REVIEWED
By Kellie Jones at 8:38 am, Nov 04, 2015

Chevron

INFORMATION ONLY

Luke Welch
Project Manager

Upstream Business Unit
Environmental Management Company
1400 Smith Street
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Tel 713-372-0292
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1. At sample point 3, we have contamination at 2100 ppm chlorides, which shows that the vertical extent of contamination has not been determined.
2. Please note that the Ranking Score is determined from the lowest extent of contamination, which will change the regulatory threshold from 1000 ppm to 500 ppm for chlorides.
3. Please provide a plan on a path forward.

December 15, 2014

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

Re : Chevron Special Projects – VGWU No. 85 (RP# 3266)

Dear Dr. Oberding,

Please find enclosed for your records, a copy of the final report documenting the assessment activities at the Vacuum Glorietta West Unit No. 85 (RP # 3266).

The report was prepared by Arcadis US, Inc. (Arcadis) on behalf of Chevron Environmental Management Company (CEMC) to document 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 activities identified several locations with soil impacts in the upper fifteen feet of soil at levels of regulatory concern. To address these issues, CEMC proposes to conduct further remedial activities where practical, given the limitations of buried and overhead lines. For more information, please see the attached report. Should you have any questions regarding the content of the report or the proposed activities, 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

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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 Glorieta West Unit #85
Lea County, New Mexico

Date:
December 2, 2014

Contact:
Jonathan Olsen

Phone:
713.953.4874

Email:
Jonathan.Olsen@arcadis-us.com

Our ref:
B0048617.0000

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 performed at the Vacuum Glorieta West Unit (VGWU) #85 located in Lea County, New Mexico (site; Figure 1). These activities were conducted in response to a release of approximately 123.7 barrels (bbls) of produced water and oil that occurred on August 29, 2012.

To evaluate the potential impacts related to this release, 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:

- Response activities included removal of liquids and visually 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 (119 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 August 29, 2012 release and follow-up soil assessment activities conducted on November 6, 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 0.5 mile 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 9 miles east of the site.

The site is located northeast of the VGWU #85 wellhead. The release described in the following sections occurred in the field next to the wellhead. 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 2 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 314 water-supply wells within a 5-mile radius of the site (NMOSE 2011). A petroleum-industry-related water-supply well, located approximately 1,300 feet northwest (i.e., hydraulically crossgradient) 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 recorded for the area of the site 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 4,000 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. East of the ridge, the Ogallala Formation 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 55 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 bgs (Summers 1972).

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 119 feet bgs (NMOSE 2014; Attachment 3).

Initial Release Response Activities

A release of approximately 123.6 bbls of produced water and 0.12 bbl of oil occurred at the site on August 29, 2012 due to the failure in the integrity of a line. Chevron personnel from the Mid-Continent Business Unit (MCBU) stopped the release and recovered approximately 60 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 four discrete confirmation soil samples from the base of the excavation on January 22, 2013. Information regarding the disposal of the excavated soil was not available to ARCADIS. 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 C-141 form is included as Attachment 4.

Confirmation Soil Sampling

Four discrete confirmation soil samples were collected from the base of the excavation on January 22, 2013. 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 four confirmation soil samples collected in January 2013 to regulatory criteria to provide context for the concentrations of analytes detected and to evaluate if additional sampling was necessary. 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	>100 feet	0
Wellhead protection area	No	0
Distance to surface-water body	>1,000 feet	0
Total Ranking Score		**0**

SRALs	Benzene (mg/kg)	Total BTEX (mg/kg)	TPH (mg/kg)
	10	50	5,000

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 have been removed (NMAC 2009).

Criteria	Site-Specific Result	Chloride (mg/kg)
Depth below bottom of pit to groundwater	>100 feet	1,000

Confirmation Soil Sample Results

The analytical results for BTEX, TPH-GRO, TPH-DRO, and chloride for the four discrete confirmation soil samples collected in January 2013 are provided in Table 1 and summarized below:

- Benzene and BTEX were not detected above the laboratory reporting limits (LRLs) or above the SRALs of 10 and 50 mg/kg, respectively.
- TPH-GRO and TPH-DRO were not detected above LRLs.
- TPH (TPH-DRO and TPH-GRO) was not detected above the LRLs or above the SRAL of 5,000 mg/kg in the four discrete confirmation samples.
- Chloride was detected in all four confirmation samples, at concentrations ranging from 1,340 mg/kg (VGWU #85 Sample #3) to 9,760 mg/kg (VGWU #85 Sample #1). Chloride was detected above the NMAC closure criterion of 1,000 mg/kg in all four soil samples (VGWU #85 Sample #1, VGWU #85 Sample #2, VGWU #85 Sample #3, and VGWU #85 Sample #4).

The complete laboratory analytical results with chain of custody documentation are included in Attachment 5. Chloride concentrations in confirmation soil samples VGWU #85 Sample #1, VGWU #85 Sample #2, VGWU #85 Sample #3, and VGWU #85 Sample #4 were above the regulatory criteria, which prompted additional site assessment activities.

Site Assessment Activities

In November 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 January 2013, 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 four soil borings (VGWU85-01, VGWU85-02, VGWU85-03, and VGWU85-04) on November 6, 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 25 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 20 feet bgs overlaying a poorly sorted sand layer from approximately 20 to 25 feet bgs (Attachment 6).

Soil Assessment Sampling

Six soil samples were collected from each boring location (for a total of 24 soil samples) beginning at a depth of 2 feet bgs and continuing at 5-foot intervals from 5 to 25 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 Assessment Sample Analysis

Soil samples collected from each boring were analyzed for 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.

The Chloride MULTIMED Simulated Soil Screening Levels for the Protection of Groundwater memo 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)	20
Source area (m^2)	400
Source depth (m)	0 to 1
Depth to groundwater (m)	20
Chloride SSL (mg/kg)	**100,000[1]**

Notes:
[1] A chloride SSL of 108,000 mg/kg was calculated using MUTLTIMED (USEPA 1996); however, a maximum allowable soil concentration of 100,000 mg/kg is recommended in accordance with the New Mexico Environment Department (NMED) risk assessment guidance (NMED 2012).
m = meter
m^2 = square meter

Soil Assessment Sample Results

The analytical results for chloride for the 24 soil assessment samples are provided in Table 1 and summarized below. Laboratory analytical results with chain of custody documentation are provided in Attachment 5.

Chloride was detected in all 24 soil samples, at concentrations ranging from 30 mg/kg (VGWU85-01 at 25 feet bgs) to 3,700 mg/kg (VGWU85-03 at 10 feet bgs). Chloride concentrations were not detected above the site-specific SSL of 100,000 mg/kg and only nine of the 24 soil assessment samples had chloride concentrations above 1,000 mg/kg (Table 1).

Summary and Conclusions

A release of approximately 123.6 bbls of produced water and 0.12 bbl of oil occurred at the site on August 29, 2012 due to the failure in the integrity of a line. Chevron MCBU personnel stopped the release and recovered approximately 60 bbls of fluids using a vacuum truck. Visually impacted soil was excavated to a depth of approximately 2 feet bgs and four discrete confirmation soil samples were collected from the base of the excavation in January 2013. Concentrations of chloride in all

four confirmation soil samples were above regulatory criteria, which prompted an additional investigation.

In November 2013, additional soil samples were collected to assess soil impacts within the observed aerial extent of the release. Chloride concentrations in soil samples collected during the 2013 assessment were below the site-specific SSL, which was calculated using the MULTIMED model (USEPA 1996; Attachment 6).

Potential migration of remaining petroleum hydrocarbons or chloride to groundwater is not expected due to the relatively small volume of unrecovered material, low precipitation (WRCC 2014a), high evapotranspiration rates (WRCC 2014b), and fine-grained nature of caliche layers present beneath the site. MULTIMED (USEPA 1996) model results demonstrate that the remaining soil concentrations associated with the release do not pose a significant risk to groundwater resources

Soil data presented in this report support a conclusion that impacted soil associated with the August 29, 2012 release at the site poses no significant threat to groundwater resources or other receptors. Accessible, visually impacted soil in the area of the release has already been excavated to a depth of approximately 2 feet bgs and backfilled with clean soil.

However, to minimize soil exceeding the 1,000 mg/kg chloride concentration discussed during a meeting on August 20, 2014 between CEMC and the NMCOD, ARCADIS proposes that limited excavation be implemented at the site. Shallow soil (up to 4 feet bgs) with chloride concentrations above 1,000 mg/kg will be excavated to provide clean soil to establish potential vegetation at the site in the future.

ARCADIS proposes to collect soil samples (up to 4 feet bgs) to delineate the excavation area to 1,000 mg/kg of chloride. Once the proposed excavation area is defined, soil within the proposed area will be excavated to 4 feet bgs. A liner will be placed within the limits of the excavation footprint and clean fill will be used to backfill the excavation areas. Pre-excavation samples will be used as confirmation samples and no post-excavation soil samples are proposed to be collected. The proposed excavation area is presented on Figure 3. Areas in close proximity to utility lines which does not allow for safe excavation were not included in the excavation footprint.

ARCADIS recommends that, upon completion of the excavation plan, 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 – VGWU #85
Figure 2	Release and Soil Boring Locations – VGWU #85
Figure 3	Proposed Excavation Area – VGWU #85

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 (November 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 Glorieta West Unit #85
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**	**5,000**		---	---
		NMAC Closure Criteria [(b)]	---	---	---	---	---	---	---	**500**	---
		MULTIMED Site-Specific SSL [(c)]	---	---	---	---	---	---	---	**100,000**	---
VGWU #85 Sample #1	1/22/2013	0	<0.050	<0.050	<0.050	<0.150	--	<10.0	<10.0	9,760	--
VGWU #85 Sample #2	1/22/2013	0	<0.050	<0.050	<0.050	<0.150	--	<10.0	<10.0	7,840	--
VGWU #85 Sample #3	1/22/2013	0	<0.050	<0.050	<0.050	<0.150	--	<10.0	<10.0	1,340	--
VGWU #85 Sample #4	1/22/2013	0	<0.050	<0.050	<0.050	<0.150	--	<10.0	<10.0	9,040	--
VGWU85-01	11/6/2013	2	--	--	--	--	--	--	--	2,700	5
	11/6/2013	5	--	--	--	--	--	--	--	2,700	6
	11/6/2013	10	--	--	--	--	--	--	--	640	6
	11/6/2013	15	--	--	--	--	--	--	--	320	8
	11/6/2013	20	--	--	--	--	--	--	--	59	20
	11/6/2013	25	--	--	--	--	--	--	--	30	5
VGWU85-02	11/6/2013	2	--	--	--	--	--	--	--	3,400	5
	11/6/2013	5	--	--	--	--	--	--	--	620	4
	11/6/2013	10	--	--	--	--	--	--	--	690	2
	11/6/2013	15	--	--	--	--	--	--	--	39	8
	11/6/2013	20	--	--	--	--	--	--	--	50	7
	11/6/2013	25	--	--	--	--	--	--	--	35	5
VGWU85-03	11/6/2013	2	--	--	--	--	--	--	--	2,000	10
	11/6/2013	5	--	--	--	--	--	--	--	2,000	17
	11/6/2013	10	--	--	--	--	--	--	--	3,700	15
	11/6/2013	15	--	--	--	--	--	--	--	590	19
	11/6/2013	20	--	--	--	--	--	--	--	450	4
	11/6/2013	25	--	--	--	--	--	--	--	2,100	8
VGWU85-04	11/6/2013	2	--	--	--	--	--	--	--	2,500	6
	11/6/2013	5	--	--	--	--	--	--	--	1,700	5
	11/6/2013	10	--	--	--	--	--	--	--	260	13
	11/6/2013	15	--	--	--	--	--	--	--	800	9
	11/6/2013	20	--	--	--	--	--	--	--	720	7
	11/6/2013	25	--	--	--	--	--	--	--	740	7

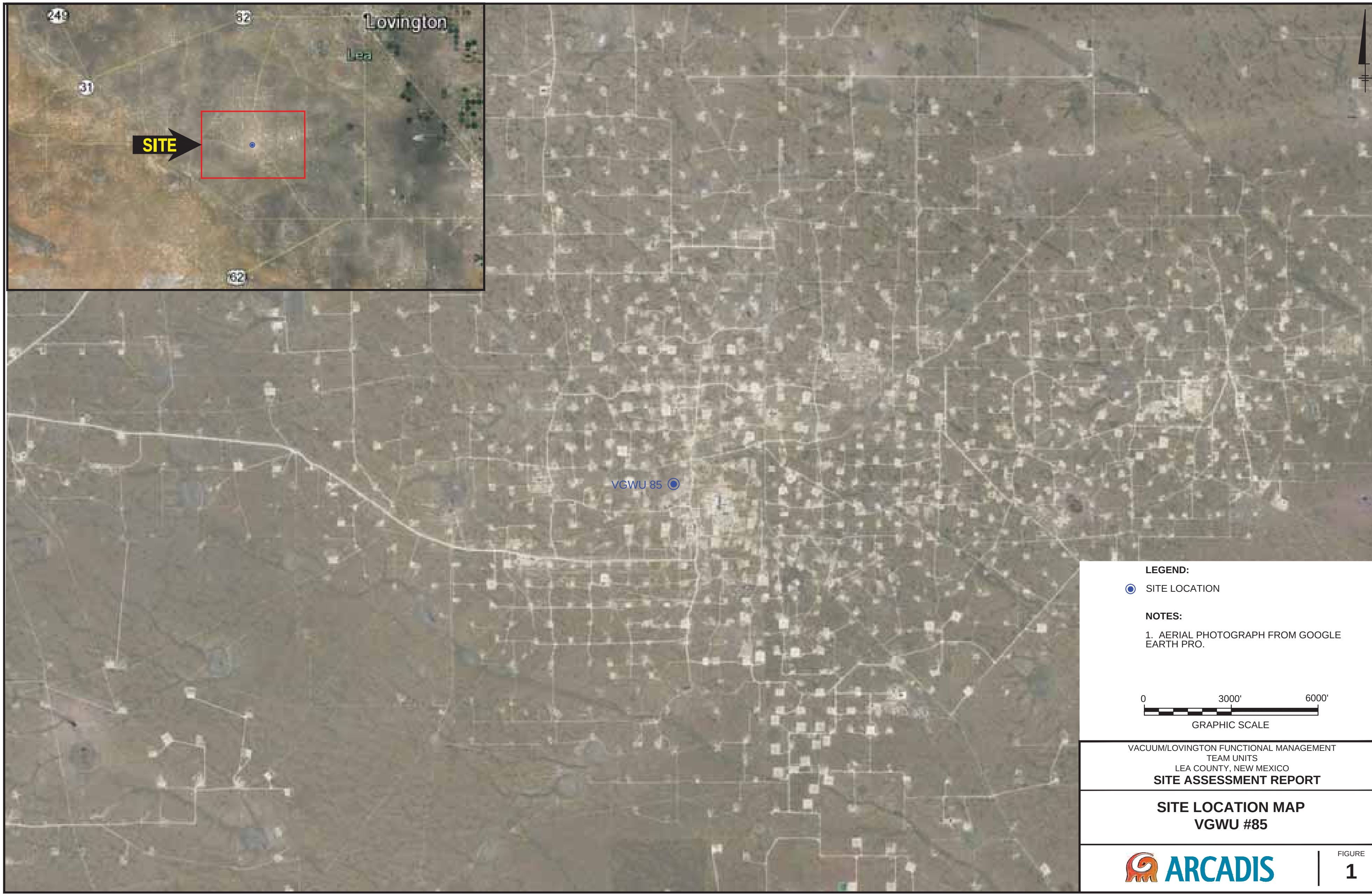
Notes:

%	Percent
mg/kg	Miligram(s) per kilogram
<	Analyte was not detected above the specified method reporting limit
--	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

ARCADIS

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
VGWU #85

ARCADIS

FIGURE
1

CITY: MANCHESTER DIV/GROUP: ENVCAD DB: B.SMALL PM: TM
G:\ENVCAD\Manchester\ACT\B0048615\0000\00002\B00486150000.dwg LAYOUT: 2 SAVED: 12/11/2013 6:29 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 12/11/2013 6:32 PM BY: SMALL, BRIAN

LEGEND:

- NOVEMBER 2013 ASSESSMENT SOIL SAMPLING LOCATION
- 1 JANUARY 2013 CONFIRMATION SOIL SAMPLING LOCATION
- APPROXIMATE EXTENT OF SPILL
- UNDERGROUND UTILITY LINE

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO.
2. COORDINATES FOR ALL NOVEMBER 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 80' 160'
GRAPHIC SCALE

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

RELEASE AND SOIL BORING LOCATIONS VGWU #85

ARCADIS

FIGURE
2

CITY: MANCHESTER DIV/GROUP: ENVCAD DB: B.SMALL PM: TM
G:\ENVCAD\Manchester\ACT\B0048615\0000\00002\B00486150000-VGWU85.dwg LAYOUT: 3 SAVED: 10/9/2014 3:37 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 10/9/2014 3:37 PM BY: SMALL, BRIAN

LEGEND:

- NOVEMBER 2013 ASSESSMENT SOIL SAMPLING LOCATION
- 1 JANUARY 2013 CONFIRMATION SOIL SAMPLING LOCATION
- APPROXIMATE EXTENT OF SPILL
- UNDERGROUND UTILITY LINE
- PROPOSED EXCAVATION AREA

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO.
2. COORDINATES FOR ALL NOVEMBER 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 80' 160'
GRAPHIC SCALE

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

PROPOSED EXCAVATION AREA VGWU #85

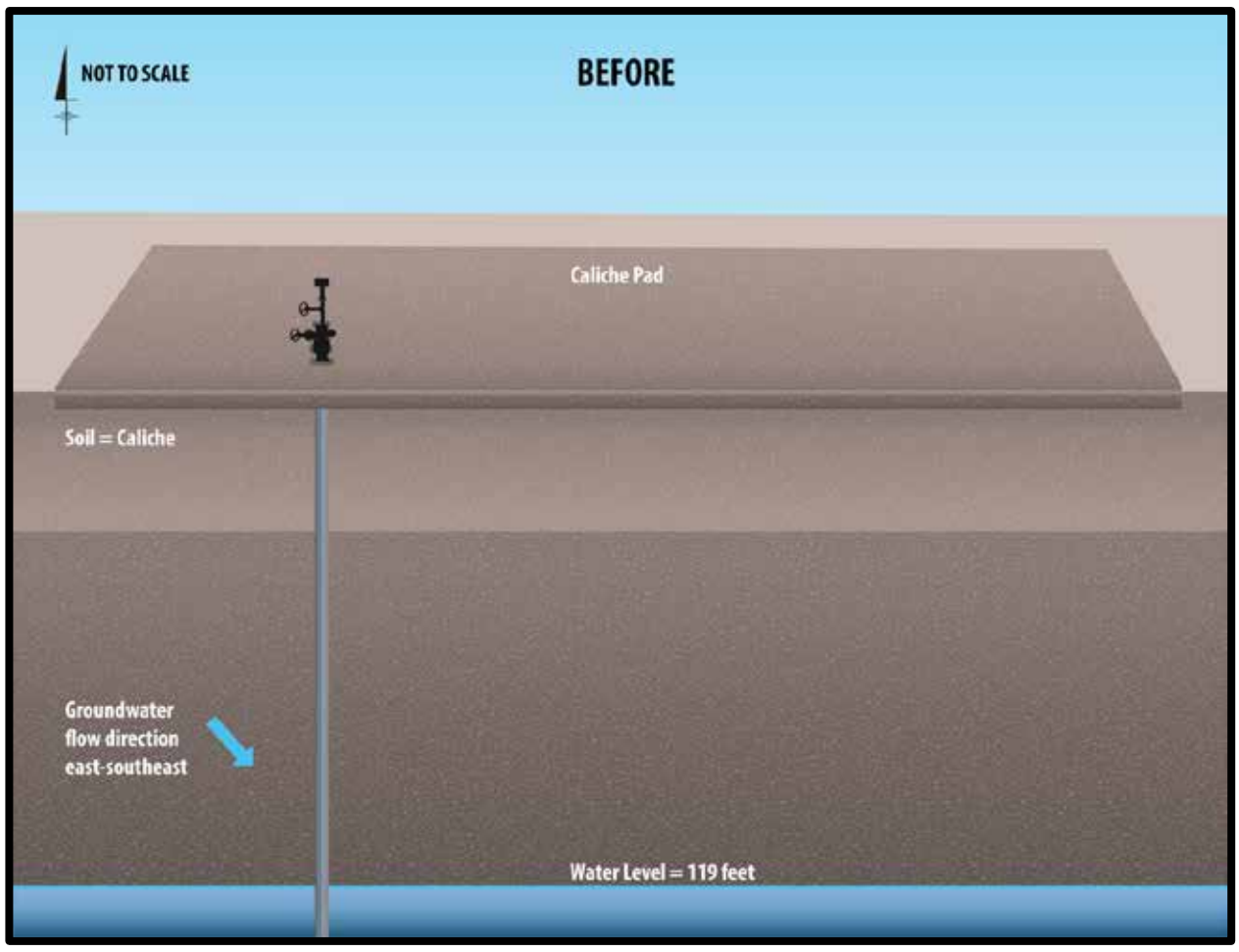
ARCADIS

FIGURE
3

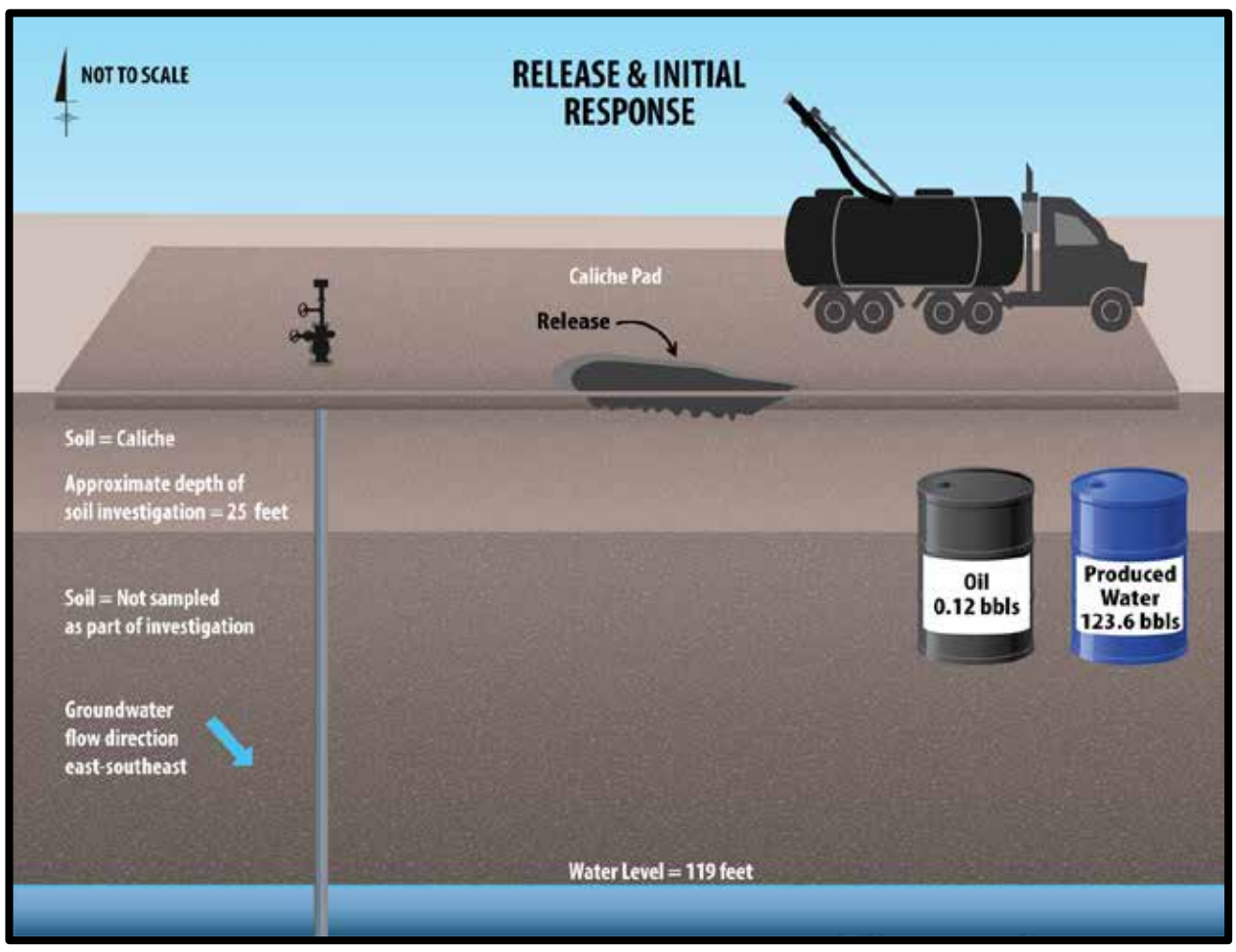
ARCADIS

Attachment 1

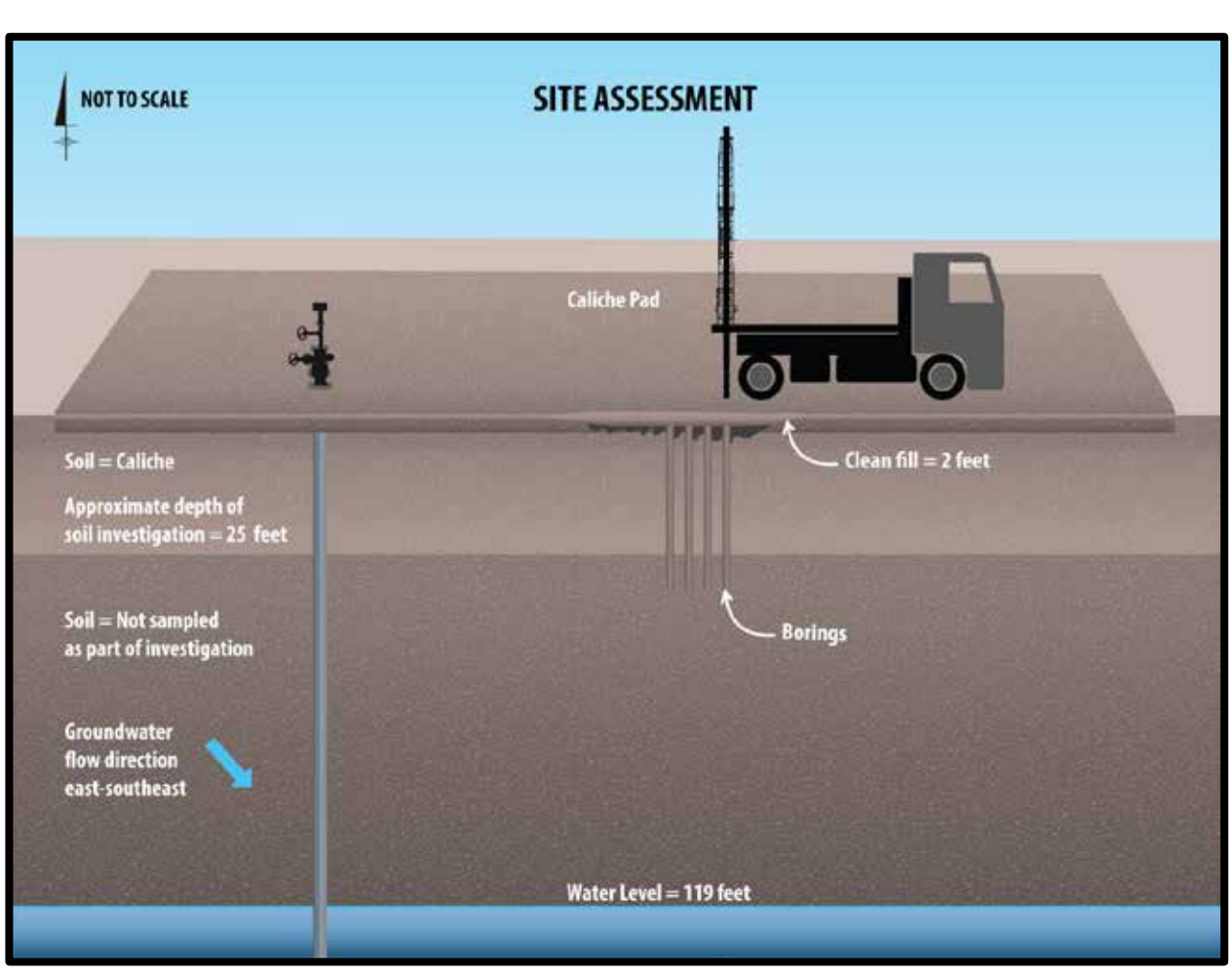
Site Conceptual Model



The site is located in the western edge of the Permian Basin with Lovington (the closest town) located approximately 14 miles northeast of the site. Due to the arid climate, the site experiences low precipitation and high evapotranspiration rates. According to information obtained from the NMOSE online database, groundwater near the site is encountered at a depth of approximately 119 feet bgs.



