FORM 27 Rev 3/16

State of Colorado
Oil and Gas Conservation Commission

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

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Report taken by: CHRIS CANFIELD

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 INFORMATON

Name of Operator: KERR MCGEE OIL & GAS ONSHORE LP Operator No: 47120
Address: P O BOX 173779
City: DENVER State: CO Zip: 80217-3779
Contact Person: Erik Mickelson Email: erik.mickelson@anadarko.com

Phone Numbers
Phone: (720) 929-4306
Mobile: ( )

PROJECT, PURPOSE & SITE INFORMATION

PROJECT INFORMATION

Remediation Project #: 9617 Initial Form 27 Document #: 2526106

PURPOSE INFORMATION

- [ ] 901.e. Sensitive Area Determination
- [ ] 909.c.(1), Rule 905: Pit or PW vessel closure
- [ ] 909.c.(2), Rule 906: Spill/Release Remediation
- [ ] 909.c.(3), Rule 907.e.: Land treatment of oily waste
- [ ] 909.c.(4), Rule 908.g.: Centralized E&P Waste Management Facility closure
- [ ] 909.c.(5), Rule 910.b.(4): Remediation of impacted ground water
- [ ] Rule 909.e.(2)A.: Notice completion of remediation in accordance with Rule 909.b.
- [x] Rule 909.e.(2)B.: Closure of remediation project
- [ ] Rule 906.c.: Director request
- [ ] Other

SITE INFORMATION

N Multiple Facilites (in accordance with Rule 909.c.)

Facility Type: LOCATION Facility ID: 320310 API #: County Name: ADAMS
Facility Name: GREEN-61S68W 14SWNE Latitude: 39.966425 Longitude: -104.966769
** correct Lat/Long if needed: Latitude: 39.966631 Longitude: -104.966438
QtrQtr: SWNE Sec: 14 Twp: 1S Range: 68W Meridian: 6 Sensitive Area? Yes

SITE CONDITIONS

General soil type - USCS Classifications: SC
Most Sensitive Adjacent Land Use: Wetlands - City of Thornton
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

Two water wells (one monitoring well approximately 400 feet NE and one domestic well approximately 980 feet SSE), surface water, and wetlands.

SITE INVESTIGATION PLAN

TYPE OF WASTE:

- [x] **E&P Waste**
  - [ ] Produced Water
  - [x] Oil
  - [ ] Condensate
  - [ ] Drilling Fluids
  - [ ] Drill Cuttings
- [ ] **Other E&P Waste**
  - [ ] Workover Fluids
  - [ ] Tank Bottoms
  - [ ] Pigging Waste
  - [ ] Rig Wash
  - [ ] Spent Filters
  - [ ] Pit Bottoms
  - [ ] Other (as described by EPA) _____
- [ ] **Non-E&P Waste** _____

DESCRIPTION OF IMPACT

Impacted?	Impacted Media	Extent of Impact	How Determined
Yes	GROUNDWATER	See attached data	Sampling GW within excavation
Yes	SOILS	41' (N-S) x 32' (W-E) x 6' BGS	Sampling soils during excavation

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 April 5, 2016, a release was discovered at the Green 61S68W/14SWNE facility (Location ID 320310). An estimated 45 barrels of crude oil was released into the unlined secondary containment berm, from a hole located just above the base of the oil tank. Groundwater was encountered in the excavation at approximately 5 feet below ground surface (bgs). On April 6, soil excavation and groundwater extraction activities began, after emergency utility locates cleared. On April 8, an Initial Form 19 was submitted to the COGCC and on April 14, a Supplemental Form 19 was submitted to the COGCC. The COGCC issued a Spill Tracking number 445453 for this release. During excavation activities, apparent potential remnant staining from a former release was observed. COGCC Remediation Project #485, which was assigned to the former release that occurred in 2000, was closed by the COGCC in 2003. A copy of COGCC's closure letter for the 2000 release is attached. A regional topographic facility location map is provided as Figure 1.

PROPOSED SAMPLING PLAN

Proposed Soil Sampling

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

Soil grab samples were collected from each of the four walls of the excavation's final lateral extent. Soil samples were submitted to Origins Laboratory in Denver, Colorado, for analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), total petroleum hydrocarbons (TPH) - gasoline range organics (GRO) by USEPA Method 8260C, TPH - diesel range organics and residual range organics (DRO and RRO, respectively) by USEPA Method 8015, electrical conductivity (EC), and pH. The general facility layout, excavation location, and laboratory results are shown in Figure 3. Analytical results are summarized in Tables 1 - 3, and laboratory reports are provided.

