

State of Colorado  
Oil and Gas Conservation Commission

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Report taken by:  
Taylor Robinson

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.

Closure request is not available for an Initial Site Investigation and Remediation Workplan.

OPERATOR INFORMATION

Name of Operator: <u>PDC ENERGY INC</u>	Operator No: <u>69175</u>	<b>Phone Numbers</b> Phone: <u>(303) 860-5800</u> Mobile: <u>( )</u>
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>taspillremediationcontractor@pdce.com</u>		

PROJECT, PURPOSE & SITE INFORMATION

PROJECT INFORMATION

Remediation Project #: 18828 Initial Form 27 Document #: 402706349

PURPOSE INFORMATION

- Rule 913.c.(1): Pit or Cuttings Trench closure.
- Rule 913.c.(2): Buried or partially buried vessel closure, which will be by removal.
- Rule 913.c.(3): Remediation of Spill and Releases pursuant to Rule 912.
- Rule 913.c.(4): Land treatment of Oily Waste pursuant to Rule 905.e.
- Rule 913.c.(5): Closure of Centralized E&P Waste Management Facilities pursuant to Rule 907.h.
- Rule 913.c.(6): Remediation of impacted Groundwater pursuant to Rule 915.e.(3).D, and the contaminant concentrations in Table 915-1.
- Rule 913.c.(7): Investigation and remediation of natural gas in soil or Groundwater.
- Rule 913.c.(8): When requested by the Director due to any potential risk to soil, Groundwater, or surface water.
- Rule 913.c.(9): Decommissioning of Oil and Gas Facilities.
- Rule 913.g: Changes of Operator.
- Rule 915.b: Request to leave elevated inorganics in situ.
- Other: Tank Battery Closure

SITE INFORMATION

No Multiple Facilities

Facility Type: <u>LOCATION</u>	Facility ID: <u>328962</u>	API #: _____	County Name: <u>WELD</u>
Facility Name: <u>HSR-GREENBERG-64N66W 23NWNW</u>		Latitude: <u>40.302760</u>	Longitude: <u>-104.751180</u>
		** correct Lat/Long if needed: Latitude: <u>40.302108</u>	Longitude: <u>-104.751228</u>
QtrQtr: <u>NWNW</u>	Sec: <u>23</u>	Twps: <u>4N</u>	Range: <u>66W</u> Meridian: <u>6</u> Sensitive Area? <u>Yes</u>

SITE CONDITIONS

General soil type - USCS Classifications SM Most Sensitive Adjacent Land Use Industrial  
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? Yes

**Other Potential Receptors within 1/4 mile**

Nearest Well: Commercial - 811 feet NW, Surface Water: Freshwater Pond - 316 feet N, Occupied Buildings: 540 feet SW / 595 SE, Livestock: 1,260 feet NW,  
FWS Wetlands: Freshwater Pond - 316 feet N

Flowline conflict unlikely, but wellhead is ~ 70 feet north of freshwater pond with flowline running away from pond towards tank battery

# 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 Table 5 and Figure 2	Confirmation Groundwater Sampling
Yes	SOILS	Refer to Tables 1-4 and Figures 1-2	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 August 9, 2021, field screening and confirmation soil sampling was conducted in accordance with the COGCC Rule 911 during the decommissioning and closure of the Greenberg Federal 4-23 Tank Battery (Figure 1). Based on initial results, it was determined that a historic release was discovered below the former produced water vessel. During excavation activities, groundwater was encountered at approximately 8 feet below ground surface (bgs). Approximately 4,330 cubic yards (CY) of impacted material were removed and transported to the Buffalo Ridge Landfill for disposal under PDC 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 August 10, 2021, one soil sample (SS01) was collected from the source area at approximately 4 feet bgs and submitted to Summit Scientific Laboratories for analysis of the full COGCC Table 915-1 analyte list. Preliminary analytical results indicate that the COCs include BTEX, 1,2,4-TMB, 1,3,5-TMB, naphthalene (N), TPH, all table 915 PAHs (excluding chrysene & dibenz(a,h)anthracene), and cadmium. Between August 10 and 27, 2021, seventy-one (71) soil samples (SS02-SS61, SS63-SS73) were collected from the sidewalls and base of the excavation at depths ranging from 4 to 19 feet bgs and were submitted for laboratory analysis of the above referenced COCs. In addition, one sample (SS62) was collected at 2.5 feet bgs and submitted for laboratory analysis of cadmium. Analytical results indicated that organic and inorganic compound concentrations were below the applicable COGCC Table 915-1 Protection of Groundwater SSLs in the samples collected from the final excavation extent.

