

State of Colorado
Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203 (303) 894-2100 Fax 894-2109



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SITE INVESTIGATION AND REMEDIATION WORKPLAN

This form shall be submitted to the Director for approval prior to the initiation of site investigation and remediation activities. Form 27 is intended to be used whenever possible. Additional documentation will be required when large volumes of soil and groundwater have been impacted or involve large facilities with multiple source areas. See Rule 910. Attach as many pages as needed to fully describe the proposed work.

CAUSE OF CONDITION BEING INVESTIGATED AND REMEDIATED

Spill or Release Plug & Abandon Central Facility Closure Site/Facility Closure Other (describe): Vault Closure

OGCC Employee:

Spill Complaint
 Inspection NOAV

Tracking No:

GENERAL INFORMATION

OGCC Operator Number: 69175	Contact Name and Telephone
Name of Operator: <u>PDC Energy, Inc.</u>	Name: <u>Brandon Bruns</u>
Address: <u>1775 Sherman Street, Suite 3000</u>	No: <u>(303) 831-3971</u>
City: <u>Denver</u> State: <u>CO</u> P: <u>80203</u>	Fax: <u>(303) 860-5838</u>
API/Facility No: <u>05-123-10892</u>	County: <u>Weld</u>
Facility Name: <u>Steinwald #1</u>	Facility Number: <u>319218</u>
Well Name: <u>Steinwald</u>	Well Number: <u>#1</u>
Location (Otr/Otr, Sec, Twp, Rng, Meridian): <u>NWNW, S3, T1N, R64W, M6</u>	Latitude: <u>40.084936</u> Longitude: <u>-104.543915</u>

TECHNICAL CONDITIONS

Type of Waste Causing Impact (crude oil, condensate, produced water, etc.): Produced Water

Site Conditions: Is location within a sensitive area (according to Rule 901e)? Y N If yes, attach evaluation.

Adjacent land use (cultivated, irrigated, dry land farming, industrial, residential, etc.): Cropland

Soil type, if not previously identified on Form 2A or Federal Surface Use Plan: Weld loam, 1 to 3 percent slopes

Potential receptors (water wells within 1/4 mi, surface waters, etc.): Residential buildings are located 785' north of the tank battery location.

The closest water well is located 815' north of the location and the nearest surface water is located 2,430' to the west.

Description of Impact (if previously provided, refer to that form or document):

Impacted Media (check):	Extent of Impact:	How Determined:
<input checked="" type="checkbox"/> Soils	<u>Refer to Figure 2 and Tables 1 and 2</u>	<u>Excavation and soil sampling</u>
<input type="checkbox"/> Vegetation		
<input checked="" type="checkbox"/> Groundwater	<u>Refer to Figure 3 and Table 3</u>	<u>Drilling and groundwater sampling</u>
<input type="checkbox"/> Surface water		

REMEDIATION WORKPLAN

Describe initial action taken (if previously provided, refer to that form or document):

Excavation activities commenced on April 22, 2014 following the discovery of a historic release during plug and abandon activities, as described in the Form 19 submitted on May 28, 2014. The COGCC issued Spill Tracking # 400615494 to the location.

Describe how source is to be removed:

A historic release was discovered below the partially buried produced water vessel during the plugging and abandoning of the Steinwald #1 tank battery. On April 22, 2014, sub-surface site assessment and excavation activities subsequently commenced below the former vessel location. The vertical and lateral extent of the excavation was determined in the field using a photoionization detector (PID) to measure volatile organic compounds (VOCs) in soil. Between April 22, 2014 - May 21, 2014, approximately 9,530 cubic yards [CY] of impacted material were excavated and transported to the Buffalo Ridge Landfill in Keenesburg, Colorado for disposal under PDC waste manifests. Following initial excavation efforts, the remedial strategy for the site was modified to chemical oxidant (chemox) soil treatment. This remediation method was selected due to the close proximity of private residences and the anticipated volume of remaining impacted material. Between May 22, 2014 - August 26, 2014, approximately 32,900 CY of impacted material were chemically treated using hydrogen peroxide. One composite soil sample was collected per 100 CY of treated material to confirm hydrocarbon concentrations were reduced below applicable COGCC Table 910-1 standards and could be used for subsequent backfilling. Clean backfill was also brought in to bring the excavation up to existing grade. A total of 354 confirmation samples (CS01-CS15, WCS01-WCS14, SCS01-SCS300, NWC01-NWSC12) were collected and submitted to Summit Scientific Laboratories (Summit) in Golden, Colorado for laboratory analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX), naphthalene, and total petroleum hydrocarbons (TPH) - gasoline range organics (GRO) by USEPA Method 8260B. Samples were also analyzed for TPH - diesel range organics (DRO) by USEPA Method 8015. Treated material that exhibited elevated constituent concentrations above regulatory standards was further treated and subsequently re-sampled (sample designation - XX@XXR). Final analytical results indicated constituent concentrations were below COGCC Table 910-1 regulatory standards for the 32,900 CY of treated material used for backfill. Soil analytical data for samples collected from treated material are summarized in Table 2.