A release of approximately 123.6 bbls of produced water and 0.12 bbl of oil occurred at the site on August 29, 2012 due to the failure in the integrity of a Chevron personnel from the Mid-Continent Business Unit (MCBU) stopped the release and recovered approximately 60 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 four discrete confirmation soil samples from the base of the excavation on July 12, 2012.Analyte concentrations in one or more confirmation soil samples were above regulatory criteria, which prompted additional site assessment activities.



In November 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 January 2013, 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. Analyte concentrations in samples collected during the 2013 assessment were reported below site-specific criteria. Site assessment activities demonstrate that remaining soil concentrations associated with the release do not pose significant risk to groundwater resources or other receptors.

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

Site Conceptual Model
VGWU #85

ARCADIS

FIGURE
1

ARCADIS

Attachment 2

Photolog

Photograph 1 – Vacuum Glorieta West Unit #85 release area ; Facing North

ARCADIS

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	Code	POD Sub-basin	County	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Distance	Depth Well	Depth Water	Water Column
L 05843		L	LE			3	36	17S	34E	638753	3628731*	340		240	
L 06030		L	LE		3	3	36	17S	34E	638552	3628530*	577	230	102	128
L 10467		L	LE		1	2	01	18S	34E	639365	3628137*	651	231	115	116
L 05288		L	LE		4	4	36	17S	34E	639760	3628552*	689	231	90	141
L 05288	R	L	LE		4	4	36	17S	34E	639760	3628552*	689	231	90	141
L 02724 S4		L	LE	3	3	3	36	17S	34E	638451	3628429*	709	230	140	90
L 02722 S4		L	LE	1	2	2	01	18S	34E	639666	3628246*	749	234		
L 06115		L	LE	1	1	1	01	18S	34E	638460	3628217*	815	230	110	120
L 05003		L	LE			1	36	17S	34E	638742	3629538*	881	135	105	30
L 02722 S5		L	LE	2	2	2	01	18S	34E	639866	3628246*	911	232		
L 02722		L	LE	3	1	1	01	18S	34E	638460	3628017*	953	229	105	124
L 06029		L	LE		4	4	35	17S	34E	638150	3628523*	966	230	102	128

Average Depth to Water: **119 feet**

Minimum Depth: **90 feet**

Maximum Depth: **240 feet**

Record Count: 12

UTMNAD83 Radius Search (in meters):

Easting (X): 639093.82 **Northing (Y):** 3628729.46 **Radius:** 1000

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

ARCADIS

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 U.S.A Inc.	Contact: Josie DeLeon
Address 56 Texas Camp Road, Lovington, NM 88260	Telephone No. Office: 575-396-4414 ext 222 Cellular: 432-425-1528
Facility Name Vacuum Glorietta West Unit #85	Facility Type Production Well

Surface Owner State of New Mexico	Mineral Owner State of New Mexico	API No. 3002520236

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
B	6	18.0S	35.0E					Lea

Latitude 32.787698° **Longitude** -103.514739°

NATURE OF RELEASE

Type of Release Produced Water Spill; oil	Volume of Release 0.12 BO and 123.6 BW	Volume Recovered 60 BW
Source of Release Flowline leak due to integrity of line	Date and Hour of Occurrence 08/29/12 03:00	Date and Hour of Discovery 08/29/12 9:30
Was Immediate Notice Given? ☒ Yes ☐ No ☐ Not Required	If YES, To Whom? Mr. Leking via voicemail	
By Whom? Nick Moschetti	Date and Hour 08/29/12 10:45	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*
NA

Describe Cause of Problem and Remedial Action Taken.*

Flowline leak occurred while rig was flowing back well throughout the night into the header to relieve pressure. VGSAU 85 is a submersible production well that is currently down and has been down since early June. There is a rig currently rigged up on the well and when the well pressures up at night they release the pressure down the line to relieve pressure on the well. Our belief is that the release was due to either carbonic acid eating thru the line or CO2 breakthrough on the line causing the internal corrosion.

Describe Area Affected and Cleanup Action Taken.*

On discovery vacuum truck contacted and vacuumed up the standing fluids which were sent to disposal. 60bbls of produced water was recovered. Next steps are for the visually contaminated soil to be excavated up to 2 feet and sent off for disposal.

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:	OIL CONSERVATION DIVISION	
Printed Name: David Pagano	Approved by Environmental Specialist:	
Title: Health & Environmental Specialist	Approval Date:	Expiration Date:
E-mail Address: dpgn@chevron.com	Conditions of Approval:	Attached ☐
Date: 09/04/12 Phone: 505-787-9816		

* Attach Additional Sheets If Necessary

ARCADIS

Attachment 5

Laboratory Analytical Reports

CARDINAL Laboratories

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

January 29, 2013

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 01/22/13 16:55.

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:

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

Received:	01/22/2013	Sampling Date:	01/22/2013
Reported:	01/29/2013	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: VGWU #85 SAMPLE #1 (H300179-01)

BTEX 8021B mg/kg Analyzed By: AP

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	01/26/2013	ND	1.81	90.3	2.00	13.2	
Toluene*	<0.050	0.050	01/26/2013	ND	1.92	96.0	2.00	13.2	
Ethylbenzene*	<0.050	0.050	01/26/2013	ND	1.99	99.7	2.00	13.4	
Total Xylenes*	<0.150	0.150	01/26/2013	ND	6.04	101	6.00	13.5	
Total BTEX	<0.300	0.300	01/26/2013	ND					

Surrogate: 4-Bromofluorobenzene (PID *104 %* *89.4-126*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**9760**	16.0	01/25/2013	ND	400	100	400	0.00	

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	01/24/2013	ND	205	103	200	19.4	
DRO >C10-C28	<10.0	10.0	01/24/2013	ND	198	99.0	200	15.1	

Surrogate: 1-Chlorooctane *75.7 %* *65.2-140*

Surrogate: 1-Chlorooctadecane *88.7 %* *63.6-154*

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:	01/22/2013	Sampling Date:	01/22/2013
Reported:	01/29/2013	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: VGWU #85 SAMPLE #2 (H300179-02)

BTEX 8021B mg/kg Analyzed By: AP

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	01/26/2013	ND	1.81	90.3	2.00	13.2	
Toluene*	<0.050	0.050	01/26/2013	ND	1.92	96.0	2.00	13.2	
Ethylbenzene*	<0.050	0.050	01/26/2013	ND	1.99	99.7	2.00	13.4	
Total Xylenes*	<0.150	0.150	01/26/2013	ND	6.04	101	6.00	13.5	
Total BTEX	<0.300	0.300	01/26/2013	ND					

Surrogate: 4-Bromofluorobenzene (PID *104 %* *89.4-126*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**7840**	16.0	01/25/2013	ND	400	100	400	0.00	

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	01/26/2013	ND	205	103	200	19.4	
DRO >C10-C28	<10.0	10.0	01/26/2013	ND	198	99.0	200	15.1	

Surrogate: 1-Chlorooctane *98.1 %* *65.2-140*

Surrogate: 1-Chlorooctadecane *107 %* *63.6-154*

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:	01/22/2013	Sampling Date:	01/22/2013
Reported:	01/29/2013	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: VGWU #85 SAMPLE #3 (H300179-03)

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	01/26/2013	ND	1.81	90.3	2.00	13.2	
Toluene*	<0.050	0.050	01/26/2013	ND	1.92	96.0	2.00	13.2	
Ethylbenzene*	<0.050	0.050	01/26/2013	ND	1.99	99.7	2.00	13.4	
Total Xylenes*	<0.150	0.150	01/26/2013	ND	6.04	101	6.00	13.5	
Total BTEX	<0.300	0.300	01/26/2013	ND					

Surrogate: 4-Bromofluorobenzene (PID *104 %* *89.4-126*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**1340**	16.0	01/25/2013	ND	400	100	400	0.00	

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	01/26/2013	ND	205	103	200	19.4	
DRO >C10-C28	<10.0	10.0	01/26/2013	ND	198	99.0	200	15.1	

Surrogate: 1-Chlorooctane *93.9 %* *65.2-140*

Surrogate: 1-Chlorooctadecane *102 %* *63.6-154*

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:	01/22/2013	Sampling Date:	01/22/2013
Reported:	01/29/2013	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: VGWU #85 SAMPLE #4 (H300179-04)

BTEX 8021B mg/kg Analyzed By: AP

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	01/26/2013	ND	1.81	90.3	2.00	13.2	
Toluene*	<0.050	0.050	01/26/2013	ND	1.92	96.0	2.00	13.2	
Ethylbenzene*	<0.050	0.050	01/26/2013	ND	1.99	99.7	2.00	13.4	
Total Xylenes*	<0.150	0.150	01/26/2013	ND	6.04	101	6.00	13.5	
Total BTEX	<0.300	0.300	01/26/2013	ND					

Surrogate: 4-Bromofluorobenzene (PID *103 %* *89.4-126*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**9040**	16.0	01/25/2013	ND	400	100	400	0.00	

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	01/24/2013	ND	205	103	200	19.4	
DRO >C10-C28	<10.0	10.0	01/24/2013	ND	198	99.0	200	15.1	

Surrogate: 1-Chlorooctane *81.4 %* *65.2-140*

Surrogate: 1-Chlorooctadecane *92.1 %* *63.6-154*

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

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

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 #:	505-781-9816 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
H300179																	
1	V6WU #85 Sample #1	G	1			✓					✓		1/28/13	13:20	✓	✓	✓
2	V6WU #85 Sample #2	G	1			✓					✓			13:25			
3	V6WU #85 Sample #3	G	1			✓					✓			13:30			
4	V6WU #85 Sample #4	G	1			✓					✓			13:35			
5	V6WU #94 Sample #1	G	1			✓					✓			14:00			
6	V6WU #94 Sample #2	G	1			✓					✓			14:05			
7	V6WU #94 Sample #3	G	1			✓					✓			14:10			
8	V6WU #94 Sample #4	G	1			✓					✓			14:15			
9	V6WU #94 Sample #5	G	1			✓					✓			14:20			
10	V6WU #94 Sample #6	G	1			✓					✓			14:25			

Relinquished By:	David Pagano	Date: 1/28/13 Time: 4:55	Received By: Jodi Henson
Relinquished By:		Date: Time:	Received By:
Delivered By: (Circle One) Sampler - UPS - Bus - Other:		5°C	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:

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

#26

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Houston
6310 Rothway Street
Houston, TX 77040
Tel: (713)690-4444

TestAmerica Job ID: 600-82341-1
Client Project/Site: HES Transfer Sites, Lea County NM

For:
ARCADIS U.S., Inc.
2929 Briarpark Drive
Suite 300
Houston, Texas 77042

Attn: Mr. Jonathan Olsen

Authorized for release by:
11/21/2013 5:46:22 PM

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Case Narrative

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Job ID: 600-82341-1

Laboratory: TestAmerica Houston

Narrative

Job Narrative
600-82341-1

Comments
No additional comments.

Receipt
The samples were received on 11/8/2013 7:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 7 coolers at receipt time were 1.2º C, 1.4º C, 1.5º C, 1.5º C, 1.7º C, 1.8º C and 2.6º C.

General Chemistry
Method(s) 9056: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for batch 120998 were outside control limits for Chloride. The associated laboratory control sample (LCS) recovery met acceptance criteria.

Method(s) 9056: The matrix spike duplicate (MSD) recovery for batch 120998 was outside control limits for Chloride. The associated laboratory control sample (LCS) recovery met acceptance criteria.

Method(s) 9056: Thematrix spike duplicate (MSD) recovery for batch 120998 was outside control limits for Chloride. The associated laboratory control sample (LCS) recovery met acceptance criteria.

No other analytical or quality issues were noted.

Industrial Hygiene
No analytical or quality issues were noted.

