August 17, 2017

Ms. Olivia Yu
Environmental Specialist
New Mexico Oil Conservation Division
Hobbs District 1 Office
1625 French Drive
Hobbs, New Mexico 88240

SUBMITTED VIA EMAIL
Olivia.Yu@state.nm.us

APPROVED
By Olivia Yu at 10:58 am, Sep 20, 2017

NMOCD approves of the proposed delineation plan for 1RP-4633.

Re: Release Characterization Work Plan
Chalupa #4 SWD Pipeline Release Site
Lea County, New Mexico
NMOCD Case No. 1R-4633

Dear Ms. Yu:

Enviro Clean Cardinal LLC (ECC) is pleased to submit to the New Mexico Oil Conservation Division (NMOCD), on behalf of our client Foundation Energy Management, LLC (FEM), the following work plan to complete the horizontal and vertical delineation of produced water impacts to soil at a pipeline release site associated with FEM's Chalupa #4 SWD Lease. This release site is referred to within this work plan as the Chalupa #4 SWD Pipeline Release Site (Site) and is located approximately 18 miles northwest of the City of Lovington in Lea County, New Mexico. The Site is on New Mexico State Trust Lands that are administered by the New Mexico State Land Office (NMSLO). The NMSLO has leased the surface of the Site to Norman and Elwanda Hahn Ranches, LTD for agricultural purposes. The location of the Site and its topographic features are shown on the attached **Figure 1**. The Site is located in the west-half of the southwest quarter of Section 13, Township 14 South, Range 33 East, and the geodetic coordinates of the Sites are latitude 33.103422ºN and longitude -103.576112ºW.

Description of Release

On March 2, 2017, FEM experienced a release of produced water at the Site from a leak that developed in a pipeline connected to the Chalupa #4 saltwater disposal well (SWD). Approximately 25 bbls of saltwater were released to the ground surface of which approximately 15 bbls were recovered (approximately 10 bbls were not recovered). FEM submitted a *Release Notification and Corrective Action* Form C-141 to the NMOCD on March 6, 2017. The NMOCD assigned incident database and remediation case number 1R-4633 to the Site and established a maximum permissible chloride level in soil of 600 mg/kg in their response documentation. A copy of FEM's C-141 Form and the NMOCD's response documentation are provided in the attached **Appendix A**.

The released fluids appear to have flowed approximately 550 feet towards the northeast. There appear to be two areas where the produced water accumulated along this flowpath. The first area of accumulation extends from 100 to 200 feet, and the second extends from 400 to 500 feet relative to the point of release. The total affected surface area appears to be approximately 0.48 acres. The New Mexico Office of the State Engineer's (OSE's) online water well database indicates the depth-to-groundwater levels of wells within 2,000-meter radius of the site range between 80 and 120 feet, and average 108 feet below ground surface. The ChevronTexaco Lea

7060 South Yale Avenue, Suite 603 ▪ Tulsa, Oklahoma ▪ 74136 ▪ 918.794.7828
www.EnviroCleanPS.com

County Depth to Groundwater Map (W. Johnson, 2005) indicates that the depth to groundwater is approximately 90 to 100 feet below ground surface. FEM has been directed to conduct both horizontal and vertical delineation of the chloride impacts to bound the edges of impact and to demonstrate that at least 10 feet of separation exists between the base of chloride impact and top of groundwater saturation. FEM understands that if chloride impacts are found to extend too deeply relative to groundwater saturation, and a 10-foot vertical separation cannot be demonstrated, a groundwater investigation will be warranted.

Initial Assessment

FEM retained Basin Environmental Service Technologies, LLC (Basin) to conduct an initial release characterization at the Site. During this investigation, Basin collected surface soil samples at locations 1 through 8 as shown on Basin's **Figure 2** which is attached. Subsurface soil samples were also collected at locations 6, 7 and 8. These soil samples were submitted to Cardinal Laboratories in Midland, Texas for chloride analyses (Method SM4500-CI B). Basin delineated the lateral limits of impact by mapping the visually apparent surface soil staining. This work was performed on May 16, 2017. The results of Basin's characterization work are presented graphically on **Figure 2**. As can be seen from these results, all but two soil samples contained chloride levels that exceed the NMOCD's cleanup level of for this Site of 600 mg/kg. The horizontal and vertical limits of impact have not been fully defined through these initial assessment activities.