Between April 22, 2014 - August 26, 2014, 213 soil samples (SS01 through SS213) were collected from the sidewalls and base of the excavation area at depths varying between 9 feet and 44 feet below ground surface (bgs). Soil samples were submitted to Summit for laboratory analysis of BTEX, naphthalene, TPH-GRO and TPH-DRO. Analytical results indicated constituent concentrations were below COGCC Table 910-1 soil standards in the soil samples collected from the final excavation extent, with the exception of four samples (SS14 and SS135 - SS137) located adjacent to the buried Kerr-McGee (KMG) gathering line. Groundwater was not encountered during excavation and remedial activities. The final excavation extent and soil sample locations are illustrated on Figure 2. Soil analytical data for samples collected from the excavation area are summarized in Table 1. The laboratory analytical reports are included as Attachment A. The tank battery was abandoned following remedial activities and the site was reclaimed for agricultural use.

Describe how remediation of existing impacts is to be accomplished, including removal and disposal at an injection well or licensed facility, land treatment on site, removal of impacted groundwater, insitu bioremediation, burning of oily vegetation, etc.:

Petroleum hydrocarbon impacts in soil were successfully mitigated by excavation and chemical oxidant treatment activities, with the exception of the area immediately adjacent to the buried KMG gathering line. Following one year of natural attenuation, confirmation soil sampling will be collected in the four sample locations which previously exhibited constituent concentrations above regulatory standards. Given the volume of impacted soil treated on site and fractured sub-surface lithology, a final site assessment was completed to ensure the absence of hydrocarbon impacts below the base of the excavation area. Between October 6 - October 7, 2014, four boreholes (BH01 - BH04) were installed using hollow stem drilling techniques to a depth of 75 feet bgs, as illustrated on Figure 3. Groundwater was encountered in the boreholes at approximately 70 feet bgs. Consequently, temporary monitoring wells were installed at the four borehole locations and developed using EPA designated methods. On October 20, 2014, groundwater sampling was completed at the four monitoring well locations and samples were submitted to Summit for analysis of BTEX by USEPA Method 8260B. Analytical results indicated benzene concentrations were in exceedance of COGCC Table 910-1 groundwater standards at one monitoring well location (BH04). On October 23, 2014, BH04 was resampled and analytical results indicated benzene concentrations remained in exceedance of regulatory standards. Consequently, on November 11, 2014, an additional monitoring well (BH05) was installed south of BH04 to achieve point of compliance. On November 26, 2014, the new monitoring well was sampled and analytical results indicated BTEX concentrations were below laboratory detection limits. Groundwater analytical results are summarized on Table 3. Quarterly groundwater monitoring will be completed until four quarters of compliant groundwater data are achieved. PDC will evaluate remedial options to address residual dissolved aqueous phase hydrocarbon impacts should concentrations persist above regulatory standards.



REMEDIATION WORKPLAN (CONT.)

OGCC Employees: _____

Tracking Number: _____
 Name of Operator: PDC Energy, Inc.
 OGCC Operator No: 69175
 Received Date: _____
 Well Name & No: Steinwald #1
 Facility Name & No.: Steinwald #1

If groundwater has been impacted, describe proposed monitoring plan (# of wells or sample points, sampling schedule, analytical methods, etc.):
 Between October 10 - November 26, 2014, groundwater monitoring was completed at the five temporary well locations (BH01 - BH05). Groundwater samples were submitted to Summit Scientific Laboratories in Golden, Colorado for analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX) by USEPA Method 8260B. Analytical results indicate benzene concentrations are in exceedance of CGOCC Table 910-1 regulatory standards in BH04. BTEX concentrations are below regulatory standards in the remaining four monitoring well locations. Groundwater analytical results are summarized in Table 3. Quarterly groundwater monitoring will be completed until four consecutive quarters of BTEX concentrations are in compliance with regulatory standards.

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. Use additional sheet for description if required.
 The excavation was backfilled and re-contoured to match pre-existing conditions. The tank battery and wellhead were plugged and abandoned following excavation activities and the area was reclaimed for agricultural use.

Attach samples and analytical results taken to verify remediation of impacts. Show locations of samples on an onsite schematic or drawing.
 Is further site investigation required? Y N If yes, describe:
 Confirmation drilling and soil sampling will be completed adjacent to the Kerr-McGee gathering line following one year of natural attenuation to assess remaining hydrocarbon impacts in soil. Soil analytical data is summarized in Tables 1 and 2. Based on the groundwater analytical results described herein, the extent of dissolved phase hydrocarbon impacts has been delineated at this site and point of compliance (POC) has been established. Groundwater monitoring will continue on a quarterly basis until four consecutive quarters of monitoring data indicate BTEX concentrations are in compliance with the applicable COGCC Table 910-1 groundwater standards. Groundwater analytical data is summarized in Table 3. The laboratory analytical reports are included as Attachment A.

Final disposition of E&P waste (landtreated and disposed onsite, name of licensed disposal facility, recycling, reuse, etc.):
 Impacted material was transported of at the Buffalo Ridge Landfill in Keenesburg, Colorado under PDC waste manifests.

IMPLEMENTATION SCHEDULE

Date Site Investigation Began: <u>4/22/2014</u>	Date Site Investigation Completed: <u>8/26/2014</u>	Remediation Plan Submitted: _____
Remediation Start Date: <u>5/22/2014</u>	Anticipated Completion Date: <u>10/1/15</u>	Actual Completion Date: _____

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

Print Name: Brandon Bruns

Signed:  Title: EHS Supervisor Date: 1/12/15

OGCC Approved: _____ Title: EPS Date: 3/13/2015