Method Summary

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Method	Method Description	Protocol	Laboratory
9056	Anions, Ion Chromatography	SW846	TAL HOU
Moisture	Percent Moisture	EPA	TAL HOU

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL HOU = TestAmerica Houston, 6310 Rothway Street, Houston, TX 77040, TEL (713)690-4444

Sample Summary

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
600-82341-1	VGWU85-01-02	Solid	11/06/13 14:20	11/08/13 07:00
600-82341-2	VGWU85-01-05	Solid	11/06/13 14:22	11/08/13 07:00
600-82341-3	VGWU85-01-10	Solid	11/06/13 14:24	11/08/13 07:00
600-82341-4	VGWU85-01-15	Solid	11/06/13 14:26	11/08/13 07:00
600-82341-5	VGWU85-01-20	Solid	11/06/13 14:28	11/08/13 07:00
600-82341-6	VGWU85-01-25	Solid	11/06/13 14:30	11/08/13 07:00
600-82341-7	VGWU85-02-02	Solid	11/06/13 14:35	11/08/13 07:00
600-82341-8	VGWU85-02-05	Solid	11/06/13 14:37	11/08/13 07:00
600-82341-9	VGWU85-02-10	Solid	11/06/13 14:39	11/08/13 07:00
600-82341-10	VGWU85-02-15	Solid	11/06/13 14:41	11/08/13 07:00
600-82341-11	VGWU85-02-20	Solid	11/06/13 14:43	11/08/13 07:00
600-82341-12	VGWU85-02-25	Solid	11/06/13 14:45	11/08/13 07:00
600-82341-13	VGWU85-03-02	Solid	11/06/13 13:35	11/08/13 07:00
600-82341-14	VGWU85-03-05	Solid	11/06/13 13:37	11/08/13 07:00
600-82341-15	VGWU85-03-10	Solid	11/06/13 13:39	11/08/13 07:00
600-82341-16	VGWU85-03-15	Solid	11/06/13 13:41	11/08/13 07:00
600-82341-17	VGWU85-03-20	Solid	11/06/13 13:43	11/08/13 07:00
600-82341-18	VGWU85-03-25	Solid	11/06/13 13:45	11/08/13 07:00
600-82341-19	VGWU85-04-02	Solid	11/06/13 14:00	11/08/13 07:00
600-82341-20	VGWU85-04-05	Solid	11/06/13 14:02	11/08/13 07:00
600-82341-21	VGWU85-04-10	Solid	11/06/13 14:04	11/08/13 07:00
600-82341-22	VGWU85-04-15	Solid	11/06/13 14:06	11/08/13 07:00
600-82341-23	VGWU85-04-20	Solid	11/06/13 14:08	11/08/13 07:00
600-82341-24	VGWU85-04-25	Solid	11/06/13 14:10	11/08/13 07:00

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-01-02

Lab Sample ID: 600-82341-1

Date Collected: 11/06/13 14:20
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	5.0		1.0		%			11/10/13 12:08	1
Percent Solids	95		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	2700		210		mg/Kg	☼		11/21/13 04:06	50

Client Sample ID: VGWU85-01-05

Lab Sample ID: 600-82341-2

Date Collected: 11/06/13 14:22
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	6.3		1.0		%			11/10/13 12:08	1
Percent Solids	94		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	2700		110		mg/Kg	☼		11/21/13 04:22	25

Client Sample ID: VGWU85-01-10

Lab Sample ID: 600-82341-3

Date Collected: 11/06/13 14:24
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	5.7		1.0		%			11/10/13 12:08	1
Percent Solids	94		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	640		8.5		mg/Kg	☼		11/21/13 04:37	2

Client Sample ID: VGWU85-01-15

Lab Sample ID: 600-82341-4

Date Collected: 11/06/13 14:26
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	7.7		1.0		%			11/10/13 12:08	1
Percent Solids	92		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	320		4.3		mg/Kg	☼		11/21/13 04:53	1

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-01-20

Lab Sample ID: 600-82341-5

Date Collected: 11/06/13 14:28
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	20		1.0		%			11/10/13 12:08	1
Percent Solids	80		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	59		5.0		mg/Kg	☼		11/21/13 05:08	1

Client Sample ID: VGWU85-01-25

Lab Sample ID: 600-82341-6

Date Collected: 11/06/13 14:30
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	4.9		1.0		%			11/10/13 12:08	1
Percent Solids	95		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	30		4.2		mg/Kg	☼		11/19/13 12:18	1

Client Sample ID: VGWU85-02-02

Lab Sample ID: 600-82341-7

Date Collected: 11/06/13 14:35
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	4.6		1.0		%			11/10/13 12:08	1
Percent Solids	95		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	3400		420		mg/Kg	☼		11/19/13 13:04	100

Client Sample ID: VGWU85-02-05

Lab Sample ID: 600-82341-8

Date Collected: 11/06/13 14:37
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	4.1		1.0		%			11/10/13 12:08	1
Percent Solids	96		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	620		8.3		mg/Kg	☼		11/19/13 13:20	2

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-02-10

Lab Sample ID: 600-82341-9
Date Collected: 11/06/13 14:39
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	2.4		1.0		%			11/10/13 12:08	1
Percent Solids	98		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	690		8.2		mg/Kg	☼		11/19/13 13:35	2

Client Sample ID: VGWU85-02-15

Lab Sample ID: 600-82341-10
Date Collected: 11/06/13 14:41
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	8.4		1.0		%			11/10/13 12:08	1
Percent Solids	92		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	39		4.4		mg/Kg	☼		11/19/13 13:51	1

Client Sample ID: VGWU85-02-20

Lab Sample ID: 600-82341-11
Date Collected: 11/06/13 14:43
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	6.7		1.0		%			11/10/13 12:08	1
Percent Solids	93		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	50		4.3		mg/Kg	☼		11/19/13 14:06	1

Client Sample ID: VGWU85-02-25

Lab Sample ID: 600-82341-12
Date Collected: 11/06/13 14:45
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	5.5		1.0		%			11/10/13 12:08	1
Percent Solids	95		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	35		4.2		mg/Kg	☼		11/19/13 14:53	1

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-03-02

Lab Sample ID: 600-82341-13
Date Collected: 11/06/13 13:35
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	10		1.0		%			11/10/13 12:08	1
Percent Solids	90		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	2000		45		mg/Kg	☼		11/19/13 15:39	10

Client Sample ID: VGWU85-03-05

Lab Sample ID: 600-82341-14
Date Collected: 11/06/13 13:37
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	17		1.0		%			11/10/13 12:08	1
Percent Solids	83		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	2000		24		mg/Kg	☼		11/19/13 15:55	5

Client Sample ID: VGWU85-03-10

Lab Sample ID: 600-82341-15
Date Collected: 11/06/13 13:39
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	15		1.0		%			11/10/13 12:08	1
Percent Solids	85		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	3700		230		mg/Kg	☼		11/19/13 16:10	50

Client Sample ID: VGWU85-03-15

Lab Sample ID: 600-82341-16
Date Collected: 11/06/13 13:41
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	19		1.0		%			11/10/13 12:08	1
Percent Solids	81		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	590		9.9		mg/Kg	☼		11/19/13 16:26	2

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-03-20

Lab Sample ID: 600-82341-17

Date Collected: 11/06/13 13:43
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	4.1		1.0		%			11/10/13 12:08	1
Percent Solids	96		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	450		8.3		mg/Kg	☼		11/19/13 16:41	2

Client Sample ID: VGWU85-03-25

Lab Sample ID: 600-82341-18

Date Collected: 11/06/13 13:45
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	8.0		1.0		%			11/10/13 12:08	1
Percent Solids	92		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	2100		43		mg/Kg	☼		11/19/13 16:57	10

Client Sample ID: VGWU85-04-02

Lab Sample ID: 600-82341-19

Date Collected: 11/06/13 14:00
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	6.3		1.0		%			11/10/13 12:08	1
Percent Solids	94		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	2500		210		mg/Kg	☼		11/19/13 17:12	50

Client Sample ID: VGWU85-04-05

Lab Sample ID: 600-82341-20

Date Collected: 11/06/13 14:02
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	4.9		1.0		%			11/10/13 12:08	1
Percent Solids	95		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	1700		21		mg/Kg	☼		11/19/13 18:30	5

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-04-10

Lab Sample ID: 600-82341-21

Date Collected: 11/06/13 14:04
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	13		1.0		%			11/10/13 12:08	1
Percent Solids	87		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	260		4.6		mg/Kg	☼		11/19/13 19:16	1

Client Sample ID: VGWU85-04-15

Lab Sample ID: 600-82341-22

Date Collected: 11/06/13 14:06
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	8.6		1.0		%			11/10/13 12:08	1
Percent Solids	91		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	800		8.8		mg/Kg	☼		11/19/13 19:32	2

Client Sample ID: VGWU85-04-20

Lab Sample ID: 600-82341-23

Date Collected: 11/06/13 14:08
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	7.2		1.0		%			11/10/13 12:08	1
Percent Solids	93		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	720		8.6		mg/Kg	☼		11/19/13 19:47	2

Client Sample ID: VGWU85-04-25

Lab Sample ID: 600-82341-24

Date Collected: 11/06/13 14:10
Matrix: Solid
Date Received: 11/08/13 07:00

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	7.2		1.0		%			11/10/13 12:08	1
Percent Solids	93		1.0		%			11/10/13 12:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	740		8.6		mg/Kg	☼		11/19/13 20:03	2

Qualifiers

General Chemistry

Qualifier	Qualifier Description
F	MS/MSD Recovery and/or RPD exceeds the control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method: 9056 - Anions, Ion Chromatography

Lab Sample ID: MB 600-120665/1-A
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: Method Blank
Prep Type: Soluble

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		4.0		mg/Kg			11/19/13 10:18	1

Lab Sample ID: MB 600-120665/21-A
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: Method Blank
Prep Type: Soluble

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		4.0		mg/Kg			11/19/13 17:59	1

Lab Sample ID: LCS 600-120665/22-A
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: Lab Control Sample
Prep Type: Soluble

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	200	193		mg/Kg		96	90 - 110

Lab Sample ID: LCS 600-120665/2-A
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: Lab Control Sample
Prep Type: Soluble

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	200	188		mg/Kg		94	90 - 110

Lab Sample ID: 600-82341-6 MS
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: VGWU85-01-25
Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	30		105	111	F	mg/Kg	☼	76	80 - 120

Lab Sample ID: 600-82341-6 MSD
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: VGWU85-01-25
Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	30		105	113	F	mg/Kg	☼	78	80 - 120	2	20

Lab Sample ID: 600-82341-12 MS
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: VGWU85-02-25
Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	35		106	122		mg/Kg	☼	82	80 - 120

Lab Sample ID: 600-82341-12 MSD
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: VGWU85-02-25
Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	35		106	117	F	mg/Kg	☼	77	80 - 120	4	20

Lab Sample ID: 600-82341-20 MS
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: VGWU85-04-05
Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	1700		526	2110		mg/Kg	☼	85	80 - 120

Lab Sample ID: 600-82341-20 MSD
Matrix: Solid
Analysis Batch: 120998

Client Sample ID: VGWU85-04-05
Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	1700		526	2070	F	mg/Kg	☼	76	80 - 120	2	20

Method: Moisture - Percent Moisture

Lab Sample ID: 600-82341-1 DU
Matrix: Solid
Analysis Batch: 120079

Client Sample ID: VGWU85-01-02
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Percent Moisture	5.0		5.4		%		8	20
Percent Solids	95		95		%		0.5	20

Lab Sample ID: 600-82341-11 DU
Matrix: Solid
Analysis Batch: 120079

Client Sample ID: VGWU85-02-20
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Percent Moisture	6.7		6.3		%		6	20
Percent Solids	93		94		%		0.4	20

Lab Sample ID: 600-82341-21 DU
Matrix: Solid
Analysis Batch: 120079

Client Sample ID: VGWU85-04-10
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Percent Moisture	13		13		%		3	20
Percent Solids	87		87		%		0.4	20

General Chemistry

Analysis Batch: 120079

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
600-82341-1	VGWU85-01-02	Total/NA	Solid	Moisture	
600-82341-1 DU	VGWU85-01-02	Total/NA	Solid	Moisture	
600-82341-2	VGWU85-01-05	Total/NA	Solid	Moisture	
600-82341-3	VGWU85-01-10	Total/NA	Solid	Moisture	
600-82341-4	VGWU85-01-15	Total/NA	Solid	Moisture	
600-82341-5	VGWU85-01-20	Total/NA	Solid	Moisture	
600-82341-6	VGWU85-01-25	Total/NA	Solid	Moisture	
600-82341-7	VGWU85-02-02	Total/NA	Solid	Moisture	
600-82341-8	VGWU85-02-05	Total/NA	Solid	Moisture	
600-82341-9	VGWU85-02-10	Total/NA	Solid	Moisture	
600-82341-10	VGWU85-02-15	Total/NA	Solid	Moisture	
600-82341-11	VGWU85-02-20	Total/NA	Solid	Moisture	
600-82341-11 DU	VGWU85-02-20	Total/NA	Solid	Moisture	
600-82341-12	VGWU85-02-25	Total/NA	Solid	Moisture	
600-82341-13	VGWU85-03-02	Total/NA	Solid	Moisture	
600-82341-14	VGWU85-03-05	Total/NA	Solid	Moisture	
600-82341-15	VGWU85-03-10	Total/NA	Solid	Moisture	
600-82341-16	VGWU85-03-15	Total/NA	Solid	Moisture	
600-82341-17	VGWU85-03-20	Total/NA	Solid	Moisture	
600-82341-18	VGWU85-03-25	Total/NA	Solid	Moisture	
600-82341-19	VGWU85-04-02	Total/NA	Solid	Moisture	
600-82341-20	VGWU85-04-05	Total/NA	Solid	Moisture	
600-82341-21	VGWU85-04-10	Total/NA	Solid	Moisture	
600-82341-21 DU	VGWU85-04-10	Total/NA	Solid	Moisture	
600-82341-22	VGWU85-04-15	Total/NA	Solid	Moisture	
600-82341-23	VGWU85-04-20	Total/NA	Solid	Moisture	
600-82341-24	VGWU85-04-25	Total/NA	Solid	Moisture	