Proposed Groundwater Sampling

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

During excavation activities, groundwater grab samples were collected from the excavation. Groundwater samples were submitted to Origins Laboratory for analysis of BTEX by USEPA 8260C. A subsurface assessment will be conducted at the facility, to determine if shallow groundwater has been impacted outside of the excvation area. Proposed monitoring well locations are shown in Figure 4. Between May 5 and May 20, 2016, six groundwater monitoring wells were installed. Groundwater monitoring was conducted on a quarterly basis and groundwater samples were submitted for laboratory analysis.

Proposed Surface Water Sampling

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

Four surface water samples were collected from the adjacent water feature, Big Dry Creek (Figure 2).

Additional Investigative Actions

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

SITE INVESTIGATION REPORT

SAMPLE SUMMARY

Soil

Number of soil samples collected: 4

Number of soil samples exceeeding 910-1: 0

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

Approximate areal extent (square feet): 1300

NA / ND

ND — Highest concentration of TPH (mg/kg):

NA — Highest concentration of SAR:

BTEX > 910-1: No

Vertical Extent > 910-1 (in feet): 0

Groundwater

Number of groundwater samples collected: 26

Was extent of groundwater contaminated delineated? Yes

Depth to groundwater (below ground surface, in feet): 5`

Number of groundwater monitoring wells installed: 6

Number of groundwater samples exceeding 910-1: 2

-- — Highest concentration of Benzene (µg/l): 774

-- — Highest concentration of Toluene (µg/l): 2770

-- — Highest concentration of Ethylbenzene (µg/l): 136

-- — Highest concentration of Xylene (µg/l): 1670

NA — Highest concentration of Methane (mg/l):

Surface Water

4 Number of surface water samples collected

0 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?

Groundwater monitoring wells will be installed to delineate the dissolved-phase hydrocarbon plume. Quarterly groundwater monitoring will be conducted to determine the extent and magnitude of dissolved-phase hydrocarbon impacts. The need for future remediation activities will be based on the results from the groundwater assessment 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.

In total, approximately 360 cubic yards of impacted material was excavated and transported to Front Range Landfill in Erie, Colorado, for disposal. The excavation was expanded, as guided in the field by volatile organic carbon screening equipment. Soils were excavated into the phreatic zone to remove potential hydrocarbon impacts that may have been present below the current groundwater table. Soil samples (North 1@5', West1@5', South1@5' and East1@5') were collected from the sidewalls at the excavation's final lateral extent. Soil samples were submitted to Origins Laboratory in Denver, Colorado, for analysis of BTEX, TPH-GRO by USEPA Method 8260C, TPH-DRO and RRO by USEPA Method 8015, EC and pH. Laboratory analytical results indicated that BTEX and TPH concentrations in the soil samples collected from the final lateral excavation extent were below laboratory detection limits and below applicable COGCC Table 910-1 standards. For EC and pH, soil sample laboratory analytical results indicated that concentrations were within COGCC Table 910-1 allowable thresholds. On April 6, four surface water samples (Green 1 through 4) were collected from the adjacent water feature, Big Dry Creek (Figure 2). Surface water samples were submitted to Origins Laboratory in Denver, Colorado, for analysis of BTEX by USEPA Method 8260C. Laboratory analytical results from the surface water samples indicated that BTEX concentrations were below laboratory detection limits and less than COGCC Table 910-1 allowable levels. On April 7, a groundwater sample (Groundwater1@6') was collected and submitted for laboratory analysis of BTEX by USEPA Method 8260C. Analytical results from the sample indicated that benzene and toluene exceeded the applicable COGCC Table 910-1 standards for groundwater at 774 micrograms per liter and 2,770, respectively. To address impacted groundwater, approximately 768 barrels of groundwater were removed from the excavation via vacuum truck and transported to Kerr-McGee's licensed injection facility for disposal. A second groundwater sample (Groundwater2@6') was subsequently collected from the excavation and submitted for laboratory analysis of BTEX. Analytical results from the sample indicated that benzene and toluene exceeded the applicable COGCC Table 910-1 standards for groundwater at 255 and 798, respectively. Groundwater was encountered in the excavation at approximately 5 feet bgs but due to groundwater extraction activities, the groundwater level in the excavation was 6 feet bgs at the time the samples were collected. The general facility layout, excavation location, and laboratory results are shown in Figure 3.Analytical results are summarized in Tables 1 - 3, and laboratory reports are provided.

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.

Between April 6 and April 13, remediation was conducted by excavation of impacted soils, groundwater removal activities, and application of Chemically Oxygenated Granular Activated Carbon (COGAC) to the groundwater within the excavation. Groundwater monitoring wells were installed to identify, and if still present, delineate the dissolved-phase hydrocarbon plume. Based on quarterly groundwater analytical results, as discussed in the Groundwater Monitoring section, no further investigation or remediation is warranted.

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) 360
  - Name of Licensed Disposal Facility or COGCC Facility ID # _____
- ____ Excavate and onsite remediation
  - ____ 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.