To complete both the horizontal and vertical delineation of the chloride impacts at this Site, ECC proposes the following work scope.

Horizontal Delineation

To supplement the delineation activities conducted by Basin, ECC recommends performing an EM38 ground conductivity survey at the Site. This survey will explore the upper 5 feet of the soil profile and should identify the lateral limits of brine impacts to soils. It should also identify the areas of deepest impacts to soils.

When the EM38 survey is complete, ECC recommends collecting soil samples at approximately four (4) additional locations. The locations of these borings will be selected based upon the results of the EM survey. The locations will be selected to provide soil samples that are representative of the full range of EM ground conductivities. At each soil sample location, ECC will install a borehole using either a hand auger or air rotary drilling methods where resistant strata is encountered. The borings will extend to a depth of 6 feet below ground surface. Soil samples will be collected from each borehole from the following depth intervals: 0 to 0.5 feet, 0.5 to 1 foot, 1 to 2 feet, 2 to 3 feet, 3 to 4 feet, 4 to 5 feet, and 5 to 6 feet below ground surface. These soil samples will be field analyzed for chloride using Quantab® titrator strips, and then submitted to the laboratory for chloride analyses by Method 300. Having both ground conductivities and laboratory chloride analyses across the range of impacts at the Site should allow ECC to develop a correlation between the two that can be used to develop remedial actions.

Vertical Delineation

Vertical delineation of the chloride impacts is required by the NMOCD to assess any potential impacts to groundwater. The NMOCD requires at least 10 feet of vertical separation between the base of the chloride impact and the top of groundwater saturation. As discussed above, groundwater at this Site has been shown to be between 80 and 120 feet below ground surface. ECC proposes that a single deep borehole be installed in the area of highest EM ground conductivities. It is likely that this deep boring will be an extension of one of the four borings described above used for horizontal delineation. This boring will be drilled and sampled on 5-foot depth intervals until a 10-foot interval of soil/rock (i.e., three 5-foot soil samples taken

consecutively) is identified through field chloride analyses using Quantab® titrator strips. When such an interval is identified, drilling and sampling will terminate and the borehole will be plugged. The soil samples collected form this boring will be submitted to the laboratory for confirmation chloride analyses by Method 300. If the depth of drilling is sufficient to encounter groundwater and chloride levels remain above 600 mg/kg, a permanent groundwater monitoring well will be installed and sampled.

The information obtained through implementation of this work plan, in conjunction with the data previously obtained by Basin, will be used to develop a remediation work plan to address Site soils that contain chloride at levels greater than the NMOCD cleanup level. If 10 feet of vertical separation cannot be demonstrated below the base of chloride impacts and top of groundwater saturation, the remediation work plan will also address groundwater impacts.

If you have any questions regarding this proposal or our estimated costs, please do not hesitate to contact Ms. Alyssa Beard at Foundation Energy Management in Denver at 303-244-8114, or myself at 918-794-7828. Thanks.

