

State of Colorado
Oil and Gas Conservation Commission

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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> | Phone Numbers |
| Address: <u>1775 SHERMAN STREET - STE 3000</u> | | Phone: <u>(303) 860-5800</u> |
| City: <u>DENVER</u> State: <u>CO</u> Zip: <u>80203</u> | | Mobile: <u>()</u> |
| Contact Person: <u>Karen Olson</u> | Email: <u>COGCCSpillRemediation@pdce.com</u> | |

PROJECT, PURPOSE & SITE INFORMATION

PROJECT INFORMATION

Remediation Project #: 12170 Initial Form 27 Document #: 401856839

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: _____

SITE INFORMATION

No Multiple Facilities

| | | | |
|--|---|-------------------------------|---|
| Facility Type: <u>LOCATION</u> | Facility ID: <u>326785</u> | API #: _____ | County Name: <u>WELD</u> |
| Facility Name: <u>MARK-64N65W 35NWSW</u> | Latitude: <u>40.267007</u> | Longitude: <u>-104.637436</u> | |
| | ** correct Lat/Long if needed: Latitude: <u>40.264670</u> | Longitude: <u>-104.636270</u> | |
| QtrQtr: <u>NWSW</u> | Sec: <u>35</u> | Twp: <u>4N</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 Ranch land

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

Wetlands are located approximately 85 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 type="checkbox"/> Produced Water | <input type="checkbox"/> Workover Fluids | _____ |
| <input checked="" type="checkbox"/> Oil | <input type="checkbox"/> Tank Bottoms | |
| <input 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 | Not defined. | Implementation of proposed site investigation. |
| Yes | SOILS | Refer to Figure 1 and Table 1. | Excavation and confirmation 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 November 7, 2018, historic hydrocarbon impacts were discovered below the produced water vessel during plug and abandonment activities at the Mark 11, 12, 14-35 tank battery. Following the discovery, site investigation and excavation activities were initiated to delineate and remove remaining hydrocarbon impacts. Approximately 3,130 cubic yards of impacted material were removed and transported to the Buffalo Ridge Waste Management Facility in Keenesburg, Colorado 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):

Between November 7 and November 20, 2018, fifty-eight (58) soil samples (SS01 - SS23, GS01 - GS03, and WSS01 - WSS32) were collected from the base and sidewalls of the final extent of the eastern and western excavations at depths ranging between 6 and 10 feet below ground surface (bgs). Soil samples were collected from the unsaturated and saturated intervals in both excavations to confirm that the horizontal and vertical extent of soil impacts were successfully removed. All samples were submitted to Summit Scientific Laboratory in Golden, Colorado for analysis of benzene, toluene, ethylbenzene, total xylenes (BTEX), naphthalene, total petroleum hydrocarbons (TPH) - gasoline range organics (GRO) by USEPA Method 8260B, and TPH - diesel range organics (DRO) by USEPA Method 8015. Analytical results indicated that organic compound concentrations were in compliance with the applicable COGCC Table 910-1 standards in the soil samples collected from the final excavation extents.

Proposed Groundwater Sampling

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

During initial excavation activities, groundwater was encountered at approximately 7 feet below ground surface (bgs). Groundwater recovery activities were conducted concurrent with excavation activities and a total of approximately 5,020 barrels of groundwater were removed from both excavations and transported to a licensed disposal facility. On November 19, 2018, one groundwater sample (GW01) was collected from the eastern excavation and submitted for laboratory analysis of BTEX by USEPA Method 8260B. Analytical results indicated that the benzene concentration was above the applicable COGCC Table 910-1 groundwater standard. On November 27, 2018, a second groundwater sample (W-GW01) was collected from the western excavation and submitted for laboratory analysis of BTEX by USEPA Method 8260B. Analytical results indicated that constituent concentrations were below applicable regulatory standards.

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):

Nine (9) monitoring wells will be installed via direct-push drilling methods to delineate the lateral extent of the dissolved-phase hydrocarbon impacts on site. Proposed monitoring well locations are illustrated on Figure 2.