BASED ON THE ANALYTICAL RESULTS FROM THE GROUNDWATER SAMPLES, A SUBSURFACE ASSESSMENT WILL BE CONDUCTED AT THE FACILITY, TO DETERMINE IF SHALLOW GROUNDWATER HAS BEEN IMPACTED OUTSIDE OF THE EXCAVATION AREA. IN AN ATTEMPT TO DETERMINE THE EXTENT AND MAGNITUDE OF IMPACTS, A MINIMUM OF FOUR GROUNDWATER MONITORING WELLS WILL BE INSTALLED. GROUNDWATER MONITORING WILL BE CONDUCTED ON A QUARTERLY BASIS. COLLECTED GROUNDWATER SAMPLES WILL BE SUBMITTED FOR LABORATORY ANALYSIS OF BTEX BY USEPA 8260. QUARTERLY GROUNDWATER MONITORING AT THE LOCATION WILL CONTINUE UNTIL BTEX CONCENTRATIONS REMAIN BELOW COGCC TABLE 910-1 GROUNDWATER STANDARDS IN ALL WELLS FOR FOUR CONSECUTIVE QUARTERS. IF NECESSARY, ADDITIONAL MONITORING WELLS WILL BE INSTALLED TO CHARACTERIZE THE EXTENT OF THE HYDROCARBON PLUME. LOCATIONS OF THE PROPOSED MONITORING WELLS ARE SHOWN IN FIGURE 4. Between May 5 and May 20, 2016, six groundwater monitoring wells were installed. One well was installed in the source area (MW01), one well upgradient of the source (MW02), and four wells cross-gradient and downgradient of the source (MW03, 04, 05, and 06). Locations of the monitoring wells are shown in Figure 5. Groundwater monitoring was conducted on a quarterly basis and groundwater samples were submitted to Origins Laboratory for analysis of BTEX by USEPA 8260C. For all quarterly monitoring events, analytical results of the groundwater samples were either not detectable at the laboratory's detection limits or below COGCC Table 910-1 allowable concentrations. Analytical results of the quarterly events are provided as Table 4, and laboratory reports are attached.

REMEDIATION PROGRESS UPDATE

PERIODIC REPORTING

Frequency: ☐ Quarterly ☐ Semi-Annually ☐ Annually ☒ Other Closure of remediation project.

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

☒ Other Closure of remediation project.

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:

N/A

Volume of E&P Waste (solid) in cubic yards 360

E&P waste (solid) description Soil

COGCC Disposal Facility ID #, if applicable:

Non-COGCC Disposal Facility: Front Range Landfill in Erie, Colorado

Volume of E&P Waste (liquid) in barrels 768

E&P waste (liquid) description Shallow groundwater

COGCC Disposal Facility ID #, if applicable:

Non-COGCC Disposal Facility: Kerr-McGee's Aggregate Recycling Facility

REMEDIATION COMPLETION REPORT

REMEDIATION COMPLETION SUMMARY

Is this a Final Closure Request for this Remediation Project? Yes

Do all soils meet Table 910-1 standards? Yes

Does the previous reply indicate consideration of background concentrations? No

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? Yes

Is additional groundwater monitoring to be conducted? No

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.

Kerr-McGee backfilled the excavation with clean sand and soil, and graded the location to match the adjacent topography. The tank battery and associated components remain at the facility location, and are currently operated by Great Western Oil & Gas Company (COGCC Operator #10110).

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. 04/05/2016

Actual Spill or Release date, if known.

SITE INVESTIGATION DATES

Date of Initial Actions described in Site Investigation Plan (start date). 04/05/2016

Date of commencement of Site Investigation. 04/05/2016

Date of completion of Site Investigation. 04/13/2016

REMEDIAL ACTION DATES

Date of commencement of Remediation. 04/06/2016

Date of completion of Remediation. 02/16/2017

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:` Erik Mickelson Title: Senior HSE Representative

Submit Date:` 04/03/2017 Email: erik.mickelson@anadarko.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: CHRIS CANFIELD Date: 04/04/2017

Remediation Project Number: 9617

COA Type	Description

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
401221419	FORM 27-SUPPLEMENTAL-SUBMITTED
401247360	SITE MAP
401247363	SITE MAP
401247366	SOIL SAMPLE LOCATION MAP
401247368	GROUND WATER SAMPLE LOCATION
401247369	GROUND WATER SAMPLE LOCATION
401247371	ANALYTICAL RESULTS
401247372	ANALYTICAL RESULTS
401247374	ANALYTICAL RESULTS
401247386	ANALYTICAL RESULTS
401250096	ANALYTICAL RESULTS

Total Attach: 11 Files

General Comments

User Group	Comment	Comment Date
		Stamp Upon Approval

Total: 0 comment(s)