Sincerely,
Enviro Clean Cardinal, LLC

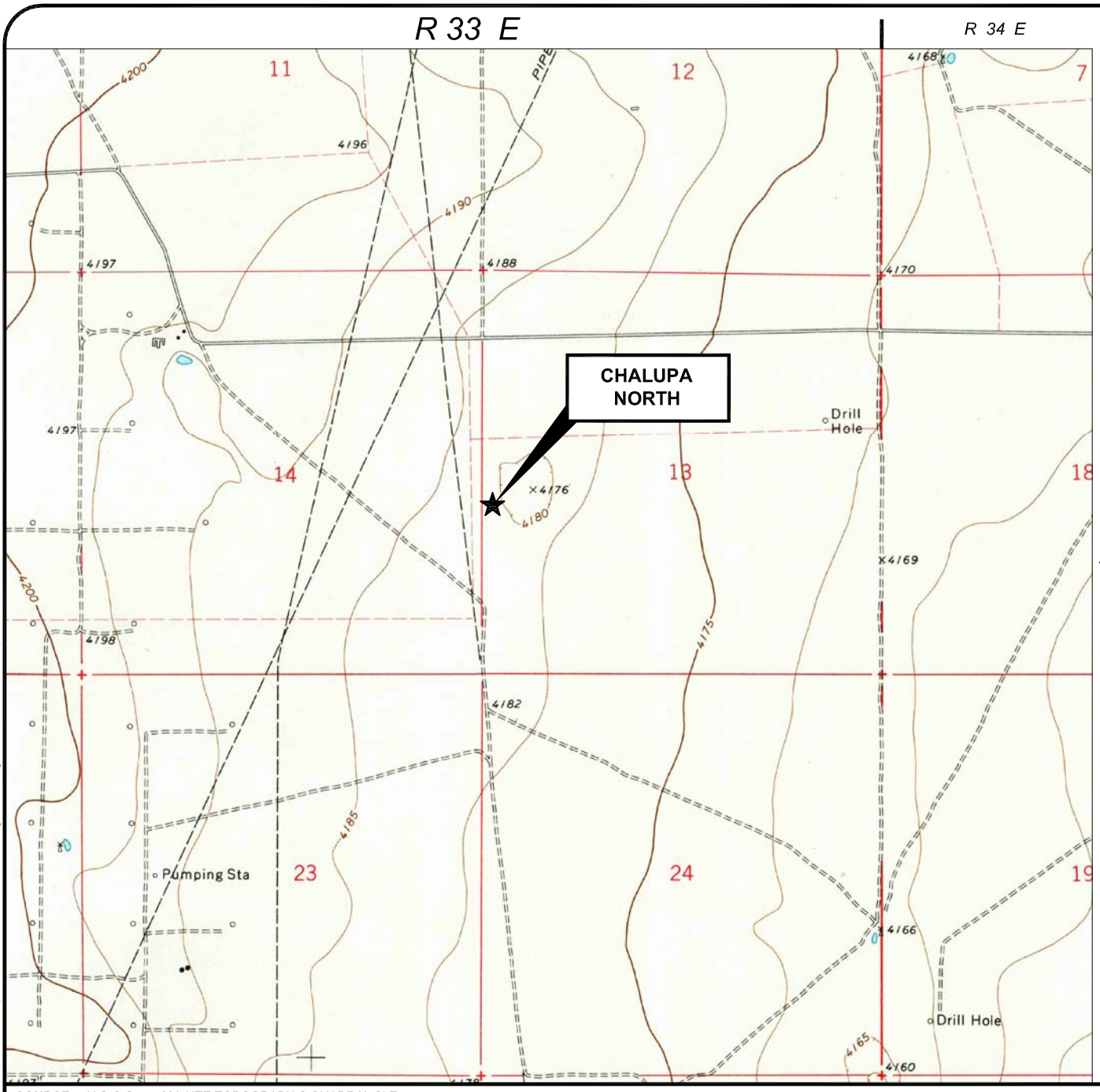
George H. (Buddy) Richardson, P.G.
Manager Hydrogeology

Attachments: Figure 1 - Site Location and Topographic Features
Figure 2 - From Basin Characterization

xc: Ms. Rachel Grant, Foundation Energy Management, Tulsa, OK
Ms. Alyssa Beard, Foundation Energy Management, Denver, CO

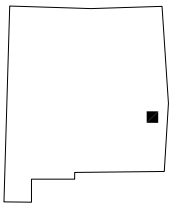
ATTACHMENTS

FIGURES



SOURCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE
FORT RANCH, NEW MEXICO 1973

NEW MEXICO



N

SCALE
0 1/2 1 MILE

CLIENT: FOUNDATION ENERGY MANAGEMENT	FIGURE TITLE: ***SITE LOCATION AND TOPOGRAPHIC FEATURES***
LOCATION: SEC. 13, T14S, R33E LEA COUNTY, NEW MEXICO	DOCUMENT TITLE: RELEASE CHARACTERIZATION WORK PLAN