SITE INVESTIGATION REPORT

SAMPLE SUMMARY

Soil

Number of soil samples collected 58
Number of soil samples exceeding 915-1 3
Was the areal and vertical extent of soil contamination delineated? Yes
Approximate areal extent (square feet) 13790

NA / ND

-- Highest concentration of TPH (mg/kg) 3500
NA Highest concentration of SAR _____
BTEX > 915-1 Yes
Vertical Extent > 915-1 (in feet) 10

Groundwater

Number of groundwater samples collected 2
Was extent of groundwater contaminated delineated? No
Depth to groundwater (below ground surface, in feet) 7
Number of groundwater monitoring wells installed 0
Number of groundwater samples exceeding 915-1 1

-- Highest concentration of Benzene (µg/l) 21
-- Highest concentration of Toluene (µg/l) 4.5
-- Highest concentration of Ethylbenzene (µg/l) 3.6
-- Highest concentration of Xylene (µg/l) 710
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?

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

Volume of solid waste (cubic yards) 3130 Volume of liquid waste (barrels) 5020

Is further site investigation required?

Nine (9) temporary monitoring wells will be installed to delineate the lateral extent of dissolved-phase hydrocarbon impacts. Proposed monitoring well locations are illustrated on Figure 2.

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 November 7 and November 20, 2018, approximately 3,130 cubic yards of petroleum hydrocarbon impacted material were excavated and transported to the Buffalo Ridge Landfill in Keenesburg, Colorado for disposal under PDC waste manifests. As previously described, confirmation soil samples collected from the final extent of both excavations indicated that unsaturated and saturated impacted material were successfully removed by excavation 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.

Monitored natural attenuation (MNA) was selected as the remediation strategy for this site during the first quarter 2019 and continued through fourth quarter 2019. Due to persisting benzene concentrations, one air sparge (AS) and enhanced fluid recovery (EFR) event was conducted in November 2019. On February 20, 2020, six remediation wells (RW01 – RW06) were installed within the former source area to assist in remedial efforts and address remaining dissolved-phase hydrocarbon impacts. EFR/AS was the selected remediation strategy for this location between April 2020 and second quarter 2021. Based on the second quarter analytical results, PDC is requesting to initiate MNA as the selected remediation strategy for the fourth quarter 2021.

Soil Remediation Summary

In Situ

Ex Situ

_____ Bioremediation (or enhanced bioremediation)

Yes _____ Excavate and offsite disposal

_____ Chemical oxidation

_____ If Yes: Estimated Volume (Cubic Yards) _____ 3130

_____ 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

No _____ 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.

Groundwater monitoring will continue on a quarterly basis at the nine site monitoring wells (BH01 - BH09). Groundwater samples will be submitted for laboratory analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX), naphthalene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene by EPA Method 8260B in accordance with Table 915-1. In addition, site-specific inorganic parameters, including total dissolved solids (TDS), chloride, and sulfate, were evaluated at the source, up-gradient, and down-gradient monitoring wells during the second quarter 2021. Analytical results indicated that inorganic parameters are within 1.25x of the background sample collected from the up-gradient monitoring well BH06.

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 _____

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 3130

E&P waste (solid) description E&P contaminated soil.

COGCC Disposal Facility ID #, if applicable: _____

Non-COGCC Disposal Facility: Buffalo Ridge Waste Mangement Facility

Volume of E&P Waste (liquid) in barrels 5020

E&P waste (liquid) description Petroleum hydrocarbon impacted groundwater.

COGCC Disposal Facility ID #, if applicable: _____

Non-COGCC Disposal Facility: NGL Energy

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.

The excavation areas were backfilled, compacted, and re-graded to match pre-existing conditions. The produced water vessel and associated production infrastructure were decommissioned following excavation activities. The former facility 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. _____

Proposed date of completion of Reclamation. _____

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. 11/07/2018

Actual Spill or Release date, or date of discovery. _____

SITE INVESTIGATION DATES

Date of Initial Actions described in Site Investigation Plan (start date). 11/07/2018

Proposed site investigation commencement. 11/07/2018

Proposed completion of site investigation. 02/11/2019

REMEDIAL ACTION DATES

Proposed start date of Remediation. 11/07/2018

Proposed date of completion of Remediation. _____

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:
