

State of Colorado
Oil and Gas Conservation Commission

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Document Number:
401718708
Receive Date:
08/03/2018

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> | | 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>Karen.Olson@pdce.com</u> | |

PROJECT, PURPOSE & SITE INFORMATION

PROJECT INFORMATION
Remediation Project #: 11252 Initial Form 27 Document #: 401600443

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 checked="" 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 type="checkbox"/> Other _____ |

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

| | | | |
|--|---|-------------------------------|---|
| Facility Type: <u>SPILL OR RELEASE</u> | Facility ID: <u>454307</u> | API #: _____ | County Name: <u>WELD</u> |
| Facility Name: <u>Sitzman 1U</u> | Latitude: <u>40.369520</u> | Longitude: <u>-104.657630</u> | |
| | ** correct Lat/Long if needed: Latitude: <u>40.369520</u> | Longitude: <u>-104.657630</u> | |
| QtrQtr: <u>NWSW</u> | Sec: <u>27</u> | Twp: <u>5N</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 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? Yes

Other Potential Receptors within 1/4 mile

An occupied residence is located approximately 270 northwest of the location. There are two (2) water wells permitted by the Colorado DWR within 250 feet of the location (Permit # 276778 and Permit # 202929-A). Both wells are permitted for domestic use and are currently owned and operated by one landowner. On May 15 and May 22, 2018, residential water well sampling was conducted at both wells to confirm water quality. Analytical results indicated BTEX concentrations were below laboratory detection limits in both water samples. Sampling activities and analytical results are summarized in the attached letter report.

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 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 |
|--------------|----------------|-------------------------------------|-----------------------------------|
| UNDETERMINED | GROUNDWATER | Undetermined. | Completion of Site Investigation. |
| Yes | SOILS | Vertical defined; lateral undefined | Refer to Figure 1. |

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 9, 2018, historic petroleum hydrocarbon impacts were discovered below the produced water vessel during plug and abandonment activities at the Sitzman 1U tank battery. Excavation activities were subsequently initiated below the former production tanks. Between March 9 and March 13, 2018, approximately 340 cubic yards of impacted material were removed and transported to the North Weld Waste Management Facility in Ault, Colorado for disposal under PDC waste manifests. Four (4) soil samples (SS01 - SS04) were collected during the initial site investigation at depths ranging between 10 and 18 feet below ground surface (bgs) and submitted to Summit Scientific Laboratories (Summit) for analysis of benzene, toluene, ethylbenzene, total xylenes (BTEX), naphthalene, total petroleum hydrocarbons (TPH) – gasoline range organics (GRO) by United States Environmental Protection Agency (USEPA) Method 8260, and TPH – diesel range organics (DRO) by USEPA Method 8015. Analytical results indicated TPH concentrations were above the applicable COGCC Table 910-1 soil standards in soil samples SS01, SS03, and SS04. The excavation extent and soil sample locations are illustrated on Figure 1. Soil analytical data is summarized in Table 1 and laboratory reports are provided in Attachment A.

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):

Proposed Groundwater Sampling

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

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):

The lateral extent of remaining hydrocarbon impacts in soil has not been defined. Investigation and delineation activities will be conducted concurrent with the proposed remediation plan.

SITE INVESTIGATION REPORT

SAMPLE SUMMARY

Soil

Number of soil samples collected 4
Number of soil samples exceeding 910-1 3
Was the areal and vertical extent of soil contamination delineated? No
Approximate areal extent (square feet) 3000

NA / ND

-- Highest concentration of TPH (mg/kg) 6600
NA Highest concentration of SAR
BTEX > 910-1 No
Vertical Extent > 910-1 (in feet) 18

Groundwater

Number of groundwater samples collected 0
Was extent of groundwater contaminated delineated? No
Depth to groundwater (below ground surface, in feet)
Number of groundwater monitoring wells installed
Number of groundwater samples exceeding 910-1

Highest concentration of Benzene (µg/l)
Highest concentration of Toluene (µg/l)
Highest concentration of Ethylbenzene (µg/l)
Highest concentration of Xylene (µg/l)
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?

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

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

Is further site investigation required?

Delineation of remaining petroleum hydrocarbon impacts in soil is required and will be conducted during remediation activities. In addition, groundwater conditions on site must be assessed.

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 9 and March 13, 2018, approximately 340 cubic yards (CY) of impacted material were removed and transported to the North Weld Waste Management Facility in Ault, Colorado for disposal under PDC waste manifests. Per the approved Remediation Workplan, between May 7 and July 23, 2018, approximately 4,456 CY of impacted material were excavated and treated on site using ex-situ chemical oxidation.

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.

Approximately 4,456 CY of impacted material were treated on site using ex-situ chemical oxidation. Delineation of the lateral and vertical extents of petroleum hydrocarbon impacts was guided in the field by measuring volatile organic compound (VOC) concentrations using a photoionization detector (PID). Groundwater was encountered in the excavation area at approximately 15 feet below ground surface (bgs), approximately 5 feet shallower than was observed during March 2018 activities. Impacted soils were removed from 15 feet bgs to 20-25 feet bgs. A total of 20 discrete soil samples (SS05 – SS24) were collected from the sidewalls of the excavation extent at approximately 15 feet bgs (Figure 2). Soil samples were submitted to Summit Scientific Laboratories (Summit) 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 below COGCC Table 910-1 standards in all soil samples collected from the final excavation extent (Table 1). Three-point composite soil samples were collected for every 100 cubic yards of soil treated with hydrogen peroxide to confirm hydrocarbon concentrations were reduced below COGCC Table 910-1 soil standards and material could be used for backfilling. Confirmation soil samples were designated with a CS- sample identification. A total of 44 confirmation soil samples (CS01 – CS44) were collected from the treated material and submitted to Summit for laboratory analysis. Analytical results indicated that organic compound concentrations were below COGCC Table 910-1 standards in all confirmation soil samples (Table 2). Concurrent with impacted source removal and treatment, groundwater vacuum recovery events were conducted. A total of 2,800 barrels of groundwater were removed from the excavation.