ENVIRO CLEAN CARDINAL

Enviro Clean Cardinal, LLC
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Tulsa, Oklahoma 74136
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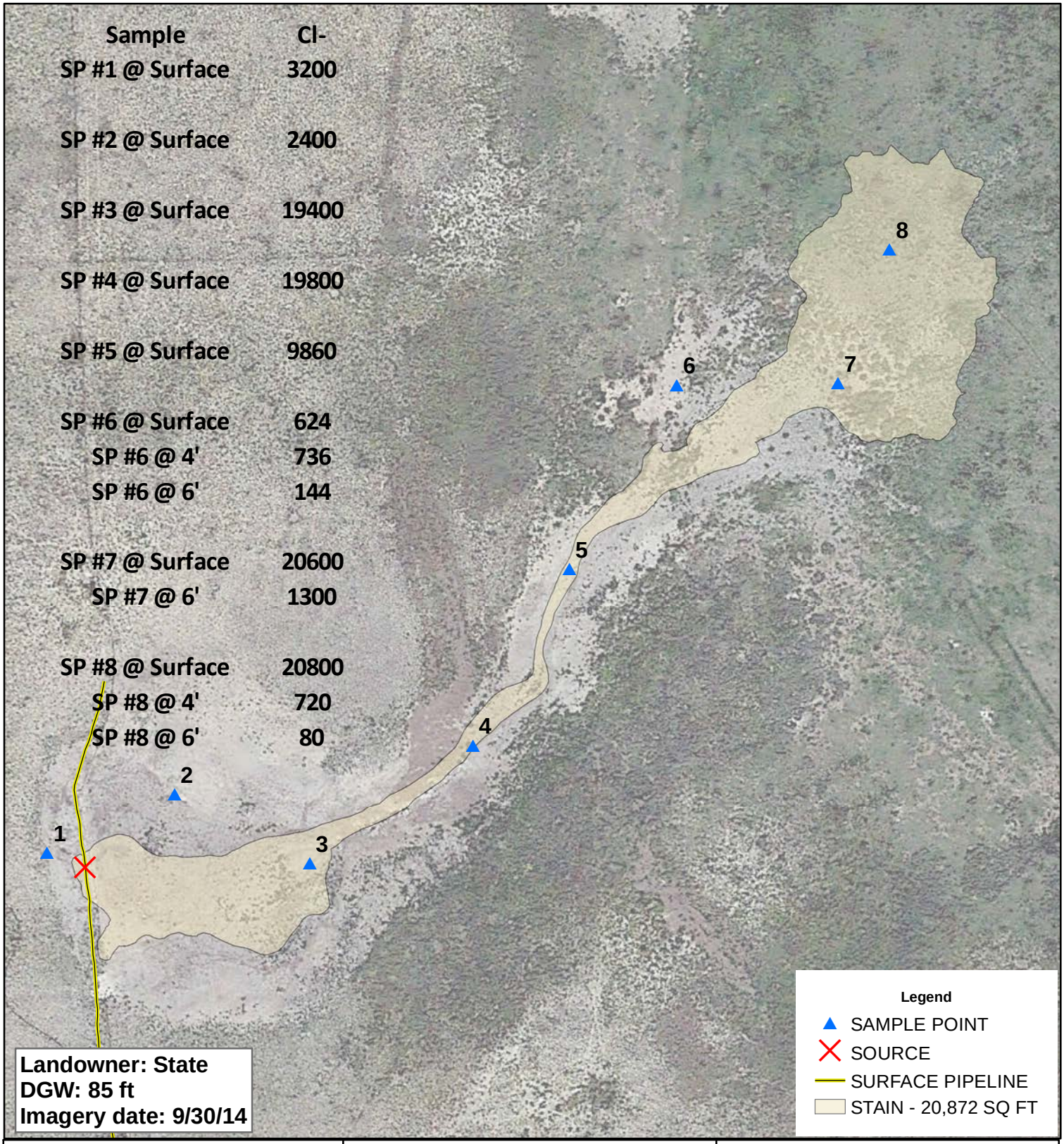
		DESIGNED BY	GHR
DATE	8/17/2017	APPROVED BY	GHR
SCALE	AS SHOWN	DRAWN BY	SKG
PROJECT NUMBER		FIGURE NUMBER	
FEMHCHAPN1		1	