### Proposed Groundwater Sampling

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

On August 11, 2021, one groundwater sample (GW01) was collected from the tank battery excavation and was submitted for laboratory analysis of BTEX, N, 1,2,4-TMB, and 1,3,5-TMB. Analytical results indicated that organic compounds were below the applicable COGCC Table 915-1 Standards. Analytical results for the tank battery are detailed on Table 5. The groundwater sample location is illustrated on Figure 2.

### 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 ):

During initial closure activities conducted on August 9, 2021, soil encountered on site and below production equipment was visually inspected and field screened for volatile organic compound (VOC) concentrations using a photoionization detector (PID). Per the approved proposed soil sampling plan, samples were collected below and/or adjacent to the above ground storage tank (AST) and separator flowline (SEP-FL) and separator dumpline (SEP-DL). Samples were submitted for analysis of BTEX, N, 1,2,4-TMB, 1,3,5-TMB, and TPH. Analytical results indicated that constituents were in compliance with the applicable COGCC Table 915-1 standards in all laboratory sample locations. Soil analytical results are summarized in Tables 1-4. GPS coordinates and field screened VOC concentrations are summarized in Table 5. Field screening and laboratory sample locations are illustrated on Figures 1 and 2.

# SITE INVESTIGATION REPORT

## SAMPLE SUMMARY

### Soil

Number of soil samples collected 76

Number of soil samples exceeding 915-1 2

Was the areal and vertical extent of soil contamination delineated? Yes

Approximate areal extent (square feet) 6607

### NA / ND

-- Highest concentration of TPH (mg/kg) 1296

-- Highest concentration of SAR 0.057  
5

BTEX > 915-1 Yes

Vertical Extent > 915-1 (in feet) 15

### Groundwater

Number of groundwater samples collected 1

Was extent of groundwater contaminated delineated? Yes

Depth to groundwater (below ground surface, in feet) 8

Number of groundwater monitoring wells installed 0

Number of groundwater samples exceeding 915-1 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) 2.2

NA Highest concentration of Methane (mg/l)           

### Surface Water

0 Number of surface water samples collected

           Number of surface water samples exceeding 915-1

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?

On August 26, 2021, three background soil samples (BKG01) were collected at approximately 4 feet bgs, 7 feet bgs, and 15 feet bgs, respectively, from native material topographically up-gradient of the tank battery and submitted for analysis of COGCC Table 915-1 metals. Analytical results indicated that arsenic and selenium were in exceedance of the applicable regulatory standards in native soil.

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

Volume of solid waste (cubic yards) 4330

Volume of liquid waste (barrels) 13695

Is further site investigation required?

On December 10, 2021, twelve (12) groundwater monitoring wells were installed via direct-push drilling methods to confirm the absence of dissolved-phase hydrocarbon impacts within and surrounding the former tank battery excavation extent. Volatile organic compound (VOC) concentrations using a photoionization detector (PID) and lithologic descriptions were recorded for each borehole. Based on elevated PID readings observed in boreholes BH10 and BH12, one sample was collected from the interval exhibiting the highest VOC concentration in each borehole at 15-16 feet bgs, as well as the terminus of soil boring BH12 at 17-18 feet bgs. Due to poor recovery, a sample was not collected from the terminus of borehole BH10. Three (3) soil samples were submitted for laboratory analysis of the COGCC approved contaminants of concern (COCs). Soil analytical results indicated that constituent concentrations were in compliance with the applicable COGCC Table 915-1 regulatory standards in all soil samples collected during monitoring well installation activities.

