

State of Colorado
Oil and Gas Conservation Commission

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Report taken by:
RICK ALLISON

Site Investigation and Remediation Workplan (Supplemental Form)

This form shall be submitted to the Director for approval prior to the initiation of site investigation and remediation activities. However, this shall not preclude the Operator from taking immediate action to protect public health or safety, the environment, wildlife, or livestock.

This Form 27 describes site conditions as currently understood by the Operator; approval of this Form 27 by COGCC is based on the site conditions accurately described herein; any changes in site conditions identified during or subsequent to the performance of the approved workplan may necessitate additional investigation or remediation which shall be described on a supplemental Form 27.

This Form 27 is intended to provide basic information regarding the proposed site investigation and remediation actions, but the workplan may be more fully described in attached documentation.

Refer to Rules 340, 905, 906, 907, 908, 909, and 910

OPERATOR INFORMATION

Name of Operator: <u>PDC ENERGY INC</u>	Operator No: <u>69175</u>	Phone Numbers
Address: <u>1775 SHERMAN STREET - STE 3000</u>		
City: <u>DENVER</u>	State: <u>CO</u>	Zip: <u>80203</u>
Contact Person: <u>Karen Olson</u>	Email: <u>COGCCSpillRemediation@pdce.com</u>	
		Phone: <u>(303) 860-5800</u>
		Mobile: <u>()</u>

PROJECT, PURPOSE & SITE INFORMATION

PROJECT INFORMATION

Remediation Project #: 16704 Initial Form 27 Document #: 402590047

PURPOSE INFORMATION

<input type="checkbox"/> 901.e. Sensitive Area Determination	<input type="checkbox"/> 909.c.(5), Rule 910.b.(4): Remediation of impacted ground water
<input checked="" type="checkbox"/> 909.c.(1), Rule 905: Pit or PW vessel closure	<input type="checkbox"/> Rule 909.e.(2)A.: Notice completion of remediation in accordance with Rule 909.b.
<input type="checkbox"/> 909.c.(2), Rule 906: Spill/Release Remediation	<input type="checkbox"/> Rule 909.e.(2)B.: Closure of remediation project
<input type="checkbox"/> 909.c.(3), Rule 907.e.: Land treatment of oily waste	<input type="checkbox"/> Rule 906.c.: Director request
<input type="checkbox"/> 909.c.(4), Rule 908.g.: Centralized E&P Waste Management Facility closure	<input checked="" type="checkbox"/> Other <u>Tank Battery Closure; Wellhead Closure, and; Removal of on-location Flowline</u>

SITE INFORMATION Y Multiple Facilities (in accordance with Rule 909.c.)

Facility Type: <u>WELL</u>	Facility ID: _____	API #: <u>123-13293</u>	County Name: <u>WELD</u>
Facility Name: <u>LEAFGREN 1-17</u>	Latitude: <u>40.482670</u>	Longitude: <u>-104.694920</u>	
** correct Lat/Long if needed: Latitude: _____		Longitude: _____	
QtrQtr: <u>SWSW</u>	Sec: <u>17</u>	Twp: <u>6N</u>	Range: <u>65W</u> Meridian: <u>6</u> Sensitive Area? <u>Yes</u>

Facility Type: <u>LOCATION</u>	Facility ID: <u>323627</u>	API #: _____	County Name: <u>WELD</u>
Facility Name: <u>LEAFGREN-66N65W 17SWSW</u>	Latitude: <u>40.482670</u>	Longitude: <u>-104.694920</u>	
** correct Lat/Long if needed: Latitude: <u>40.482298</u>		Longitude: <u>-104.695262</u>	
QtrQtr: <u>SWSW</u>	Sec: <u>17</u>	Twp: <u>6N</u>	Range: <u>65W</u> Meridian: <u>6</u> Sensitive Area? <u>Yes</u>

SITE CONDITIONS

General soil type - USCS Classifications SM Most Sensitive Adjacent Land Use agriculture / residential

Is domestic water well within 1/4 mile? Yes Is surface water within 1/4 mile? Yes

Is groundwater less than 20 feet below ground surface? No

Other Potential Receptors within 1/4 mile _____

Tank Battery Receptors: A domestic well is located approximately 486 feet northwest of the location. The Greeley No. 2 canal is located approximately 22 feet south of the location. Occupied buildings are located approximately 357 feet northwest of the location. FWS Wetlands classified as riverine habitat are located approximately 22 feet south of the location.