Soil Remediation Summary

In Situ

_____ Bioremediation (or enhanced bioremediation)
_____ Chemical oxidation
_____ Air sparge / Soil vapor extraction
_____ Natural Attenuation
_____ Other _____

Ex Situ

Yes _____ Excavate and offsite disposal
If Yes: Estimated Volume (Cubic Yards) _____ 340
Name of Licensed Disposal Facility or COGCC Facility ID # _____
Yes _____ Excavate and onsite remediation
No _____ Land Treatment
No _____ Bioremediation (or enhanced bioremediation)
Yes _____ Chemical oxidation
No _____ Other _____

Groundwater Remediation Summary

- _____ Bioremediation (or enhanced bioremediation)
- _____ Chemical oxidation
- _____ Air sparge / Soil vapor extraction
- _____ 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.

On July 23, 2018, a groundwater sample (GW01) was collected from the excavation area and submitted to Summit for laboratory analysis of BTEX (Figure 2). Analytical results indicated BTEX concentrations were below laboratory detection limits (Table 3). Following backfilling activities, temporary monitoring wells will be installed within and surrounding the former excavation area to confirm remedial activities successfully addressed remaining hydrocarbon impacts in soil and groundwater. Confirmation groundwater samples will be collected from the temporary wells and submitted for laboratory analysis of BTEX. A figure illustrating the proposed locations will be submitted under separate cover.

REMEDIATION PROGRESS UPDATE

PERIODIC REPORTING

Frequency: Quarterly Semi-Annually Annually Other Remediation Summary
Report Type: Groundwater Monitoring Land Treatment Progress Report O&M Report
 Other Remediation 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:

340 cubic yards (CY) of impacted soil were removed from location for disposal. Additionally, 4,456 CY were treated on site using ex-situ chemical oxidation. This material was sampled to confirm hydrocarbon concentrations were below COGCC standards, then subsequently used for backfilling.

Volume of E&P Waste (solid) in cubic yards 340

E&P waste (solid) description E&P exempt, non-hazardous waste

COGCC Disposal Facility ID #, if applicable:

Non-COGCC Disposal Facility: North Weld Waste Management Facility

Volume of E&P Waste (liquid) in barrels 2800

E&P waste (liquid) description Hydrocarbon impacted groundwater

COGCC Disposal Facility ID #, if applicable:

Non-COGCC Disposal Facility: Licensed 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.

The excavation area will be backfilled and re-graded to match pre-existing conditions. The tank battery will not be reconstructed and the location will be reclaimed in accordance with COGCC Rule 1004.

Is the described reclamation complete? No

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. _____

Actual Spill or Release date, if known. _____

SITE INVESTIGATION DATES

Date of Initial Actions described in Site Investigation Plan (start date). 03/09/2018

Date of commencement of Site Investigation. 03/09/2018

Date of completion of Site Investigation. _____

REMEDIAL ACTION DATES

Date of commencement of Remediation. 03/09/2018

Date of completion of Remediation. _____

SITE RECLAMATION DATES

Date of commencement of Reclamation. _____

Date of completion of Reclamation. _____

OPERATOR COMMENT

| |
|--|
| |
|--|

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 EHS Manager

Submit Date: 08/03/2018

Email: Karen.Olson@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: 08/20/2018

Remediation Project Number: 11252

COA Type**Description**

| | |
|--|--|
| | <p>COGCC Field Inspection Report #679701014 required the Operator to submit a Form 27 Supplemental Site Investigation and Remediation Workplan that included a figure with proposed monitoring well locations and a schedule for monitoring well installation. This Form 27 lacks the requested information. Therefore, the following Conditions of Approval apply:</p> <ol style="list-style-type: none"> 1. Operator shall install monitoring wells to document post-remediation groundwater conditions at this location. The monitoring well network shall include a monitoring well installed in the source area, between the excavation and the shallow domestic water well, and immediately downgradient of the excavation. In addition, a sufficient number of monitoring wells shall be installed to document the groundwater flow direction and to provide point of compliance in the upgradient and cross gradient directions. 2. Operator shall log and field screen all monitoring well boreholes and collect a soil sample from the interval exhibiting the highest degree of impact. Soil samples shall be analyzed for BTEX, TPH-GRO and TPH-DRO. 3. The monitoring wells shall be installed and the results for the initial groundwater sampling event reported using a Form 27 Supplemental Report within 60 days of the approval of this Form 27 (by October 19, 2018). Provide boring logs and well construction diagrams for the monitoring wells, soil sample and groundwater sample analytical results in the report. 4. Groundwater monitoring must be conducted on a quarterly schedule and must continue until four consecutive quarters of groundwater monitoring demonstrate compliance with Table 910-1. 5. Notify COGCC Environmental Protection Specialist Rick Allison 72 hours prior to the monitoring well installation. |
|--|--|

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 |
|--------------------|--------------------------------|
| 401718708 | FORM 27-SUPPLEMENTAL-SUBMITTED |
| 401718778 | ANALYTICAL RESULTS |
| 401718785 | SITE MAP |
| 401722295 | SOIL SAMPLE LOCATION MAP |
| 401722314 | OTHER |

Total Attach: 5 Files

General Comments

| User Group | Comment | Comment Date |
|-------------------|----------------|---------------------|
| | | Stamp Upon Approval |

Total: 0 comment(s)