Leach Batch: 120664

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
600-82341-1	VGWU85-01-02	Soluble	Solid	DI Leach	
600-82341-2	VGWU85-01-05	Soluble	Solid	DI Leach	
600-82341-3	VGWU85-01-10	Soluble	Solid	DI Leach	
600-82341-4	VGWU85-01-15	Soluble	Solid	DI Leach	
600-82341-5	VGWU85-01-20	Soluble	Solid	DI Leach	

Leach Batch: 120665

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
600-82341-6	VGWU85-01-25	Soluble	Solid	DI Leach	
600-82341-6 MS	VGWU85-01-25	Soluble	Solid	DI Leach	
600-82341-6 MSD	VGWU85-01-25	Soluble	Solid	DI Leach	
600-82341-7	VGWU85-02-02	Soluble	Solid	DI Leach	
600-82341-8	VGWU85-02-05	Soluble	Solid	DI Leach	
600-82341-9	VGWU85-02-10	Soluble	Solid	DI Leach	
600-82341-10	VGWU85-02-15	Soluble	Solid	DI Leach	
600-82341-11	VGWU85-02-20	Soluble	Solid	DI Leach	
600-82341-12	VGWU85-02-25	Soluble	Solid	DI Leach	
600-82341-12 MS	VGWU85-02-25	Soluble	Solid	DI Leach	
600-82341-12 MSD	VGWU85-02-25	Soluble	Solid	DI Leach	
600-82341-13	VGWU85-03-02	Soluble	Solid	DI Leach	
600-82341-14	VGWU85-03-05	Soluble	Solid	DI Leach	

General Chemistry (Continued)

Leach Batch: 120665 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
600-82341-15	VGWU85-03-10	Soluble	Solid	DI Leach	
600-82341-16	VGWU85-03-15	Soluble	Solid	DI Leach	
600-82341-17	VGWU85-03-20	Soluble	Solid	DI Leach	
600-82341-18	VGWU85-03-25	Soluble	Solid	DI Leach	
600-82341-19	VGWU85-04-02	Soluble	Solid	DI Leach	
600-82341-20	VGWU85-04-05	Soluble	Solid	DI Leach	
600-82341-20 MS	VGWU85-04-05	Soluble	Solid	DI Leach	
600-82341-20 MSD	VGWU85-04-05	Soluble	Solid	DI Leach	
600-82341-21	VGWU85-04-10	Soluble	Solid	DI Leach	
600-82341-22	VGWU85-04-15	Soluble	Solid	DI Leach	
600-82341-23	VGWU85-04-20	Soluble	Solid	DI Leach	
600-82341-24	VGWU85-04-25	Soluble	Solid	DI Leach	
LCS 600-120665/22-A	Lab Control Sample	Soluble	Solid	DI Leach	
LCS 600-120665/2-A	Lab Control Sample	Soluble	Solid	DI Leach	
MB 600-120665/1-A	Method Blank	Soluble	Solid	DI Leach	
MB 600-120665/21-A	Method Blank	Soluble	Solid	DI Leach	

Analysis Batch: 120998

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
600-82341-6	VGWU85-01-25	Soluble	Solid	9056	120665
600-82341-6 MS	VGWU85-01-25	Soluble	Solid	9056	120665
600-82341-6 MSD	VGWU85-01-25	Soluble	Solid	9056	120665
600-82341-7	VGWU85-02-02	Soluble	Solid	9056	120665
600-82341-8	VGWU85-02-05	Soluble	Solid	9056	120665
600-82341-9	VGWU85-02-10	Soluble	Solid	9056	120665
600-82341-10	VGWU85-02-15	Soluble	Solid	9056	120665
600-82341-11	VGWU85-02-20	Soluble	Solid	9056	120665
600-82341-12	VGWU85-02-25	Soluble	Solid	9056	120665
600-82341-12 MS	VGWU85-02-25	Soluble	Solid	9056	120665
600-82341-12 MSD	VGWU85-02-25	Soluble	Solid	9056	120665
600-82341-13	VGWU85-03-02	Soluble	Solid	9056	120665
600-82341-14	VGWU85-03-05	Soluble	Solid	9056	120665
600-82341-15	VGWU85-03-10	Soluble	Solid	9056	120665
600-82341-16	VGWU85-03-15	Soluble	Solid	9056	120665
600-82341-17	VGWU85-03-20	Soluble	Solid	9056	120665
600-82341-18	VGWU85-03-25	Soluble	Solid	9056	120665
600-82341-19	VGWU85-04-02	Soluble	Solid	9056	120665
600-82341-20	VGWU85-04-05	Soluble	Solid	9056	120665
600-82341-20 MS	VGWU85-04-05	Soluble	Solid	9056	120665
600-82341-20 MSD	VGWU85-04-05	Soluble	Solid	9056	120665
600-82341-21	VGWU85-04-10	Soluble	Solid	9056	120665
600-82341-22	VGWU85-04-15	Soluble	Solid	9056	120665
600-82341-23	VGWU85-04-20	Soluble	Solid	9056	120665
600-82341-24	VGWU85-04-25	Soluble	Solid	9056	120665
LCS 600-120665/22-A	Lab Control Sample	Soluble	Solid	9056	120665
LCS 600-120665/2-A	Lab Control Sample	Soluble	Solid	9056	120665
MB 600-120665/1-A	Method Blank	Soluble	Solid	9056	120665
MB 600-120665/21-A	Method Blank	Soluble	Solid	9056	120665

General Chemistry (Continued)

Analysis Batch: 121126

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
600-82341-1	VGWU85-01-02	Soluble	Solid	9056	120664
600-82341-2	VGWU85-01-05	Soluble	Solid	9056	120664
600-82341-3	VGWU85-01-10	Soluble	Solid	9056	120664
600-82341-4	VGWU85-01-15	Soluble	Solid	9056	120664
600-82341-5	VGWU85-01-20	Soluble	Solid	9056	120664

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-01-02

Lab Sample ID: 600-82341-1

Date Collected: 11/06/13 14:20

Matrix: Solid

Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120664	11/15/13 10:30	KRD	TAL HOU
Soluble	Analysis	9056		50	5 mL	5 mL	121126	11/21/13 04:06	DAW	TAL HOU

Client Sample ID: VGWU85-01-05

Lab Sample ID: 600-82341-2

Date Collected: 11/06/13 14:22

Matrix: Solid

Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120664	11/15/13 10:30	KRD	TAL HOU
Soluble	Analysis	9056		25	5 mL	5 mL	121126	11/21/13 04:22	DAW	TAL HOU

Client Sample ID: VGWU85-01-10

Lab Sample ID: 600-82341-3

Date Collected: 11/06/13 14:24

Matrix: Solid

Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120664	11/15/13 10:30	KRD	TAL HOU
Soluble	Analysis	9056		2	5 mL	5 mL	121126	11/21/13 04:37	DAW	TAL HOU

Client Sample ID: VGWU85-01-15

Lab Sample ID: 600-82341-4

Date Collected: 11/06/13 14:26

Matrix: Solid

Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120664	11/15/13 10:30	KRD	TAL HOU
Soluble	Analysis	9056		1	5 mL	5 mL	121126	11/21/13 04:53	DAW	TAL HOU

Client Sample ID: VGWU85-01-20

Lab Sample ID: 600-82341-5

Date Collected: 11/06/13 14:28

Matrix: Solid

Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120664	11/15/13 10:30	KRD	TAL HOU
Soluble	Analysis	9056		1	5 mL	5 mL	121126	11/21/13 05:08	DAW	TAL HOU

Lab Chronicle

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-01-25

Lab Sample ID: 600-82341-6

Date Collected: 11/06/13 14:30
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		1	5 mL	5 mL	120998	11/19/13 12:18	DAW	TAL HOU

Client Sample ID: VGWU85-02-02

Lab Sample ID: 600-82341-7

Date Collected: 11/06/13 14:35
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		100	5 mL	5 mL	120998	11/19/13 13:04	DAW	TAL HOU

Client Sample ID: VGWU85-02-05

Lab Sample ID: 600-82341-8

Date Collected: 11/06/13 14:37
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		2	5 mL	5 mL	120998	11/19/13 13:20	DAW	TAL HOU

Client Sample ID: VGWU85-02-10

Lab Sample ID: 600-82341-9

Date Collected: 11/06/13 14:39
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		2	5 mL	5 mL	120998	11/19/13 13:35	DAW	TAL HOU

Client Sample ID: VGWU85-02-15

Lab Sample ID: 600-82341-10

Date Collected: 11/06/13 14:41
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		1	5 mL	5 mL	120998	11/19/13 13:51	DAW	TAL HOU

Lab Chronicle

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-02-20

Lab Sample ID: 600-82341-11

Date Collected: 11/06/13 14:43
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		1	5 mL	5 mL	120998	11/19/13 14:06	DAW	TAL HOU

Client Sample ID: VGWU85-02-25

Lab Sample ID: 600-82341-12

Date Collected: 11/06/13 14:45
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		1	5 mL	5 mL	120998	11/19/13 14:53	DAW	TAL HOU

Client Sample ID: VGWU85-03-02

Lab Sample ID: 600-82341-13

Date Collected: 11/06/13 13:35
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		10	5 mL	5 mL	120998	11/19/13 15:39	DAW	TAL HOU

Client Sample ID: VGWU85-03-05

Lab Sample ID: 600-82341-14

Date Collected: 11/06/13 13:37
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		5	5 mL	5 mL	120998	11/19/13 15:55	DAW	TAL HOU

Client Sample ID: VGWU85-03-10

Lab Sample ID: 600-82341-15

Date Collected: 11/06/13 13:39
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		50	5 mL	5 mL	120998	11/19/13 16:10	DAW	TAL HOU

Lab Chronicle

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-03-15

Lab Sample ID: 600-82341-16

Date Collected: 11/06/13 13:41
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		2	5 mL	5 mL	120998	11/19/13 16:26	DAW	TAL HOU

Client Sample ID: VGWU85-03-20

Lab Sample ID: 600-82341-17

Date Collected: 11/06/13 13:43
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		2	5 mL	5 mL	120998	11/19/13 16:41	DAW	TAL HOU

Client Sample ID: VGWU85-03-25

Lab Sample ID: 600-82341-18

Date Collected: 11/06/13 13:45
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		10	5 mL	5 mL	120998	11/19/13 16:57	DAW	TAL HOU

Client Sample ID: VGWU85-04-02

Lab Sample ID: 600-82341-19

Date Collected: 11/06/13 14:00
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		50	5 mL	5 mL	120998	11/19/13 17:12	DAW	TAL HOU

Client Sample ID: VGWU85-04-05

Lab Sample ID: 600-82341-20

Date Collected: 11/06/13 14:02
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		5	5 mL	5 mL	120998	11/19/13 18:30	DAW	TAL HOU

Lab Chronicle

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Client Sample ID: VGWU85-04-10

Lab Sample ID: 600-82341-21

Date Collected: 11/06/13 14:04
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		1	5 mL	5 mL	120998	11/19/13 19:16	DAW	TAL HOU

Client Sample ID: VGWU85-04-15

Lab Sample ID: 600-82341-22

Date Collected: 11/06/13 14:06
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		2	5 mL	5 mL	120998	11/19/13 19:32	DAW	TAL HOU

Client Sample ID: VGWU85-04-20

Lab Sample ID: 600-82341-23

Date Collected: 11/06/13 14:08
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		2	5 mL	5 mL	120998	11/19/13 19:47	DAW	TAL HOU

Client Sample ID: VGWU85-04-25

Lab Sample ID: 600-82341-24

Date Collected: 11/06/13 14:10
Matrix: Solid
Date Received: 11/08/13 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			120079	11/10/13 12:08	MJB	TAL HOU
Soluble	Leach	DI Leach			5 g	50 mL	120665	11/15/13 10:45	KRD	TAL HOU
Soluble	Analysis	9056		2	5 mL	5 mL	120998	11/19/13 20:03	DAW	TAL HOU

Laboratory References:

TAL HOU = TestAmerica Houston, 6310 Rothway Street, Houston, TX 77040, TEL (713)690-4444

Certification Summary

Client: ARCADIS U.S., Inc.
Project/Site: HES Transfer Sites, Lea County NM

TestAmerica Job ID: 600-82341-1

Laboratory: TestAmerica Houston

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Arkansas DEQ	State Program	6	88-0759	08-04-14
Louisiana	NELAP	6	30643	06-30-14
Oklahoma	State Program	6	9503	08-31-13 *
Texas	NELAP	6	T104704223	10-31-14
USDA	Federal		P330-08-00217	04-01-14
Utah	NELAP	8	TX00083	10-31-13 *

* Expired certification is currently pending renewal and is considered valid.

TestAmerica Houston
6310 Rothway Street
Houston, TX 77040
Phone (713) 690-4444 Fax (713) 690-5646

Chain of Custody Record

600-82341 Chain of Custody

Client Information	Sampler: MELISA PHAN	Lab PM: Kudchadkar, Sachin G	Page: Page 1 of 4
Client Contact: Mr. Jonathan Olsen	Phone: 713 953 4800	E-Mail: sachin.kudchadkar@testamericainc.com	
Company: ARCADIS U.S., Inc.			Job #:
Address: 2929 Briarpark Drive Suite 300	Due Date Requested:		
City: Houston	TAT Requested (days): STANDARD		
State, Zip: TX, 77042			
Phone: 713 953 4800	PO #: Purchase Order Requested		
Email: jonathan.olsen@arcadis-us.com	WO #:		
Project Name: HES Transfer Sites, Lea County NM	Project #: 60004633		
Site: VGWU85	SSOW#:		

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2SO3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8015B_DRO	9056_28D - Chloride	8015B_GRO	8021B- BTEX	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N	N	N		
VGWU85-01-02	11/6/13	1420	G	Solid				X				DO NOT HOLD
VGWU85-01-05	"	1422		Solid				X				
VGWU85-01-10	"	1424		Solid				X				
VGWU85-01-15	"	1426		Solid				X				
VGWU85-01-20	"	1428		Solid				X				
VGWU85-01-25	"	1430		Solid				X				
VGWU85-02-02	"	1435		Solid				X				
VGWU85-02-05	"	1437		Solid				X				
VGWU85-02-10	"	1439		Solid				X				
VGWU85-02-15	"	1441		Solid				X				
VGWU85-02-20	"	1443	↓	Solid				X				↓

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:		Date:		Time:		Method of Shipment:	
Relinquished by:	Date/Time: 11/7/13 800	Company	Received by:		Date/Time: 11/8/13 700	Company	
Relinquished by:	Date/Time:	Company	Received by:		Date/Time:	Company	
Relinquished by:	Date/Time:	Company	Received by:		Date/Time:	Company	

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

TestAmerica Houston
6310 Rothway Street
Houston, TX 77040
Phone (713) 690-4444 Fax (713) 690-5646

Chain of Custody Record

Client Information	Sampler: MELISA PHAN	Lab PM: Kudchadkar, Sachin G	Carrier Tracking No(s)	COC No: 600-23595-8666.1
Client Contact: Mr. Jonathan Olsen	Phone: 713 953 4800	E-Mail: sachin.kudchadkar@testamericainc.com		Page: Page 2 of 4
Company: ARCADIS U.S., Inc.				Job #:
Address: 2929 Briarpark Drive Suite 300	Due Date Requested:	Analysis Requested		Preservation Codes:
City: Houston	TAT Requested (days): STANDARD			A - HCL; B - NaOH; C - Zn Acetate; D - Nitric Acid; E - NaHSO4; F - MeOH; G - Amchlor; H - Ascorbic Acid; I - Ice; J - DI Water; K - EDTA; L - EDA; M - Hexane; N - None; O - AsNaO2; P - Na2O4S; Q - Na2SO3; R - Na2S2SO3; S - H2SO4; T - TSP Dodecahydrate; U - Acetone; V - MCAA; W - ph 4-5; Z - other (specify); Other:
State, Zip: TX, 77042	PO #: Purchase Order Requested			
Phone: 713 953 4800	WO #:			
Email: jonathan.olsen@arcadis-us.com	Project #: 60004633			
Project Name: HES Transfer Sites, Lea County NM	SSOW#:			
Site: VGWU85				

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8015B_DRO	9056_28D - Chloride	8015B_GRO	8021B- BTEX	Total Number of containers	Special Instructions/Note:
					N	N	N	N				
VGWU85-02-25	11/6/13	1445	G	Solid				X				DO NOT HOLD
VGWU85-03-02	"	1335		Solid				X				
VGWU85-03-05	"	1337		Solid				X				
VGWU85-03-10	"	1339		Solid				X				
VGWU85-03-15	"	1341		Solid				X				
VGWU85-03-20	"	1343		Solid				X				
VGWU85-03-25	"	1345		Solid				X				
VGWU85-04-02	"	1400		Solid				X				
VGWU85-04-05	"	1402		Solid				X				
VGWU85-04-10	"	1404		Solid				X				
VGWU85-04-15	"	1406		Solid				X				

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
1		11/7/13 800			11/8/13 700	
2	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
3	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks:

11/21/2013

TestAmerica Houston
6310 Rothway Street
Houston, TX 77040
Phone (713) 690-4444 Fax (713) 690-5646

Chain of Custody Record

Client Information	Sampler: MELISA PHAN	Lab PM: Kudchadkar, Sachin G	Carrier Tracking No(s):	COC No: 600-23595-8666.1
Client Contact: Mr. Jonathan Olsen	Phone: 7139534800	E-Mail: sachin.kudchadkar@testamericainc.com		Page: Page 34
Company: ARCADIS U.S., Inc.				Job #:
Address: 2929 Briarpark Drive Suite 300	Due Date Requested:			
City: Houston	TAT Requested (days): STANDARD			
State, Zip: TX, 77042				
Phone: 7139534800	PO #: Purchase Order Requested			
Email: jonathan.olsen@arcadis-us.com	WO #:			
Project Name: HES Transfer Sites, Lea County NM	Project #: 60004633			
Site: VGWU 85	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2SO3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8016B_DRO	9056_28D - Chloride	8015B_GRO	8021B- BTEX	Total Number of containers	Special Instructions/Note:
			Preservation Code:		X	X	N	N	N	N		
VGWU85-04-20	11/6/13	1408	G	Solid				X				~~HOLD~~ DO NOT HOLD
VGWU85-04-25	"	1410		Solid				X				DO NOT HOLD
VGWU85-05-02	"	1315		Solid				X				~~DO NOT~~ HOLD
VGWU85-05-05	"	1317		Solid				X				HOLD
VGWU85-05-10	"	1319		Solid				X				HOLD
VGWU85-05-15	"	1321		Solid				X				HOLD
VGWU85-05-20	"	1323		Solid				X				HOLD
VGWU85-05-25	"	1325		Solid				X				HOLD
VGWU85-06-02	"	1457		Solid				X				HOLD
VGWU85-06-05	"	1459		Solid				X				HOLD
VGWU85-06-10	"	1501		Solid				X				HOLD

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by:	Date/Time: 11/7/13 800	Company	Received by:	Date/Time: 11/8/13 700	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: ∆ Yes ∆ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

11/21/2013

Page 26 of 28

TestAmerica Houston
6310 Rothway Street
Houston, TX 77040
Phone (713) 690-4444 Fax (713) 690-5646

Chain of Custody Record

Client Information	Sampler: MELISA PHAN	Lab PM: Kudchadkar, Sachin G	Carrier Tracking No(s):	COC No: 600-23595-8666.1
Client Contact: Mr. Jonathan Olsen	Phone: 7139534800	E-Mail: sachin.kudchadkar@testamericainc.com		Page: Page 4 of 4
Company: ARCADIS U.S., Inc.				Job #:
Address: 2929 Briarpark Drive Suite 300	Due Date Requested:			
City: Houston	TAT Requested (days): STANDARD			
State, Zip: TX, 77042				
Phone: 7139534800	PO #: Purchase Order Requested			
Email: jonathan.olsen@arcadis-us.com	WO #:			
Project Name: HES Transfer Sites, Lea County NM	Project #: 60004633			
Site: VGWU85	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2SO3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8015B_DRO	9056_28D - Chloride	8015B_GRO	8021B- BTEX	Total Number of containers	Special Instructions/Note:
			Preservation Code				N	N	N	N		
VGWU85-06-15	11/6/13	~~1445~~ 1503	G	Solid				X				HOLD
VGWU85-06-20	"	1505		Solid				X				
VGWU85-06-25	"	1507		Solid				X				
VGWU85-07-02	"	1517		Solid				X				
VGWU85-07-05	"	1519		Solid				X				
VGWU85-07-10	"	1521		Solid				X				
VGWU85-07-15	"	1523		Solid				X				
VGWU85-07-20	"	1525		Solid				X				
VGWU85-07-25	"	1527		Solid				X				
				Solid								
				Solid								

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
1		11/7/13 800			11/8/13 700	
2	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
3	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

11/21/2013

Login Sample Receipt Checklist

Client: ARCADIS U.S., Inc.

Job Number: 600-82341-1

Login Number: 82341

List Source: TestAmerica Houston

List Number: 1

Creator: Capps, Dana R

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	1.2/1.4/1.8/1.5/1.7/2.6/1.5
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

ARCADIS

Attachment 6

Boring Logs (May 2013)

Date Start/Finish: 11/6/2013
Drilling Company: Harrison and Cooper Inc/K Cooper

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 25' bgs
Descriptions By: M Phan

Well/Boring ID: **VGWU85 - 01**

Client: Chevron EMC
Location: Vacuum Glorietta West Unit 85 Flow Line Leak

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0							Air Knife only to 2"
			AR					BIRDSEYE (CAPROCK) CALICHE, Brown (7.5YR5/2), Light Gray (7.5YR7/1), to Pink (7.5YR7/3), hard, dry, fractured, subangular to angular, 4 mm to 6 mm, organic material.
		1		5	1.4	☒		CALICHE, Gray (7.5YR5/1), Light Brown (7.5YR6/3), to Pinkish White (7.5YR8/2), hard, dry, fractured, subangular, 1 mm to 7 mm.
			AR					
5	-5				2.4	☒		CALICHE, Pinkish Gray (7.5YR7/2), nodular, homogenous in color, chalky.
		2	AR	5				
10	-10				3.2	☒		CALICHE, Pinkish White (7.5YR8/2), homogenous in color, trace, subrounded to rounded nodules, hard to soft, chalky.
		3	AR	5				
15	-15				4.0	☒		SANDY CALICHE, Pink (7.5YR7/3) to White (7.5YR8/1), fine to medium grained, dry to moist.
		4	**AR**	5				
20	-20				1.2	☒		SANDSTONE, Light Brown (7.5YR6/3), fine grained, moist.
		5	**AR**	5				
25	25				2.6	☒		

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: 11/6/2013
Drilling Company: Harrison and Cooper Inc/K Cooper

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 25' bgs
Descriptions By: M Phan

Well/Boring ID: **VGWU85 - 02**

Client: Chevron EMC
Location: Vacuum Glorietta West Unit 85 Flow Line Leak

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0							Air Knife only to 2"
			AR		6.1			BIRDSEYE (CAPROCK) CALICHE, Gray (7.5YR6/1), Brown (7.5YR4/2), to Pinkish White (7.5YR8/2), hard, dry, fractured, subangular to angular, 4 mm to 9 mm, organic material.
		1		5				CALICHE, Gray (7.5YR6/1), Pink (7.5YR7/3), to White (7.5YR8/1), nodular, hard, dry, little rounded to subrounded nodules, well graded, 2 mm to 5 mm.
			AR					
5	-5				6.0			Same as above, subrounded, 3 mm to 11 mm, Pinkish White (7.5YR8/2) to White (7.5YR8/1).
		2	AR	5				
10	-10				11.9			Same as above, trace subrounded nodules, 2 mm to 5 mm, moist, Pink (7.5YR7/3 to 7.5YR8/3).
		3	AR	5				
15	-15				8.7			SANDY CALICHE, Pink (7.5YR7/3), homogenous in color, fine to medium grained sand, trace subrounded nodules, 3 mm to 6 mm, poorly graded, moist, soft.
		4	AR	5				
20	-20				3.8			SANDSTONE, Light Brown (7.5YR6/4), homogenous in color, fine grained, moist, soft.
		5	AR	5				
25	25				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: 11/6/2013
Drilling Company: Harrison and Cooper Inc/K Cooper

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 25' bgs
Descriptions By: M Phan

Well/Boring ID: **VGWU85 - 03**

Client: Chevron EMC
Location: Vacuum Glorietta West Unit 85 Flow Line Leak

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0							Air Knife only to 2"
			AR	2	2.1			BIRDSEYE (CAPROCK) CALICHE, Dark Gray (7.5YR4/1), Gray (7.5YR5/1), Light Gray (7.5YR7/1), to Black (7.5YR2.5/1), hard, dry, fractured, subangular to angular, well graded, 1 mm to 11 mm, organic material.
		1						CALICHE, Pinkish Gray (7.5YR6/2), to Light Gray (7.5YR7/1), some subangular, well graded, 3 mm to 9 mm, dry, hard.
			AR	3				
5	-5				3.0			CALICHE, Pink (7.5YR7/3), to Pinkish White (7.5YR8/2), nodular, medium to hard, poorly graded, 3 mm to 5 mm, moist, subrounded to rounded, chalky.
		2	AR	5				
10	-10				3.4			Same as above, Pinkish Gray (7.5YR7/2), Pinkish White (7.5YR8/2).
		3	AR	5				
15	-15				3.4			
		4	**AR**	5				
20	-20				2.0			SANDY CALICHE, Pink (7.5YR7/3), fine grained, trace rounded nodules, poorly graded, 2 mm to 3 mm, moist, soft.
		5	**AR**	5				
25	25				2.2			

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: 11/6/2013
Drilling Company: Harrison and Cooper Inc/K Cooper

Drilling Method: Air Rotary
Sampling Method: Shovel

Borehole Depth: 25' bgs
Descriptions By: M Phan

Well/Boring ID: VGWU85 - 04

Client: Chevron EMC
Location: Vacuum Glorietta West Unit 85 Flow Line Leak

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0							Air Knife only to 2"
		1	AR	2	0.7	☒		BIRDSEYE (CAPROCK) CALICHE, Dark Gray (7.5YR4/1), Brown (7.5YR4/2), to Pinkish White (7.5YR8/2), hard, dry, fractured, subangular to angular, well graded, 1 mm to 14 mm, organic material.
			AR	3				CALICHE, Gray (7.5YR5/1, 7.5YR6/1), Pinkish White (7.5YR8/2), to White (7.5YR8/1), some subangular, well graded, 2 mm to 7 mm, dry, hard.
5	-5	2	AR	5	1.6	☒		CALICHE, Pinkish White (7.5YR8/2), trace nodules, rounded, poorly graded, 3 mm to 5 mm, hard to soft, chalky.
10	-10	3	AR	5	3.2	☒		CALICHE, White (7.5YR8/1), to Pinkish White (7.5YR8/2), soft, chalky.
15	-15	4	AR	5	3.5	☒		SANDY CALICHE, Light Brown (7.5YR6/4, 7.5YR6/3), fine grained, trace, subrounded nodules, poorly graded, 3 mm to 5 mm, moist, soft.
20	-20	5	AR	5	2.0	☒		Same as above, Pink (7.5YR7/4), to Pink (7.5YR8/3).
25	-25				2.6	☒		

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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;

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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:
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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)

References

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

Salhotra, A.M., P. Mineart, S. Sharp-Hansen, T. Allison, R. Johns, and W.B. Mills. 1995. Multimedia Exposure Assessment Model (MULTIMED 2.0) for Evaluating the Land Disposal of Wastes--Model Theory. United States Environmental Protection Agency, Athens, GA. Unpublished Report.

United States Environmental Protection Agency. 1996. A Subtitle D Landfill Application Manual for the Multimedia Exposure Assessment Model (MULTIMED 2.0). Final Report.

Van Genuchten, M, Th., and P.J. Wierenga. 1976. Mass Transfer Studies in Sorbing Porous Media I. Analytical Solutions. Soil Science Society of America Proceedings. v 40, 473-480.

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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)

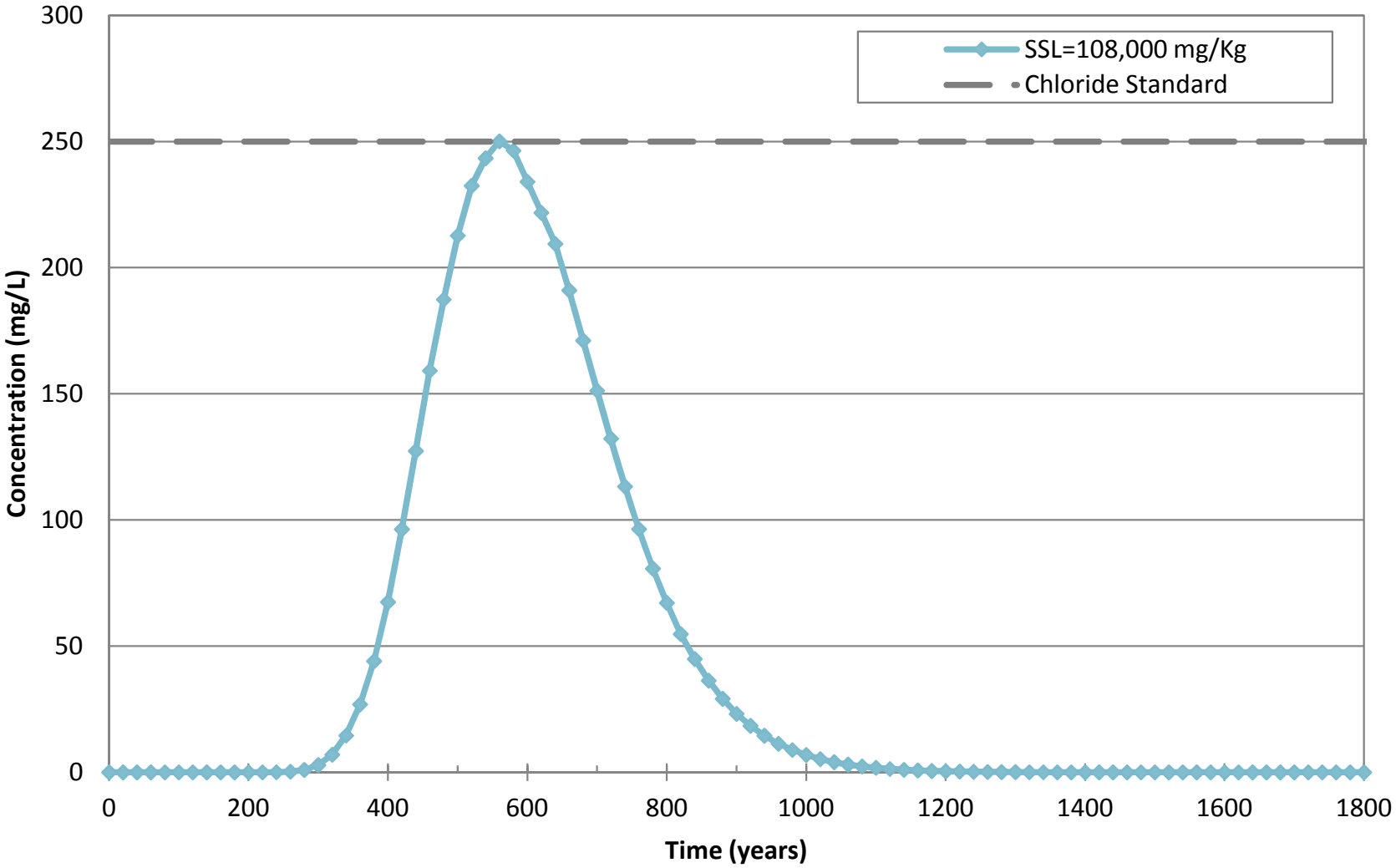

Figure 2
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 20m, Chloride 0-1m, & Depth to Groundwater = 30.5m)

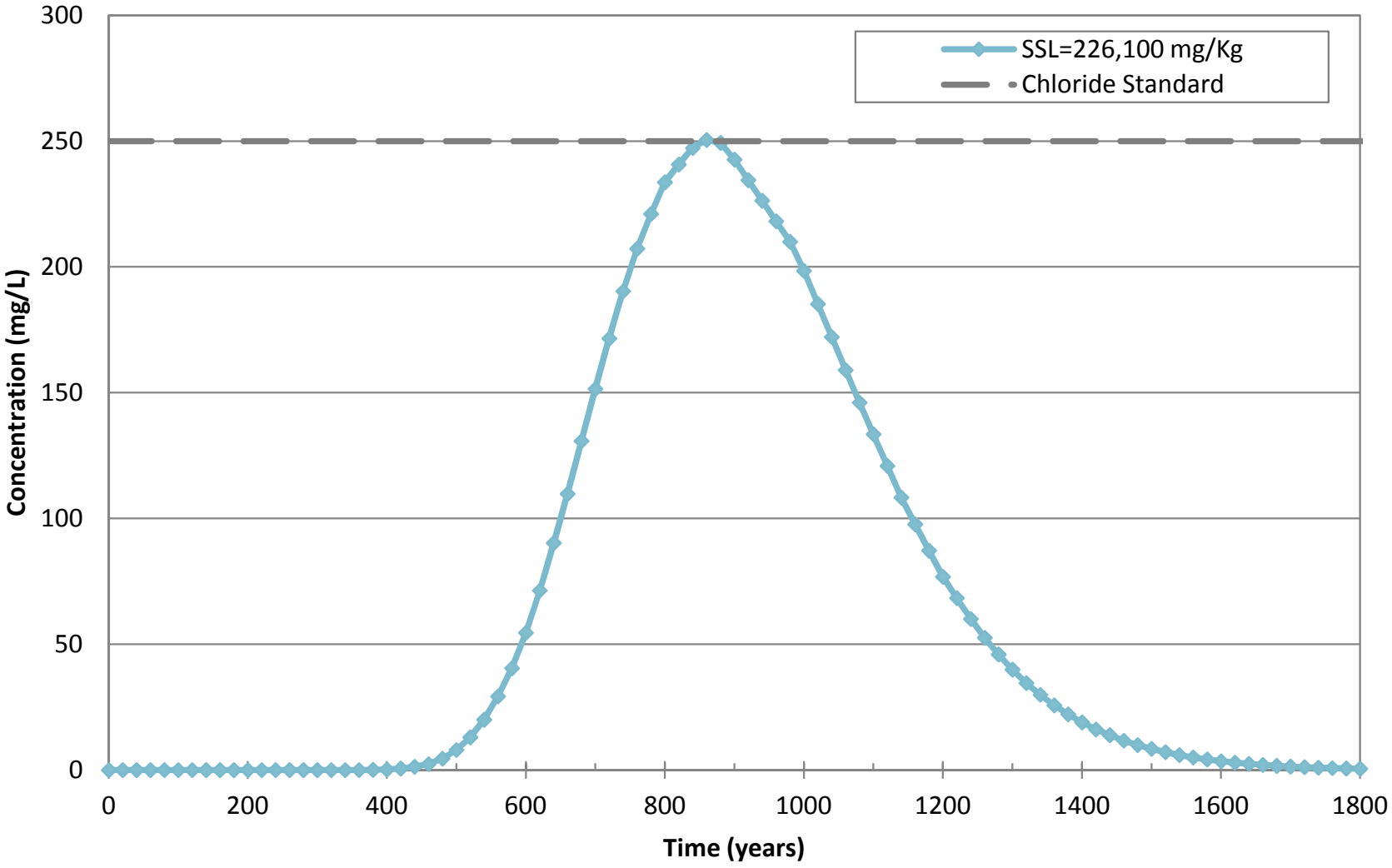

Figure 3
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 20m, Chloride 0-3m, & Depth to Groundwater = 20m)

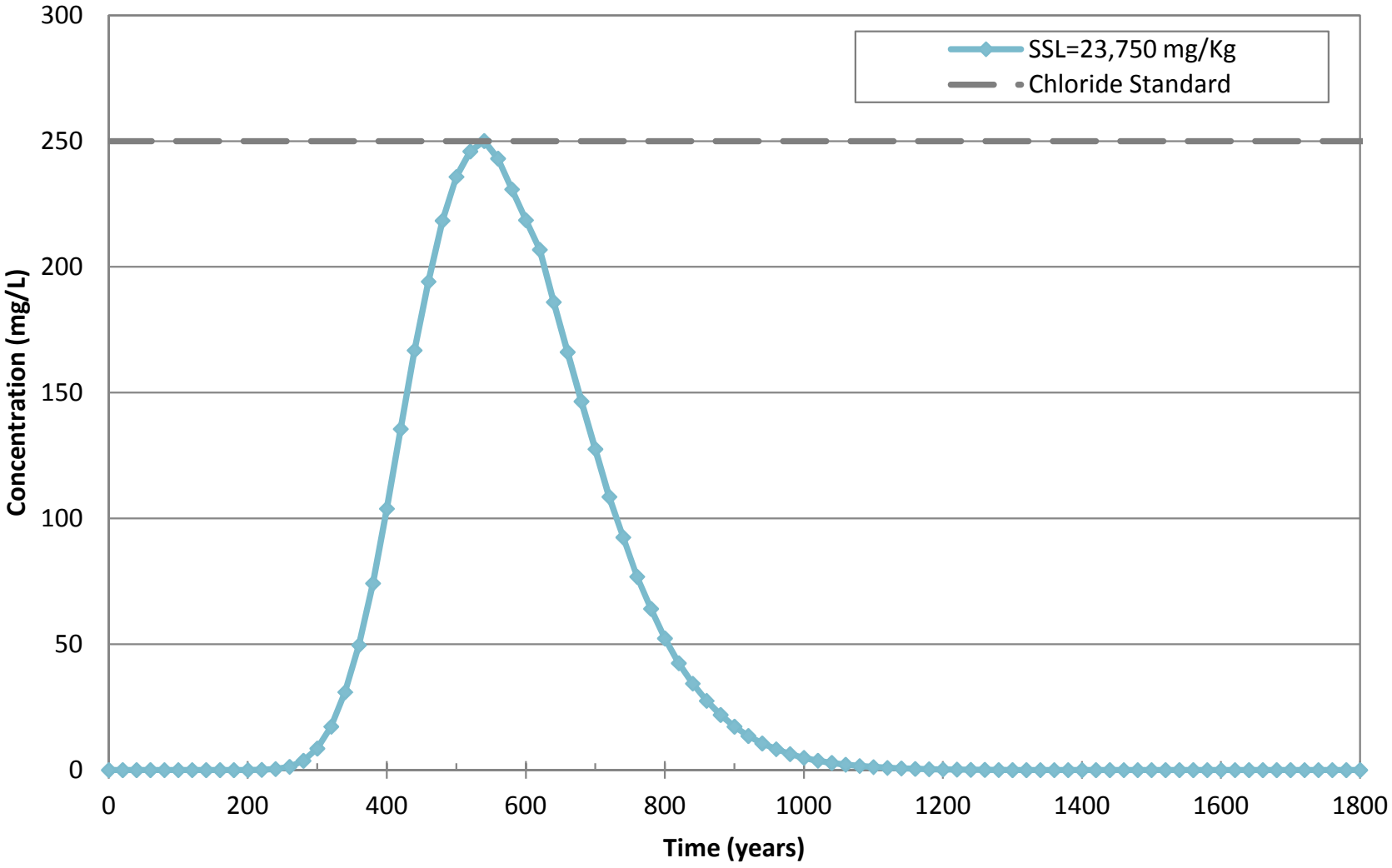

Figure 4
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 20m, Chloride 0-3m, & Depth to Groundwater = 30.5m)