Wellhead Receptors: A domestic well is located approximately 551 feet northwest of the location. The Greeley No. 2 canal is located approximately 114 feet south of the location. Occupied buildings are located approximately 389 feet northwest of the location. FWS Wetlands classified as riverine habitat are located approximately 114 feet south of the location.

SITE INVESTIGATION PLAN

TYPE OF WASTE:

- | | | |
|--|--|--|
| <input checked="" type="checkbox"/> E&P Waste | <input type="checkbox"/> Other E&P Waste | <input type="checkbox"/> Non-E&P Waste |
| <input checked="" type="checkbox"/> Produced Water | <input type="checkbox"/> Workover Fluids | |
| <input checked="" type="checkbox"/> Oil | <input type="checkbox"/> Tank Bottoms | |
| <input checked="" type="checkbox"/> Condensate | <input type="checkbox"/> Pigging Waste | |
| <input type="checkbox"/> Drilling Fluids | <input type="checkbox"/> Rig Wash | |
| <input type="checkbox"/> Drill Cuttings | <input type="checkbox"/> Spent Filters | |
| | <input type="checkbox"/> Pit Bottoms | |
| | <input type="checkbox"/> Other (as described by EPA) | |

DESCRIPTION OF IMPACT

Impacted?	Impacted Media	Extent of Impact	How Determined
Yes	GROUNDWATER	Refer to Figure 3 and Table 5	Implementation of Groundwater Assessment Plan
Yes	SOILS	Ref. to Figures 1-3 and Tables 1-6	Confirmation Soil Sampling

INITIAL ACTION SUMMARY

Description of initial action or emergency response measures take to abate, investigate, and/or remediate impacts associated with E&P Waste.

On March 3, 2021, field screening and confirmation soil sampling was conducted in accordance with the COGCC Rule 911 during the decommissioning and closure of the Leafgren 1, 13, 23-17 Tank Battery and the Leafgren 1-17 Wellhead (Figure 1). Based on the initial analytical results, it was determined that a historic release was discovered adjacent to the former wellhead. Following the discovery, mitigation activities were initiated to delineate and remove remaining hydrocarbon impacts. During excavation activities, groundwater was observed in the excavation at approximately 23 feet below ground surface (bgs). Approximately 249.5 cubic yards of impacted material were excavated and transported to the North Weld Waste Management Facility for disposal under PDC waste manifests.

PROPOSED SAMPLING PLAN

Proposed Soil Sampling

Will soil samples be collected as part of this investigation? (Number, type (grab/composite), analyses, and locations of samples):

On March 3, 2021, one soil sample (WH01) was collected from the source area (adjacent to the Wellhead) at approximately 5 feet below ground surface (bgs) and was submitted to Summit Scientific Laboratories (Summit) for analysis of the full COGCC Table 915-1 analyte list. Preliminary analytical results indicate that site specific containments of concern (COCs) include benzene, toluene, ethylbenzene, total xylenes (BTEX), naphthalene, total petroleum hydrocarbons (TPH) [C6-C36], 1,2,4-trimethylbenzene (TMB), 1,3,5-TMB, cadmium, and lead. Between March 8 and March 9, 17 soil samples (SS01 – SS17) were collected from the sidewalls and base of the excavation at depths ranging between 12 feet and 24 feet bgs and were submitted for laboratory analysis of the above referenced COCs. In addition, one sample (SS18) was collected from the final excavation extent at 2.5 feet bgs and submitted for soil suitability constituents, lead, and cadmium.

