated, silica cemented and calcium carbonate cemented caliche.
		1						SANDY CLAY, Brown (7.5YR4/4), firm, blocky, dry, mostly clay, some sand, very fine to fine grained, subangular, poorly sorted, formation contains trace caliche, Very Pale Brown (10YR8/2), nodular, friable, traces throughout formation.
			AR	3				SILTY CALICHE, Pale Yellow (2.5YR8/2), indurated, calcium carbonate cemented, dry.
5	-5				1.3			SANDY/CLAYEY CALICHE, Very Pale Brown (10YR8/2), soft, dry, argillaceous, formation contains traces sand, silt to fine grained, subrounded, poorly sorted, formation also contained traces indurated caliche, same color as formation, concretions, nodular, rounded, throughout formation.
		2	AR	5				CAPROCK CALICHE, Light Yellowish Brown (10YR6/4), laminated, siliceous, indurated, dry.
10	-10				2.2			SANDY/CLAYEY CALICHE, Very Pale Brown (10YR8/3), slightly firm, powdery, dry, contains trace sand, very fine to fine grained, subrounded, poorly sorted, loose.
		3	AR	5				Same as above, formation contains sandy caliche, concretionary nodules, 10YR7/3, Very Pale Brown, indurated, 0.5 cm, sand, very fine to fine grained, subrounded, poorly sorted, traces.
15	-15				2.6			
		4	AR	5				
20	-20				2.3			CALCAREOUS SAND, Very Pale Brown (10YR8/2), very fine to fine grained, subangular to subrounded, poorly sorted, loose, formation contains some sandy concretionary siliceous, nodules, indurated, 0.5 cm to 1.5 cm, dry, formation nodules are Light Yellowish Brown (10YR6/4).
		5	AR	5				Same as above, slight increase in sand.
25	-25				3.7			
		6	AR	5				SANDSTONE, Brown (10YR5/3), fine grained, subangular to subrounded, poorly sorted, indurated, siliceous, dry.
30	-30				5.9			

Remarks: ags = above ground surface; AK = air knife; amsl = above mean sea level; AR = air rotary; bgs = below ground surface; ppm = parts per million; cm = centimeter;

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Attachment 7

Chloride Multimedia Exposure Assessment Model Simulated Soil Screening Levels for the Protection of Groundwater Memo

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MEMO

To:
Kegan Boyer, Chevron Environmental Management Company

Copies:
Chris Shepherd, ARCADIS
Kathleen Abbott, ARCADIS
David Evans, ARCADIS

From:
Jonathan Olsen

Date:
May 8, 2014

ARCADIS Project No.:
B0048615.0000

Subject:
Chloride Multimedia Exposure Assessment Model Simulated Soil Screening Levels for the Protection of Groundwater
HES Transfer Sites, Lea County, New Mexico

On behalf of Chevron Environmental Management Company, ARCADIS U.S., Inc. (ARCADIS) evaluated chloride remediation action levels for use at the Health Environmental Safety (HES) Transfer Sites near Hobbs, New Mexico. The New Mexico Oil Conservation District (NMOCD) has established soil screening levels (SSLs) for fluid management pits (also known as the "NMOCD PIT RULE" [NMAC 19.15.17]); however, no formal SSLs have been established by the NMOCD or the New Mexico Environmental Department (NMED) for surface releases of production water. The Risk Assessment Guidance for Investigation and Remediation (NMED 2012) states that SSLs should be based on risk to human health and the potential migration to groundwater with respect to the NMED-specific tap water SSL. Chloride is not considered hazardous and the NMED and the United States Environmental Protection Agency (USEPA) have not established tap water screening levels for chloride. However, the NMED has established a chloride standard for groundwater (NMAC 20.6.2.1101) of 250 milligrams per liter (mg/L). Therefore, the SSL for chloride should be based on the soil leaching to groundwater pathway.

To evaluate a chloride SSL for use at the HES Transfer Sites, ARCADIS performed simulations of unsaturated zone flow, transport, and saturated zone mixing of chloride using the Multimedia Exposure Assessment Model Version 2.0 (MULTIMED; USEPA 1996) to evaluate the potential migration of chloride in shallow soil through the unsaturated zone to the underlying groundwater. The initial simulations were intended to estimate a maximum allowable chloride soil concentration (site SSL) to evaluate HES Transfer

Sites in Lea County and eastern Eddy County, New Mexico, and to develop a baseline approach for using the model for potential future evaluations of solute migration at other HES Transfer Sites in New Mexico.

MULTIMED Overview

MULTIMED was originally designed to simulate the movement of solutes leaching from a landfill to various exposure pathways. Due to its general acceptance by the NMOCD and the USEPA and its ability to simulate unsaturated and saturated zone flow and transport, MULTIMED was selected for this evaluation. The model, as designed, simulates one-dimensional vertical transport in the unsaturated zone to the saturated zone based on user-provided input parameters considering vadose zone, saturated zone, and chemical-specific characteristic parameters.