D:\Projects\FoundationEnergyMgmt\FEMHCHAPN1_ChalupaNorth\04_CAD\20170614_F01_TOPO.dwg on Aug 17, 2017 - 3:09pm



Basin Environmental Effective Solutions Service Technologies

FOUNDATION CHALUPA #4 SWD NORTH AREA

UL L SECTION 13
T-14-S R-33-E
LEA COOUNTY, NM

GPS: 33.103422 -103.576112

FIGURE 2

0 50 100 Feet

N W E S

GPS date: 3/14/17 TG, 5/16/17 RR
Drawing date: 5/25/17
Drafted by: T. Grieco

APPENDIX A

FORM C-141

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 Foundation Energy Management, LLC	Contact Rachel Grant
Address 16000 Dallas Parkway, Suite 875	Telephone No. 918-526-5592
Facility Name Chalupa SWD	Facility Type Salt water disposal well

Surface Owner	Mineral Owner	API No. 30-025-29184

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
I	13	14S	33E	330	South	330	West	Lea

Latitude 33.0982437 Longitude -103.5753937

NATURE OF RELEASE

Type of Release Saltwater	Volume of Release 25 bbls	Volume Recovered 15 bbls
Source of Release Flowline leak	Date and Hour of Occurrence	Date and Hour of Discovery 3/2/2017, 2:30pm
Was Immediate Notice Given? ☐ Yes ☒ No ☐ Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse. NA	

If a Watercourse was Impacted, Describe Fully.* NA

RECEIVED
By Olivia Yu at 8:47 am, Mar 07, 2017

Describe Cause of Problem and Remedial Action Taken.* Pumper installed repair clamp to fix leak until line can be replaced. Vacuum truck picked up 15 bbl fluid.

Describe Area Affected and Cleanup Action Taken.* Scheduling flowline repair. Once flowline is repaired, remaining flowline will be pressure tested to ensure no future leaks.

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: Rachel Grant	Approved by Environmental Specialist:
Title: HSE/Regulatory Manager	Approval Date: 3/7/2017 Expiration Date:
E-mail Address: regulatory@foundationenergy.com	Conditions of Approval: see attached directive Attached ☑
Date: 3/6/17 Phone: 918-526-5592	

* Attach Additional Sheets If Necessary

1RP-4633 nOY1706631442 pOY1706631752

Operator/Responsible Party,

The OCD has received the form C-141 you provided on _3/7/2017_ regarding an unauthorized release. The information contained on that form has been entered into our incident database and remediation case number __1R-_4633_ has been assigned. **Please refer to this case number in all future correspondence.**

It is the Division's obligation under both the Oil & Gas Act and Water Quality Act to provide for the protection of public health and the environment. Our regulations (19.15.29.11 NMAC) state the following,

> *The responsible person shall complete division-approved corrective action for releases that endanger public health or the environment. The responsible person shall address releases in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with 19.15.30 NMAC.* [emphasis added]

Release characterization is the first phase of corrective action unless the release is ongoing or is of limited volume and all impacts can be immediately addressed. Proper and cost-effective remediation typically cannot occur without adequate characterization of the impacts of any release. Furthermore, the Division has the ability to impose reasonable conditions upon the efforts it oversees. **As such, the Division is requiring a workplan for the characterization of impacts associated with this release be submitted to the OCD District _1_ office in __Hobbs____ on or before _4/7/2017_. If and when the release characterization workplan is approved, there will be an associated deadline for submittal of the resultant investigation report. Modest extensions of time to these deadlines may be granted, but only with acceptable justification.**