Proposed Groundwater Sampling

Will groundwater samples be collected as part of this investigation? (Number, analyses, and locations of samples):

The excavation extent and soil sample locations are illustrated on Figure 2. Soil analytical results are summarized in Tables 1-4. The laboratory reports are included in Attachment A.

On March 10, 2021, one groundwater sample (GW01) was collected from the excavation following the completion of source mass removal activities and submitted for laboratory analysis of BTEX, naphthalene, 1,2,4-TMB, and 1,3,5-TMB. Analytical results indicated that constituent concentrations were below the applicable COGCC Table 915-1 groundwater standards. The groundwater sample location is illustrated on Figure 3 and the groundwater analytical results are summarized on Table 5.

Proposed Surface Water Sampling

Will surface water samples be collected as part of this investigation? (Number, analyses, and locations of samples):

Additional Investigative Actions

Additional alternative investigative actions described in attached Site Investigation Plan (summary):

Tank battery decommissioning samples were collected adjacent to the above ground storage tanks (AST), separator flowlines and dump lines (SEP-FL and SEP-DL) and produced water vessel (PWV01). Samples were submitted for analysis of BTEX, naphthalene and TPH (C6-C36). In addition, the sidewall sample which exhibited the highest PID reading collected adjacent to the produced water vessel was submitted for analysis of pH, electrical conductivity (EC), sodium adsorption ration (SAR) and boron. Per the approved Initial Form 27, TMB analysis was not included for this location as soil sampling was conducted prior to March 4, 2021. Analytical results indicated that constituents were in compliance with the applicable COGCC Table 915-1 standards in all laboratory sample locations. Analytical results are summarized in Tables 1 and 2, GPS coordinates and field screened VOC concentrations are summarized in Table 6. Field screening and laboratory sample locations are illustrated on Figure 1.

SITE INVESTIGATION REPORT

SAMPLE SUMMARY

Soil

Number of soil samples collected 26

Number of soil samples exceeding 910-1 6

Was the areal and vertical extent of soil contamination delineated? No

Approximate areal extent (square feet) 546

NA / ND

-- Highest concentration of TPH (mg/kg) 2042

-- Highest concentration of SAR 1.23

BTEX > 910-1 Yes

Vertical Extent > 910-1 (in feet) 24

Groundwater

Number of groundwater samples collected 1

Was extent of groundwater contaminated delineated? No

Depth to groundwater (below ground surface, in feet) 23'

Number of groundwater monitoring wells installed 0

Number of groundwater samples exceeding 910-1 0

ND Highest concentration of Benzene (µg/l) _____

ND Highest concentration of Toluene (µg/l) _____

ND Highest concentration of Ethylbenzene (µg/l) _____

-- Highest concentration of Xylene (µg/l) 12

NA Highest concentration of Methane (mg/l) _____

Surface Water

0 Number of surface water samples collected

 Number of surface water samples exceeding 910-1

If surface water is impacted, other agency notification may be required.

OTHER INVESTIGATION INFORMATION

Were impacts to adjacent property or offsite impacts identified?

Were background samples collected as part of this site investigation?

The source soil sample (FLR01) exhibited arsenic, barium, cadmium, and lead concentrations in exceedance of the applicable COGCC Table 915-1 standards. Therefore, a background sample was collected within the shallow soil horizon to determine if elevated levels are a result of historic impacts or native soil conditions. On March 3, 2021, one background soil sample (BKG01) was collected at approximately 2.5 feet bgs and submitted for analysis of the COGCC Table 915-1 metals. Analytical results indicated that arsenic and barium were in exceedance of the applicable regulatory standards in native soil. Based on the results, arsenic and barium were removed from the final sampling analysis plan.

Was investigation derived waste (IDW) generated as part of this investigation?

Volume of solid waste (cubic yards) 249

Volume of liquid waste (barrels) 0

Is further site investigation required?