The simulations were performed using both the unsaturated and saturated zone modules available in MULTIMED. The unsaturated zone module performs solutions of the downward flow of infiltrating water to the water table by Darcy's Law:

$$Q = -K_v \cdot K_{rw}\left(\frac{\delta\psi}{\delta z}\right)$$

Where:

ψ is the pressure head (meters [m])

z is the depth (m)

Kv is the saturated hydraulic conductivity (meters per year [m/year])

Krw is the relative hydraulic conductivity

The boundary condition at the water table is:

$$\psi \cdot L = 0$$

Where:

L is the thickness of the unsaturated zone (m)

In the unsaturated zone, it is necessary to specify the relationship between relative hydraulic conductivity, pressure head, and water saturation. This relationship is given by van Genuchten (1976):

$$S_e = \theta r + \frac{\theta s - \theta r}{[1 + (\alpha\psi^{\beta})^{\gamma}]}$$

Where:

θr and θs are the residual water saturation and total water saturation (dimensionless), respectively

β, γ, α are empirical soil-specific parameters (dimensionless)

ψ is the air pressure entry head (m)

S_e is the effective saturation (fraction)

Source area concentrations are input as leachate concentrations, therefore, the soil/water partition equation was used to convert between total soil concentration in milligrams per kilogram (mg/kg) and the leachate concentration in mg/L:

$$C_t = \frac{C_l \cdot R \cdot \theta_w}{\rho_b}$$

Where:

C_t is the concentration of the chemical of interest in soil (mg/kg)

C_l is the concentration of the chemical of interest in leachate (mg/L)

R is the retardation coefficient (dimensionless, assumed 1 for chloride)

ρ_b is the bulk density of the soil (mg/L or grams per cubic centimeter)

The mass of the chemical of interest that reaches the groundwater is expressed by the simplified steady-state equation (Salhotra et al. 1995) that couples the vadose zone to the groundwater:

$$M_L = A_w \cdot Q_f \cdot C_l$$

Where:

M_L is the chemical of interest mass that leaches from site soil (grams per year [g/year])

A_w is the width of the source area (m^2)

Q_f is the percolation rate from the facility/site (m/year)

The mixed groundwater concentration is controlled by the quasi-three-dimensional advection dispersion equations that are evaluated based on the following chemical concentration relationship within the mixing zone (Salhotra et al. 1995):

$$C(x, y, z, t) = \frac{H}{B} C_f(x, y, t) + \Delta C_p(x, y, z, t)$$

Where:

C is the dissolved concentration (mg/L, g/m^3)

x,y,z are the spatial coordinates (m)

t is elapsed time (year)

H is the source zone penetration (m), with a maximum equal to B

B is the thickness of the saturated zone (m)

MULTIMED's output concentration is a centerline concentration based on a calculated dilution attenuation factor. Thus, the output concentration is the maximum concentration of the chemical of interest in groundwater at a reasonable distance downgradient from the source area.

Model Design, Inputs, and Assumptions

The required input parameters for the MULTIMED simulations are summarized in Table 1. Input parameters include model structure, unsaturated and saturated zones, and chemical characteristics. Minimal site-specific data regarding the HES sites are available; therefore, numerous input parameters are based on published reports, default NMED values (2012), default values provided in the modeling code, and ARCADIS's experience, as indicated in Table 1. The model values are considered representative of the Lea County, New Mexico area. Due to the intended use of the SSL at multiple sites, more conservative values were generally selected for the given ranges of input parameters.

The general assumptions used in the MULTIMED model design include:

- The unsaturated and saturated zones are a single, homogeneous material.
- The applied recharge and infiltration are constant throughout the simulation.
- Initial chloride concentrations in soil below the source area and in groundwater are equal to 0.
- The model assumes no chemical transformation or adsorption of chloride to soil materials.

The simulations were performed using the transient model capabilities of MULTIMED. Steady-state simulations were not chosen because MUTLIMED requires the assumption that the source is continuous and constant throughout the simulation, which is not appropriate for these evaluations. Also, the transient model was selected to provide output that simulates the aquifer concentrations versus time and models a finite source.

Model Simulations and Results

Using the input parameters provided, soil concentrations for chloride were iteratively varied to arrive at an appropriate maximum allowable soil concentration that would be protective of groundwater for each of the scenarios. To calculate the maximum concentration that would be observed given the input concentrations and parameters, the simulation period selected was 1,980 years with 20-year time steps.

To ascertain the maximum allowable chloride concentration for more typical chloride concentration distribution and depth to groundwater scenarios, eight MULTIMED simulations were completed. The scenarios are summarized in Table 2. The input values for the simulations were the same, except for the thickness and width of the chloride-affected soil within the soil column. The first four simulations evaluated homogeneous chloride-affected soil 20 meters wide (400 square meters [m^2]) and varied the chloride-affected soil thickness between 1 meter and 3 meters and the depth to groundwater between 20 and 30.5 meters. The remaining four simulations evaluated homogeneous chloride-affected soil 45 meters wide (2,000 m^2) and varied the chloride affected soil thickness between 1 meter and 3 meters and the depth to groundwater between 20 and 30.5 meters

The predicted groundwater concentrations versus time are illustrated on Figures 1 through 8. The peak arrival times varied between 540 and 860 years. The simulations indicate the site SSLs for the protection of groundwater ranged from 8,525 to 266,100 mg/kg (Table 2) depending on the scenario and are protective of the New Mexico chloride groundwater standard of 250 mg/L.

The MULTIMED model, like any model, requires the use of simplifying assumptions regarding subsurface conditions and flow processes that result in inherent limitations and uncertainty compared to an actual flow system. In this case, uncertainty may be related to:

- The model assumes homogeneous unsaturated and saturated zones; the actual conditions at the sites likely contain numerous heterogeneities.

- The applied recharge and infiltration rates are constant. The aquifer hydraulic gradient is also assumed to be constant. These rates likely vary with time, and these variations may influence the solute migration and mixing, resulting in short-term changes in aquifer concentrations

- The model is a theoretical simulation of transport processes and is not verified or calibrated against site-specific data.

Conclusions and Recommendations

The model simulations reasonably represent conditions encountered at most of the Lea County and eastern Eddy County HES Transfer Sites. HES Transfer Sites with chloride-affected soil can be screened

against SSLs in Table 2, assuming they meet the specified conditions (source length, source depth, depth to groundwater, and soil concentration). For calculated SSLs greater than 100,000 mg/kg, a maximum allowable soil concentration of 100,000 mg/kg is recommended in accordance with the NMED risk assessment guidance (NMED 2012). For sites that meet all of these conditions, no further action is recommended. For the sites that do not meet these conditions, site-specific evaluations should be conducted.