## 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 August 9 and 27, 2021, approximately 4,330 CY of impacted material were removed from the tank battery. All impacted material was transported to Buffalo Ridge Landfill for disposal under PDC waste manifests.

Groundwater vacuum recovery activities were conducted concurrent with excavation activities. Approximately 13,695 barrels of groundwater were recovered and transported to the NGL C3 facility for disposal under PDC waste manifests.

### REMEDICATION 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.

Monitored natural attenuation (MNA) was the selected remediation strategy for this location for the fourth quarter 2021 and will remain the selected remediation strategy through the fourth quarter 2022.

### **Soil Remediation Summary**

In Situ

Ex Situ

\_\_\_\_\_ Bioremediation ( or enhanced bioremediation )

Yes \_\_\_\_\_ Excavate and offsite disposal

\_\_\_\_\_ Chemical oxidation

If Yes: Estimated Volume (Cubic Yards) \_\_\_\_\_ 4330

\_\_\_\_\_ Air sparge / Soil vapor extraction

Name of Licensed Disposal Facility or COGCC Facility ID # \_\_\_\_\_

\_\_\_\_\_ Natural Attenuation

\_\_\_\_\_ Excavate and onsite remediation

\_\_\_\_\_ Other \_\_\_\_\_

\_\_\_\_\_ Land Treatment

\_\_\_\_\_ 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.

PDC will conduct quarterly groundwater monitoring at the 12 site monitoring wells (BH01 - BH12) until closure criteria are met. Groundwater samples will be submitted for laboratory analysis of BTEX, naphthalene, 1,2,4-TMB, and 1,3,5-TMB by EPA method 8260B, sulfate anions by EPA Method 300.0, and total dissolved solids (TDS) by Method SM 2540C in accordance with Table 915-1.

Third quarter 2022 groundwater analytical results indicated that the organic compound concentrations and inorganic parameters were in compliance with the applicable COGCC Table 915-1 regulatory standards in all 12 monitoring well locations. Additionally, during the third quarter 2022, chloride anion concentrations were in compliance with the applicable regulatory standard for the fourth consecutive quarter.

# REMEDIATION PROGRESS UPDATE

## PERIODIC REPORTING

### Approved Reporting Schedule:

Quarterly    Semi-Annually    Annually    Other

### Request Alternative Reporting Schedule:

Semi-Annually    Annually    Other

Rule 913.e:

After initial approval of a Form 27, the Operator will provide quarterly update reports in a Supplemental Form 27 to document progress of site investigation and remediation, unless an alternative reporting schedule has been requested by the Operator and approved by the Director. The Director may request a more frequent reporting schedule based on site-specific conditions.

Report Type:    Groundwater Monitoring    Land Treatment Progress Report    O&M Report  
 Other \_\_\_\_\_

## Adequacy of Operator's General Liability Insurance and Financial Assurance

Describe the adequacy of the Operator's general liability insurance and Financial Assurance to fully address the anticipated costs of Remediation, including the estimated remaining cost for this project (below).  
If this information has been provided on a Form 27 within the last 12 months, provide the Document Number of that form.

Financial assurance information was included in the second quarter 2022 Supplemental Form 27 (Document No. 403110424). This section and estimate will be updated on an annual basis until closure criteria are achieved.