The goals of a characterization effort are: 1) determination of the lateral and vertical extents along with the magnitude of soil contamination. 2) determine if groundwater or surface waters have been impacted. 3) If groundwater or surface waters have been impacted, what are the extents and magnitude of that impact. 4) The characterization of any other adverse impacts that may have occurred (examples: impacts on vegetation, impacts on wildlife, air quality, loss of use of property, etc.). To meet these goals as quickly as possible, the following items must, at a minimum, be addressed in the release characterization workplan and subsequent reporting:

- Horizontal delineation of soil impacts in each of the four cardinal compass directions. Adsorbed soil contamination must be characterized for the following constituents using the associated laboratory methods: benzene, toluene, ethylbenzene, and total xylenes by either Method 8260 or 8021, total petroleum hydrocarbons by Method 8015 extended range (GRO+DRO+MRO; C_6 thru C_{36}), and for chloride by Method 300. This is not an exclusive list of potential contaminants. Analyzed parameters should be modified based on the nature of the released substance(s). Soil sampling must be both within the impacted area and beyond.

- Vertical delineation of soil impacts. Adsorbed soil contamination must be characterized for the following constituents using the associated laboratory methods: benzene, toluene, ethylbenzene, and total xylenes by either Method 8260 or 8021, total petroleum hydrocarbons by Method 8015 extended range (GRO+DRO+MRO; C_6 thru C_{36}), and for chloride by Method 300. As above, this is not an exclusive list of potential contaminants and can be modified. Vertical characterization samples should be taken at depth intervals no greater than five feet apart. Lithologic description of encountered soils must also be provided. At least ten vertical feet of soils with contaminant concentrations at or below these values must be demonstrated as existing above the water table.

- Nominal detection limits for field and laboratory analyses must be provided.

- Composite sampling is not generally allowed.

- Field screening and assessment techniques are acceptable (headspace, titration, EC [include algorithm for validation purposes], EM, etc.), but the sampling and assay procedures must be clearly defined. Copies of field notes are highly desirable. A statistically significant set of split samples must be submitted for confirmatory laboratory analysis, including the laterally farthest and vertically deepest sets of soil samples. Make sure there are at least two soil samples submitted

for laboratory analysis from each borehole or test pit (highest observed contamination and deepest depth investigated). Copies of the actual laboratory results must be provided including chain of custody documentation.

•Probable depth to shallowest protectable groundwater and lateral distance to nearest surface water. If there is an estimate of groundwater depth, the information used to arrive at that estimate must be provided. If there is a reasonable assumption that the depth to protectable water is 50 feet or less, the responsible party should anticipate the need for at least one groundwater monitoring well to be installed in the area of likely maximum contamination.

• If groundwater contamination is encountered, an additional investigation workplan may be required to determine the extents of that contamination. Groundwater and/or surface water samples, if any, must be analyzed by a competent laboratory for volatile organic hydrocarbons (typically Method 8260 full list), total dissolved solids, pH, major anions and cations including chloride and sulfate, dissolved iron, and dissolved manganese. The investigation workplan must provide the groundwater sampling method(s) and sample handling protocols. To the fullest extent possible, aqueous analyses must be undertaken using nominal method detection limits. As with the soil analyses, copies of the actual laboratory results must be provided including chain of custody documentation.

• Accurately scaled and well-drafted site maps must be provided providing the location of borings, test pits, monitoring wells, potentially impacted areas, and significant surface features including roads and site infrastructure that might limit either the release characterization or remedial efforts. Field sketches may be included in subsequent reporting, but should not be considered stand-alone documentation of the site's layout. Digital photographic documentation of the location and fieldwork is recommended, especially if unusual circumstances are encountered.

Nothing herein should be interpreted to preclude emergency response actions or to imply immediate remediation by removal cannot proceed as warranted. Nonetheless, characterization of impacts and confirmation of the effectiveness of remedial efforts must still be provided to the OCD before any release incident will be closed.

Jim Griswold
OCD Environmental Bureau Chief
1220 South St. Francis Drive
Santa Fe, New Mexico 87505
505-476-3465
jim.griswold@state.nm.us