Enclosures:

Tables

Table 1 MULTIMED V2.0 Model Inputs

Table 2 Soil Screening Level Matrix

Figures

Figure 1 MULTIMED Simulated Chloride Concentration vs. Time (Source = 20m, Chloride 0-1m, & Depth to Groundwater = 20m)

Figure 2 MULTIMED Simulated Chloride Concentration vs. Time (Source = 20m, Chloride 0-1m, & Depth to Groundwater = 30.5m)

Figure 3 MULTIMED Simulated Chloride Concentration vs. Time (Source = 20m, Chloride 0-3m, & Depth to Groundwater = 20m)

Figure 4 MULTIMED Simulated Chloride Concentration vs. Time (Source = 20m, Chloride 0-3m, & Depth to Groundwater = 30.5m)

Figure 5 MULTIMED Simulated Chloride Concentration vs. Time (Source = 45m, Chloride 0-1m, & Depth to Groundwater = 20m)

Figure 6 MULTIMED Simulated Chloride Concentration vs. Time (Source = 45m, Chloride 0-1m, & Depth to Groundwater = 30.5m)

Figure 7 MULTIMED Simulated Chloride Concentration vs. Time (Source = 45m, Chloride 0-3m, & Depth to Groundwater = 20m)

Figure 8 MULTIMED Simulated Chloride Concentration vs. Time (Source = 45m, Chloride 0-3m, & Depth to Groundwater = 30.5m)

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Tables

Table 1
MULTIMED V2.0 Model Inputs
Chevron HES Transfer Sites
Lea County, New Mexico

Parameters		Value(s)	Units	*Notes*
Unsaturated Zone Flow Parameters:				
Depth of Unsaturated Zone		20.0	m	Local water levels (20m & 30.5m)
Hydraulic Conductivity		0.06	cm/hr	Texas (2011)
Unsaturated Zone Porosity		0.44	fraction	NMED (2012) Default
Residual Water Content		0.260	fraction	NMED (2012) Default
Unsaturated Zone Transport Parameters:				
Thickness of Layer		20 & 30.5	m	Regional water levels
Percent of Organic Matter		1.5%		NMED (2012) Default (not used)
Bulk Density		1.5	g/cm^3	NMED (2012) Default
Biological Decay Coefficient		0	1/yr	(not used)
Aquifer Parameters:				
Aquifer Porosity		0.43	fraction	NMED (2012) Default
Bulk Density		1.5	g/cm^3	NMED (2012) Default
Aquifer Thickness		12.0	m	NMED (2012) Default
Hydraulic Conductivity		542	m/yr	Texas (2011), Velocity ~ 1/2 NMED Default
Hydraulic Gradient		0.010	m/m	NMED (2012) Default
Organic Carbon Content		0.020	fraction	NMED (2012) Default (not used)
Temperature of Aquifer		15.0	°C	NMED (2012) Default (not used)
pH		6.2		(not used)
x-distance Radial Distance from Site to Receptor		12	m	equal to aquifer thickness
Source Parameters:				
Infiltration Rate		0.013	m/yr	~0.5 in/yr, Texas (2011)
Area of Waste		400 & 2000	m^2	NMED (2012) Default (~45m x45m)
Recharge Rate		0.013	m/yr	Texas (2011)
Duration of Pulse		540 to 840	yr	Varied, set equal to peak arrival time
Discharge Concentrations		0	mg/L	
Initial Soil Concentrations:				
	Depth (m)			
Chloride leachate concentration	*0*	varied	mg/L	Calculated for each scenario[1]
Chloride leachate concentration	*1 & 3*	0	mg/L	
Chloride leachate concentration	*20 & 30.5*	0	mg/L	
Additional Parameters:				
Method		Gaussian		
New Mexico Environment Department. 2012. Risk		Chloride		
Chemical Parameters:				
Normalized Distribution Coefficient		0.00	mL/g	Model Derived
Van Genuchten Parameters:				
Alpha Van Genuchten coefficient		0.38	unitless	NCSS Soil Characterization Data[2]
Beta Van Genuchten coefficient		1.2	unitless	NCSS Soil Characterization Data[2]

Notes:

°C - degrees celcius
cm - centimeters
cm^3 - cubic centimeters
g - grams
hr - hour
L - liters
m - meters
m^2 - meter squared
mg - milligrams
mL - milliliters
yr - year

1 - calculated using the soil-water partitioning equation
2 - van Genutchen transport parameters are typical values for caliche-like material

References:

NMED - New Mexico Environmental Department Risk Assessment Guidance for Site Investigations and Remediation. February 2012.
NCSS - National Cooperative Soil Survey, National Cooperative Soil Characterization Database
Texas - Texas Water Development Board 2011. Update of the Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers of Texas. January 21, 2011

Table 2
Soil Screening Level Matrix
Chevron HES Transfer Sites
Lea County, New Mexico

Scenario	Source Length (m)	Source Area (m)	Source Depth (m)	Depth to Groundwater (m)	SSL_{gw} (mg/Kg)	Notes
1	20	400	0-1	20.0	108,000	1
2	20	400	0-1	30.5	266,100	1
3	20	400	0-3	20.0	23,750	
4	20	400	0-3	30.5	45,000	
5	45	2,000	0-1	20.0	38,800	
6	45	2,000	0-1	30.5	95,500	
7	45	2,000	0-3	20.0	8,525	
8	45	2,000	0-3	30.5	16,100	

NMED SSL Ceiling = 100,000 mg/Kg

Notes:

m - meters

mg/Kg - milligrams per Kilogram

NMED - New Mexico Environmental Department

SSL_{gw} - Site soil screening levels for the migration to groundwater pathway

SSL Ceiling - Soil Screening Level Ceiling (NMED 2012)

1 - the NMED SSL ceiling should be used

References:

New Mexico Environment Department. 2012. Risk Assessment Guidance for Investigations and Remediation, Volume I. February 2012 (updated June 2012).

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Figures

Figure 1
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 20m, Chloride 0-1m, & Depth to Groundwater = 20m)

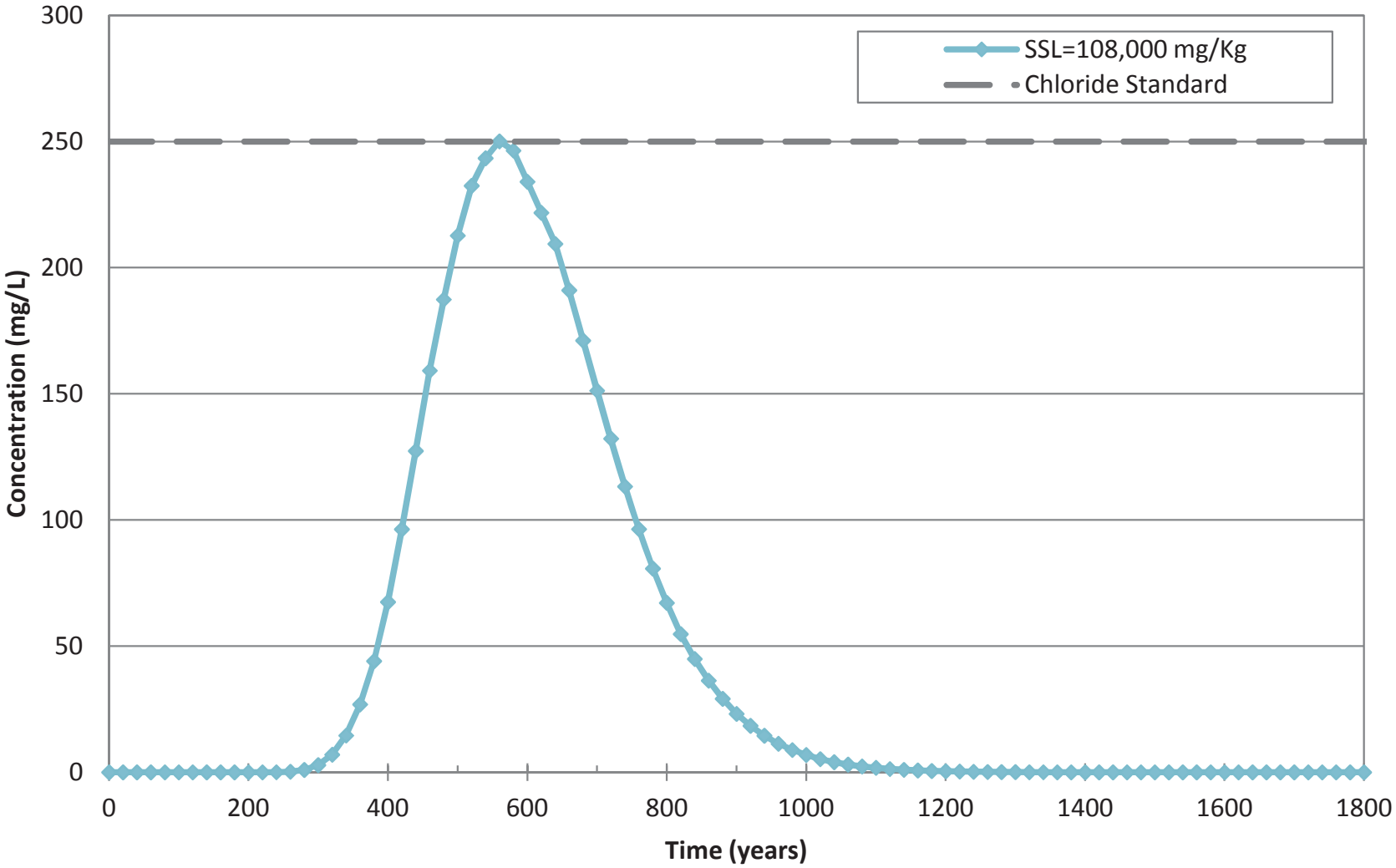

Figure 2
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 20m, Chloride 0-1m, & Depth to Groundwater = 30.5m)

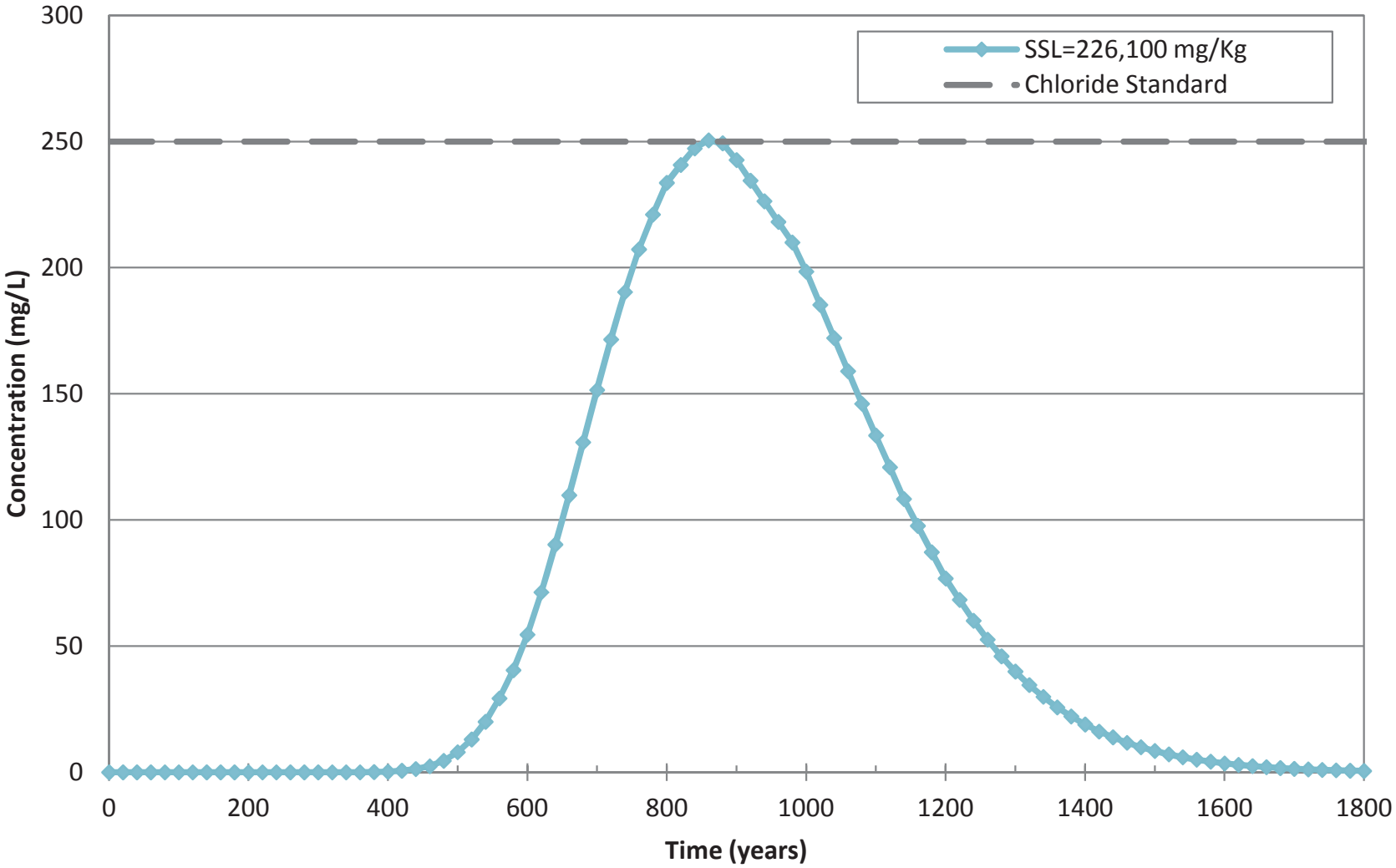

Figure 3
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 20m, Chloride 0-3m, & Depth to Groundwater = 20m)