Operator anticipates the remaining cost for this project to be: \$ 10000

## 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:

Volume of E&P Waste (solid) in cubic yards 4330

E&P waste (solid) description Hydrocarbon impacted soils

COGCC Disposal Facility ID #, if applicable: \_\_\_\_\_

Non-COGCC Disposal Facility: Buffalo Ridge Landfill

Volume of E&P Waste (liquid) in barrels 13695

E&P waste (liquid) description Hydrocarbon impacted groundwater

COGCC Disposal Facility ID #, if applicable: \_\_\_\_\_

Non-COGCC Disposal Facility: NGL C3

# REMEDIATION COMPLETION REPORT

## REMEDIATION COMPLETION SUMMARY

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

If YES:

- Compliant with Rule 913.h.(1).
- Compliant with Rule 913.h.(2).
- Compliant with Rule 913.h.(3).

Do all soils meet Table 915-1 standards? \_\_\_\_\_

Does the previous reply indicate consideration of background concentrations? \_\_\_\_\_

Does Groundwater meet Table 915-1 standards? \_\_\_\_\_

Is additional groundwater monitoring to be conducted? \_\_\_\_\_

Operator shall comply with the COGCC 1000-Series Reclamation Requirements for all impacted and disturbed areas.

## 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 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 provide the seed mix? \_\_\_\_\_

If YES, does the seed mix comply with local soil conservation district recommendations? \_\_\_\_\_

Did the local soil conservation district provide the seed mix? \_\_\_\_\_

### SITE RECLAMATION DATES

Proposed date of commencement of Reclamation. 08/09/2021

Proposed date of completion of Reclamation. 08/09/2026

## IMPLEMENTATION SCHEDULE

Per Rule 913.d.(2): Any change from the approved implementation schedule will be requested at least 14 days in advance, and the Operator may not make the change without the Director's approval.

### PRIOR DATES

Date of Surface Owner notification/consultation, if required. 05/13/2021

Actual Spill or Release date, or date of discovery. 08/09/2021

### SITE INVESTIGATION DATES

Date of Initial Actions described in Site Investigation Plan (start date). 08/09/2021

Proposed site investigation commencement. 08/09/2021

Proposed completion of site investigation. 12/10/2021

### REMEDIAL ACTION DATES

Proposed start date of Remediation. 08/09/2021

Proposed date of completion of Remediation. 08/09/2026

Per Rule 913.d.(2): Any change from the approved implementation schedule will be requested at least 14 days in advance, and the Operator may not make the change without the Director's approval.

Change from approved implementation schedule per Rule 913.d.(2).

Basis for change in implementation schedule:

\_\_\_\_\_

**OPERATOR COMMENT**

This Supplemental Form 27 was submitted to summarize quarterly groundwater monitoring activities and analytical results collected during the third quarter 2022 at the former Greenberg Federal 4-23 Tank Battery location.

Third quarter 2022 analytical results indicated that organic compound concentrations and inorganic parameters were in compliance with the applicable COGCC Table 915-1 regulatory standards in all 12 monitoring well locations.

Based on these results, organic compound and sulfate anion concentrations were in compliance with the applicable regulatory standards for the third consecutive quarter and TDS concentrations were in compliance for the second consecutive quarter.

Additionally, during the third quarter 2022, four consecutive quarters of chloride concentrations in compliance with the applicable COGCC Table 915-1 regulatory standards were achieved. Consequently, PDC is requesting that chloride anions are removed from the sampling and analysis plan.

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: 10/20/2022

Email: taspillremediationcontractor@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: Taylor Robinson

Date: 02/02/2023

Remediation Project Number: 18828

**COA Type****Description**

	COGCC agrees to the amended sampling and analysis plan to remove chloride anion at this location as it appears to be in compliance with up gradient and cross gradient samples for four consecutive quarters.
	Groundwater monitoring will continue quarterly until four consecutive quarters of results below Table 915-1 standards are achieved. Operator shall submit Quarterly Monitoring Reports including all laboratory analytical reports for all samples collected during the reporting period.
2 COAs	

**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**

403195723	FORM 27-SUPPLEMENTAL-SUBMITTED
403203265	MONITORING REPORT

Total Attach: 2 Files

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

		Stamp Upon Approval
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Total: 0 comment(s)