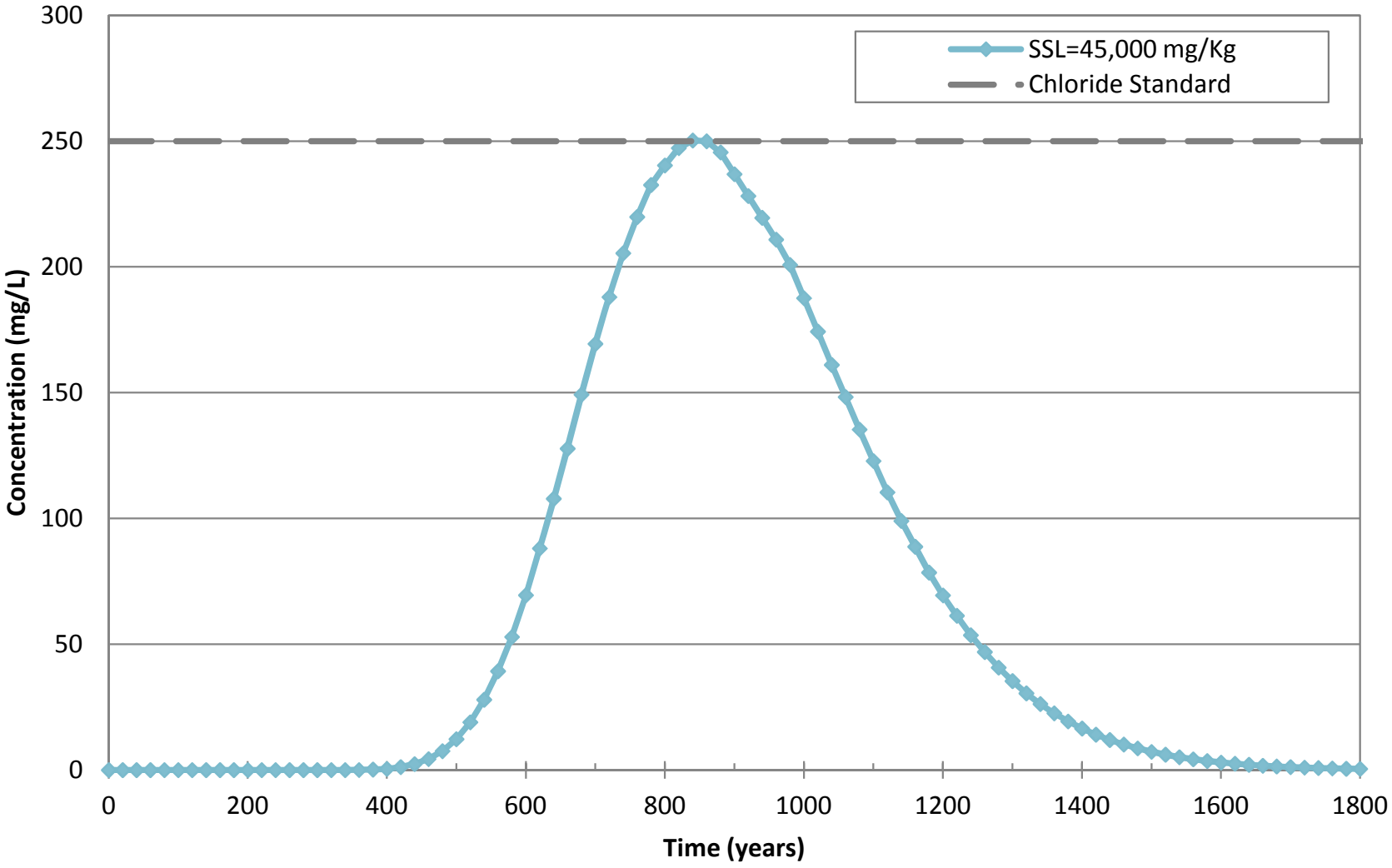

Figure 5
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 45m, Chloride 0-1m, & Depth to Groundwater = 20m)

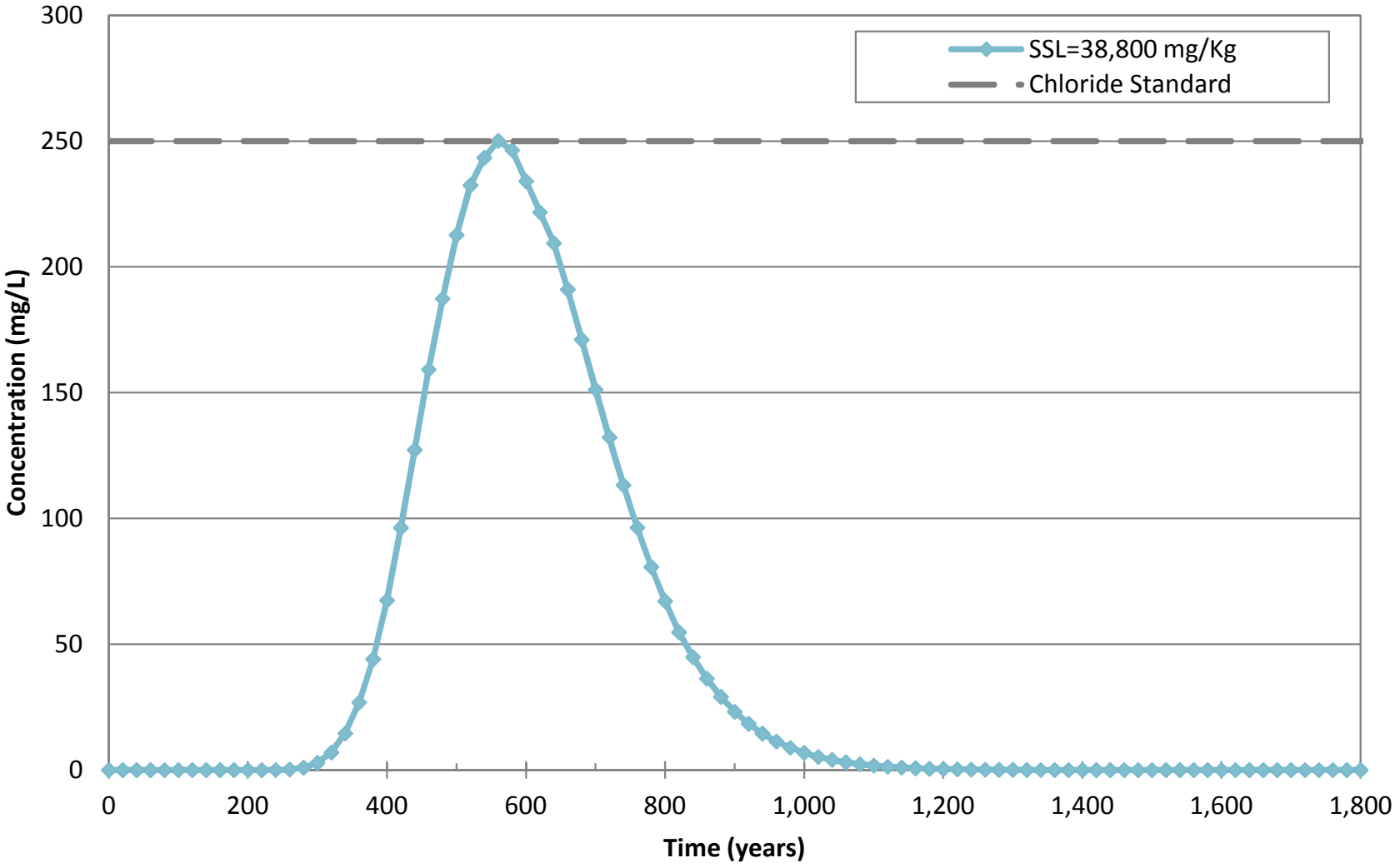

Figure 6
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 45m, Chloride 0-1m, & Depth to Groundwater = 30.5m)

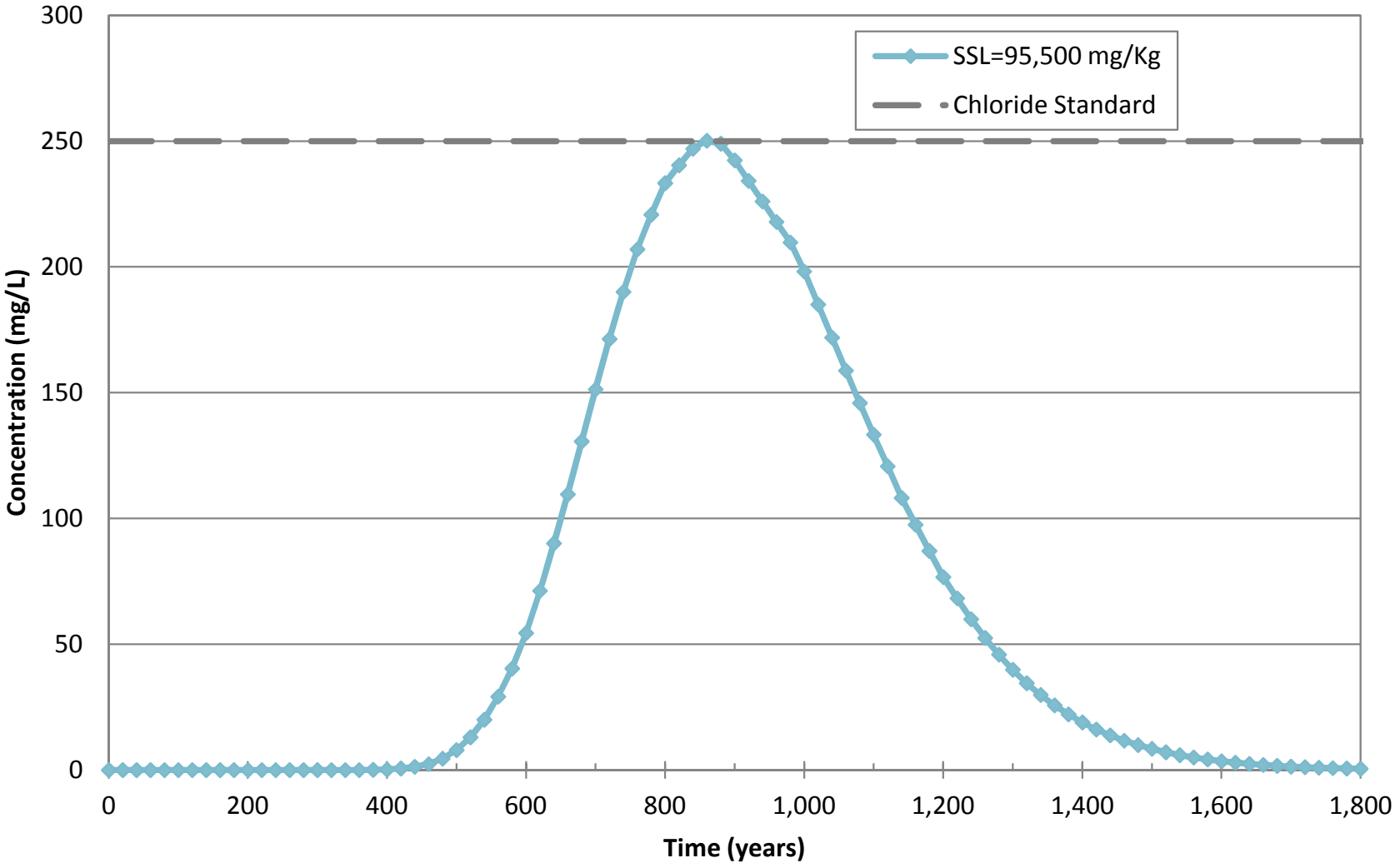

Figure 7
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 45m, Chloride 0-3m, & Depth to Groundwater = 20m)

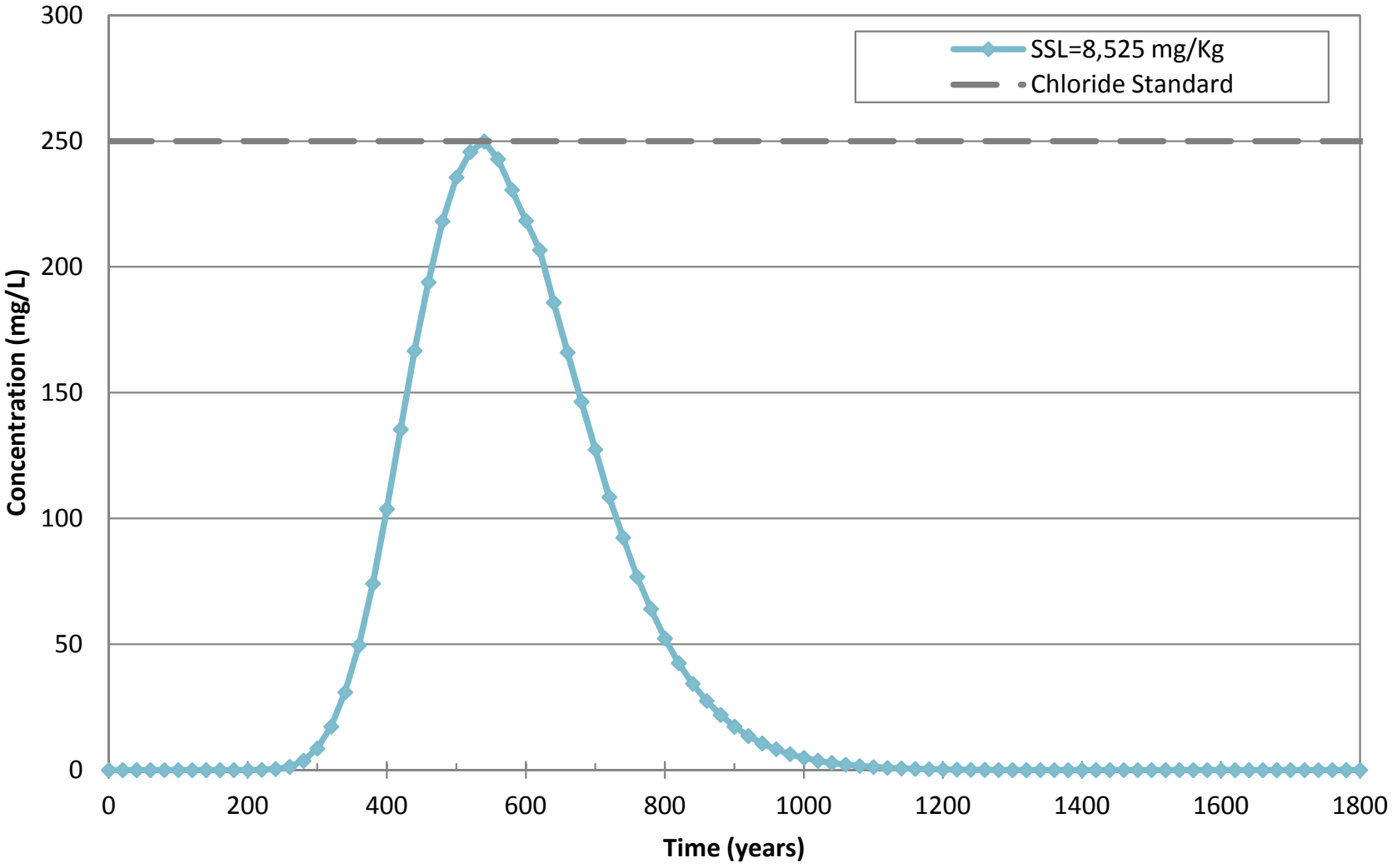

Figure 8
MULTIMED Simulated Chloride Concentration Vs Time in Groundwater
(Source = 45m, Chloride 0-3m, & Depth to Groundwater = 30.5m)