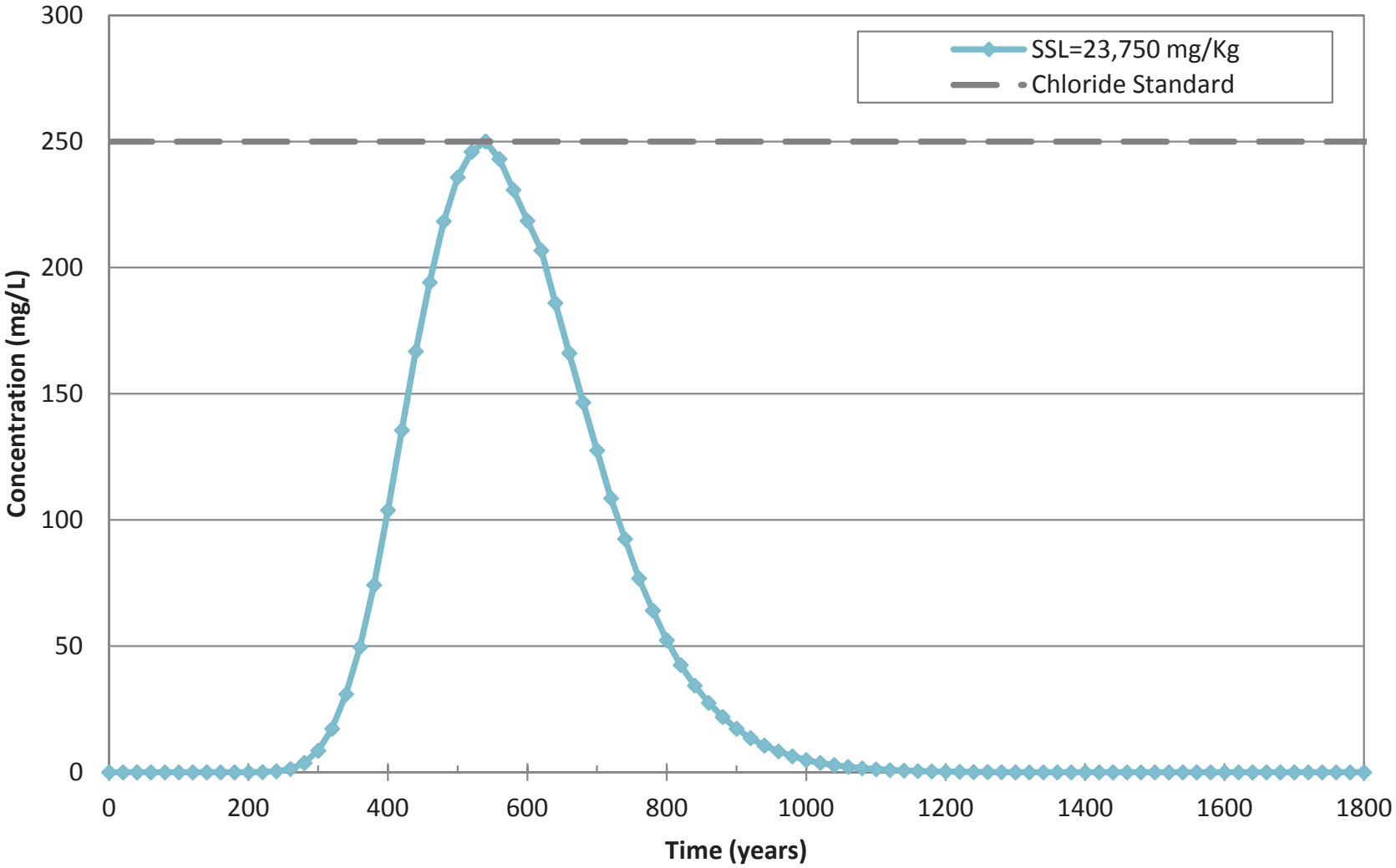

Figure 4
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 20m, Chloride 0-3m, & Depth to Groundwater = 30.5m)

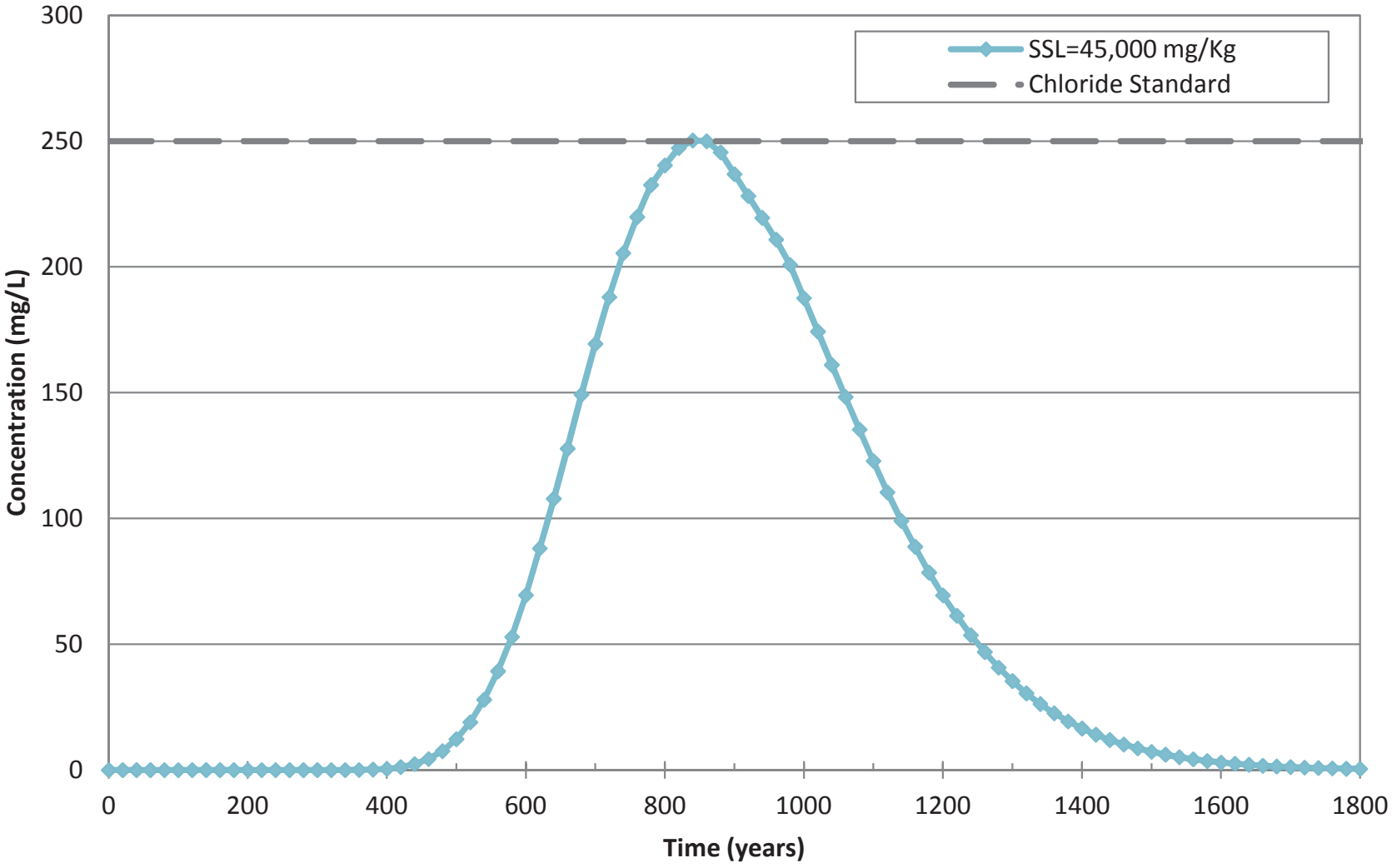

Figure 5
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 45m, Chloride 0-1m, & Depth to Groundwater = 20m)