Five (5) monitoring wells will be installed via direct-push drilling methods to confirm the absence of dissolved-phase hydrocarbon impacts within and surrounding the former excavation extent. Lithologic descriptions and volatile organic compound (VOC) concentrations using a photoionization detector (PID) will be recorded for each borehole. If elevated VOC concentrations are encountered during the investigation, a sample will be collected from the interval exhibiting the highest VOC concentration from the borehole and submitted for laboratory analysis of benzene, toluene, ethylbenzene, total xylenes (BTEX), naphthalene, total petroleum hydrocarbons (TPH C6-C36), 1,2,4-trimethylbenzene (TMB), 1,3,5-TMB, cadmium, and lead by EPA Methods 8260B, 8015, and 6020B. Proposed monitoring well locations are illustrated on Figure 4. Per landowner request, the monitoring wells will be installed during the third or fourth quarter 2021, following the completion of agricultural harvest operations.

REMEDIAL ACTION PLAN

Does this Supplemental Form 27A include changes to a previously approved Remedial Action Plan? No _____

SOURCE REMOVAL SUMMARY

Describe how source is to be removed.

Between March 3 and March 25, 2021, approximately 249.5 cubic yards of impacted material were excavated adjacent to the wellhead and transported to the North Weld Waste Management Facility in Ault, Colorado for disposal under PDC waste manifests. During excavation activities, groundwater was encountered within the excavation at approximately 23 feet below ground surface (bgs).

No soil was removed from the tank battery location during tank battery decommissioning and closure activities.

REMEDIATION SUMMARY

Describe how remediation of existing impacts to soil and groundwater is to be accomplished (i.e. summarize remedial action plan). Provide a brief narrative description including: technical justification, schedule for implementation, estimated time to attain NFA status, plus plans and specifications for the selected remedial action technology.

Analytical results for the samples collected from the final excavation extent indicated that 1, 2, 4-TMB, 1, 3, 5-TMB, and naphthalene were in exceedance of the applicable COGC Table 915-1 Protection of Groundwater SSLs within the base of the excavation. Based on the results, approximately 200 gallons of 10% Micro-Blaze bio-remediation amendment were applied to the base of the excavation via diaphragm pump to address remaining hydrocarbon impacts. Following the application, the excavation was backfilled.

A supplemental remediation strategy will be selected following the evaluation of groundwater analytical results.

Soil Remediation Summary

In Situ

Ex Situ

Yes Bioremediation (or enhanced bioremediation)

Yes Excavate and offsite disposal

_____ Chemical oxidation

_____ If Yes: Estimated Volume (Cubic Yards) 249

_____ Air sparge / Soil vapor extraction

_____ Name of Licensed Disposal Facility or COGCC Facility ID # _____

_____ Natural Attenuation

_____ Excavate and onsite remediation

_____ Other _____

_____ Land Treatment

_____ No Bioremediation (or enhanced bioremediation)

_____ Chemical oxidation

_____ Other _____

Groundwater Remediation Summary

Bioremediation (or enhanced bioremediation)

Chemical oxidation

Air sparge / Soil vapor extraction

Yes Natural Attenuation

Other _____

GROUNDWATER MONITORING

If groundwater has been impacted, describe proposed monitoring plan, including # of wells or sample points, monitoring schedule, analytical methods, points of compliance. Attach a groundwater monitoring location diagram.

Based on the analytical data collected during source mass removal activities, PDC will conduct quarterly groundwater monitoring at the 5 proposed monitoring wells until closure criteria are met. Groundwater samples will be submitted for laboratory analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX), naphthalene, 1,2,4-trimethylbenzene (TMB), and 1,3,5-TMB by EPA Method 8260B in accordance with Table 915-1. In addition, site-specific inorganic parameters, including total dissolved solids (TDS), chlorides, and sulfates, will be evaluated at the source, up-and down-gradient monitoring wells during the fourth quarter 2021. Contingent on analytical results, inorganic parameter analysis will be discontinued after one sampling event.

REMEDIATION PROGRESS UPDATE

PERIODIC REPORTING

Frequency: Quarterly Semi-Annually Annually Other _____

Report Type: Groundwater Monitoring Land Treatment Progress Report O&M Report

Other Source Mass Removal and Confirmation Sampling
Summary _____

WASTE DISPOSAL INFORMATION

Was E&P waste generated as part of this remediation? Yes _____

Describe beneficial use, if any, of E&P Waste derived from this remediation project:

No beneficial use.