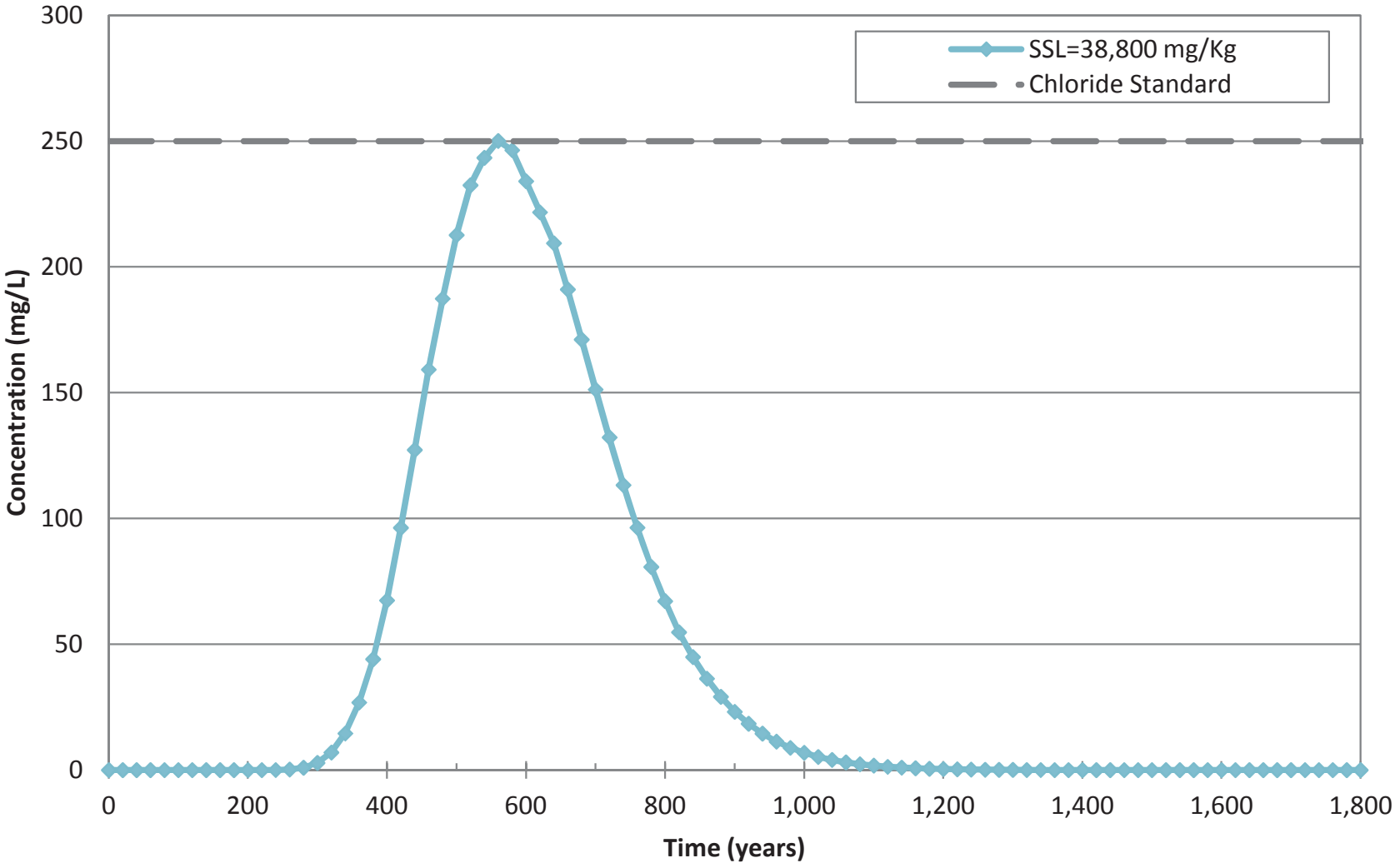

Figure 6
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 45m, Chloride 0-1m, & Depth to Groundwater = 30.5m)

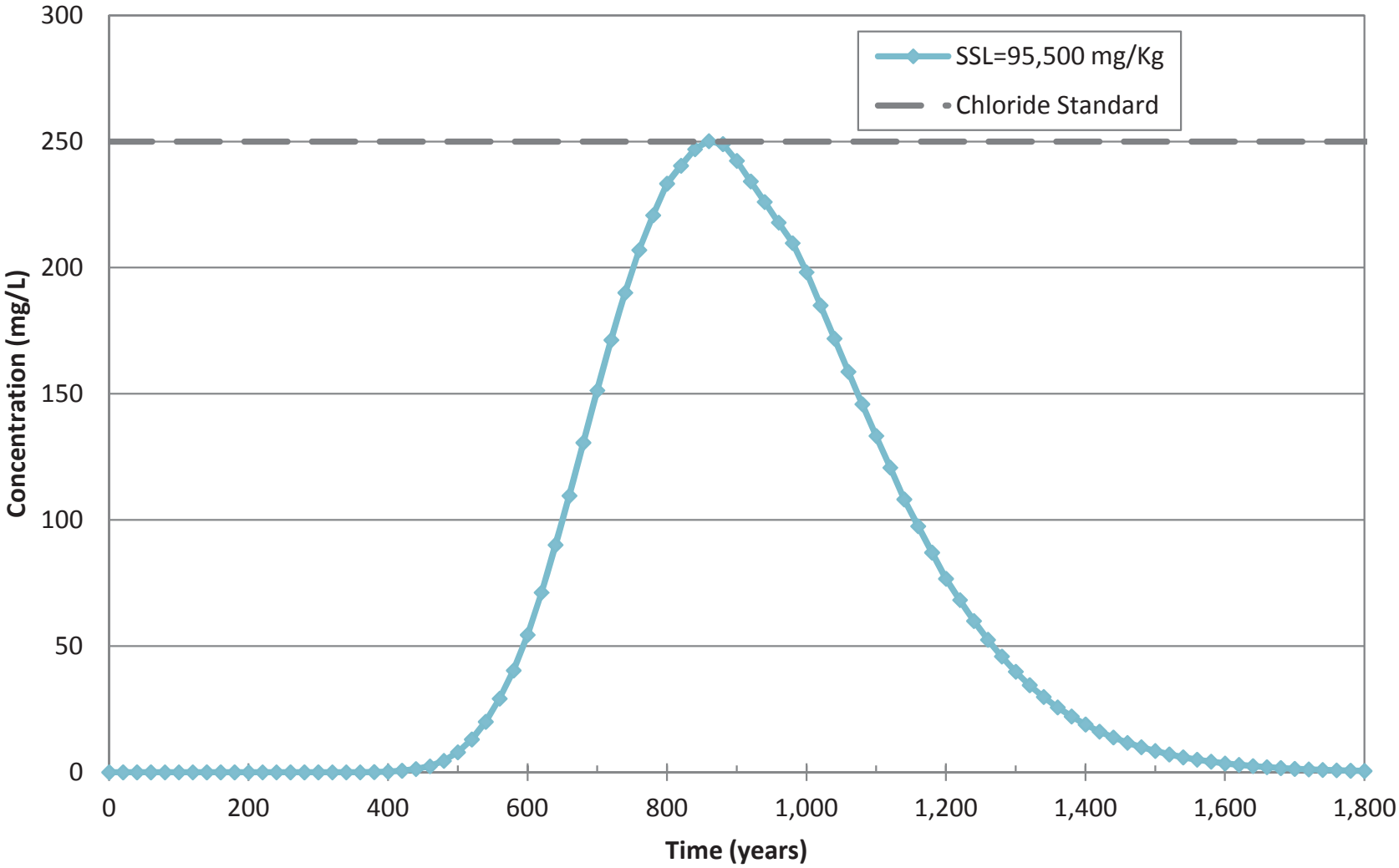

Figure 7
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 45m, Chloride 0-3m, & Depth to Groundwater = 20m)

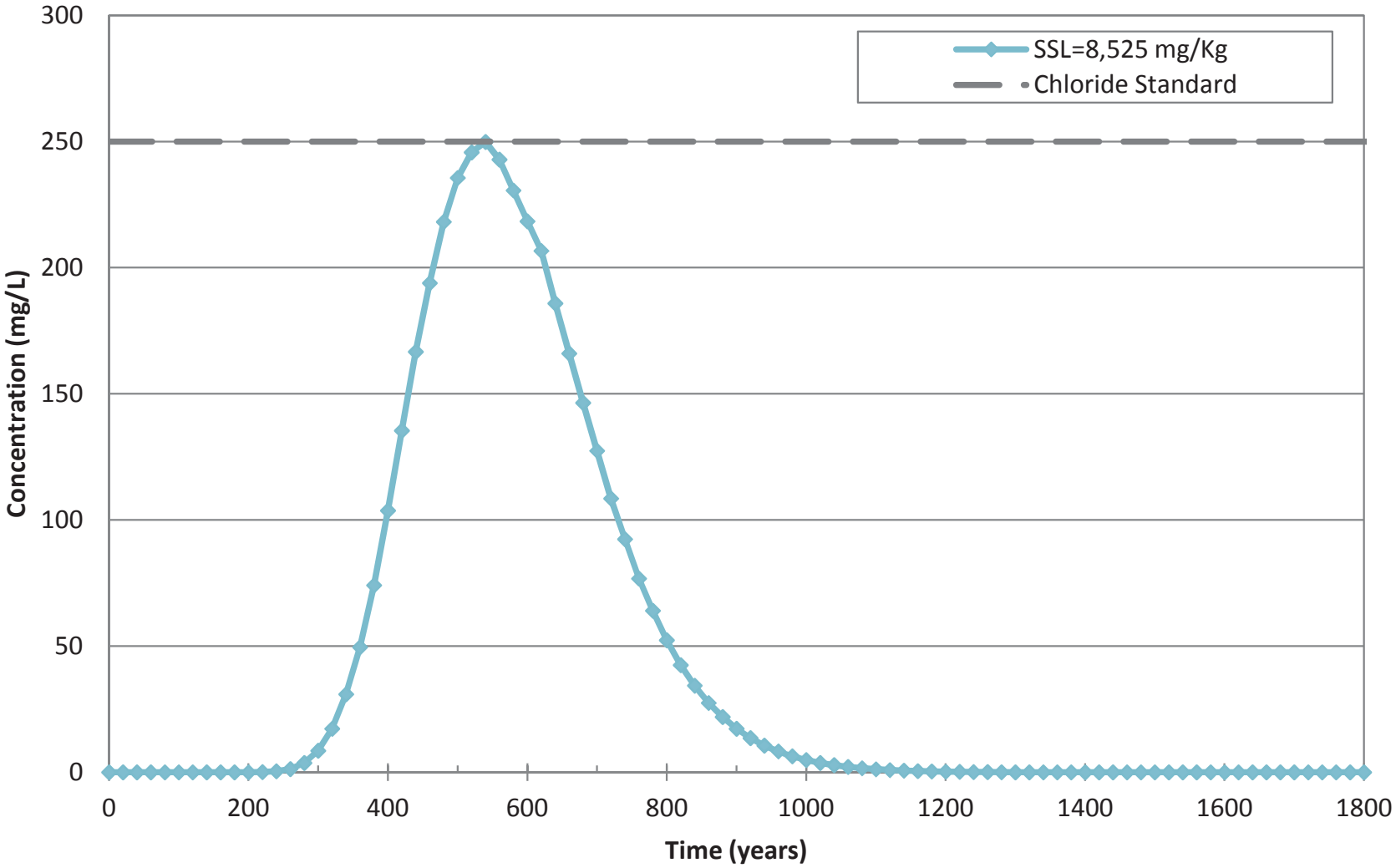

Figure 8
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 45m, Chloride 0-3m, & Depth to Groundwater = 30.5m)