Volume of E&P Waste (solid) in cubic yards _____ 249

E&P waste (solid) description Hydrocarbon impacted soil. _____

COGCC Disposal Facility ID #, if applicable: _____

Non-COGCC Disposal Facility: North Weld Waste Management
Facility _____

Volume of E&P Waste (liquid) in barrels _____ 0

E&P waste (liquid) description _____

COGCC Disposal Facility ID #, if applicable: _____

Non-COGCC Disposal Facility: _____

REMEDIATION COMPLETION REPORT

REMEDIATION COMPLETION SUMMARY

Is this a Final Closure Request for this Remediation Project? No _____

Do all soils meet Table 910-1 standards? _____

Does the previous reply indicate consideration of background concentrations? _____

Are the only residual soil impacts pH, SAR, or EC at depths greater than 3 feet below ground surface? _____

Does Groundwater meet Table 910-1 standards? _____

Is additional groundwater monitoring to be conducted? _____

RECLAMATION PLAN

RECLAMATION PLANNING

Describe reclamation plan. Discuss existing and new grade recontouring; method and testing of compaction alleviation; and reseeding program, including location of new seed, seed mix and noxious weed prevention. Attach diagram or drawing.

Following facility decommissioning and excavation activities, the location was backfilled, compacted, and re-contoured to match pre-existing conditions. The location will be reclaimed in accordance with the COGCC 1000 series.

Is the described reclamation complete? Yes _____

Does the reclamation described herein constitute interim or final reclamation of the Oil and Gas Location?

Interim? Final?

Did the Surface Owner approve the seed mix? _____

If NO, does the seed mix comply with local soil conservation district recommendations? _____

IMPLEMENTATION SCHEDULE

PRIOR DATES

Date of Surface Owner notification/consultation, if required. 10/12/2020

Actual Spill or Release date, if known. _____

SITE INVESTIGATION DATES

Date of Initial Actions described in Site Investigation Plan (start date). 02/21/2021

Date of commencement of Site Investigation. 03/03/2021

Date of completion of Site Investigation. _____

REMEDIAL ACTION DATES

Date of commencement of Remediation. 03/03/2021

Date of completion of Remediation. _____

SITE RECLAMATION DATES

Date of commencement of Reclamation. _____

Date of completion of Reclamation. _____

OPERATOR COMMENT

Per landowner request, the initial groundwater assessment and monitoring wells will be installed following harvest operations scheduled to be completed by the third or fourth quarter 2021.

I hereby certify all statements made in this form are to the best of my knowledge true, correct, and complete.

Signed: Karen Olson

Title: Senior Program Manager

Submit Date: 04/26/2021

Email: COGCCSpillRemediation@pdce.com

Based on the information provided herein, this Application for Site Investigation and Remediation Workplan complies with COGCC Rules and applicable orders and is hereby approved.

COGCC Approved: RICK ALLISON

Date: 04/29/2021

Remediation Project Number: 16704

Condition of Approval**COA Type****Description**

	Operator will make an attempt to sample water well DWR Receipt 9509935 Permit 8226 -R . Submit a Form 27 Supplemental Report regarding efforts to obtain a sample from this water well within 90 days (July 28, 2021).
1 COA	

Attachment Check List

Upon approval, the approved Form 27 and all listed attachments will be indexed to the Remediation Project file. Only the approved Form 27 will also be indexed to the related Facilities.

Att Doc Num**Name**

402649186	FORM 27-SUPPLEMENTAL-SUBMITTED
402649380	PHOTO DOCUMENTATION
402649382	SOIL SAMPLE LOCATION MAP
402649384	SITE INVESTIGATION PLAN
402649580	SOIL SAMPLE LOCATION MAP
402656977	ANALYTICAL RESULTS

Total Attach: 6 Files

General Comments**User Group****Comment****Comment Date**

		Stamp Upon Approval
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Total: 0 comment(s)