

State of Colorado  
Oil and Gas Conservation Commission

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Document Number:  
402049591  
Receive Date:  
07/30/2019

Report taken by:  
Candice (Nikki) Graber

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>KERR MCGEE OIL &amp; GAS ONSHORE LP</u>	Operator No: <u>47120</u>	<b>Phone Numbers</b>
Address: <u>P O BOX 173779</u>		Phone: <u>(970) 336-3500</u>
City: <u>DENVER</u>	State: <u>CO</u>	Zip: <u>80217-3779</u>
Contact Person: <u>Phil Hamlin</u>	Email: <u>Phil.Hamlin@anadarko.com</u>	Mobile: <u>( )</u>

PROJECT, PURPOSE & SITE INFORMATION

**PROJECT INFORMATION**  
Remediation Project #: 4348 Initial Form 27 Document #: 1984410

**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 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 type="checkbox"/> 909.c.(2), Rule 906: Spill/Release Remediation	<input checked="" 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>WELL</u>	Facility ID: _____	API #: <u>123-08414</u>	County Name: <u>WELD</u>
Facility Name: <u>ARISTOCRAT ANGUS RANCHES 1</u>	Latitude: <u>40.264612</u>	Longitude: <u>-104.652977</u>	
** correct Lat/Long if needed: Latitude: _____		Longitude: _____	
QtrQtr: <u>SESW</u>	Sec: <u>34</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 CL Most Sensitive Adjacent Land Use Agriculture and Wetlands

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**

Domestic water well approximately 540 feet (ft) northwest, surface water/wetlands approximately 60 ft southeast, building approximately 1,260 ft northeast, livestock/pasture approximately 100 ft north, and groundwater approximately 2 ft below ground surface (bgs).

SITE INVESTIGATION PLAN

**TYPE OF WASTE:**

E&P Waste       Other E&P Waste       Non-E&P Waste

- Produced Water
- Oil
- Condensate
- Drilling Fluids
- Drill Cuttings
- Workover Fluids
- Tank Bottoms
- Pigging Waste
- Rig Wash
- Spent Filters
- Pit Bottoms
- Other (as described by EPA)

## **DESCRIPTION OF IMPACT**

Impacted?	Impacted Media	Extent of Impact	How Determined
Yes	GROUNDWATER	See Attached Data	Groundwater Samples/Lab Analysis
Yes	SOILS	155' N-S x 160' E-W x 8' bgs (max)	Soil Samples/Lab Analysis

## **INITIAL ACTION SUMMARY**

Description of initial action or emergency response measures take to abate, investigate, and/or remediate impacts associated with E&P Waste.

Due to a COGCC requested investigation of former Amoco sites, Kerr-McGee undertook assessment activities at the Aristocrat Angus Ranch #1 facility to determine the magnitude and extent of potential petroleum hydrocarbon impacts to soil and/or groundwater resulting from historic operation of the site. LT Environmental, Inc. (LTE) was contracted by Kerr-McGee to perform subsurface investigation work at the site. In April 2008, LTE advanced and continuously sampled three investigation soil borings (SB01 through SB03). The soil borings were then completed as groundwater monitoring wells MW01 through MW03, respectively. Laboratory analytical results indicated exceedances to the Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 allowable levels for both the soil and groundwater samples collected from SB03/MW03. Based on the findings of the April 2008 assessment activities, excavation of source area soils with historical petroleum hydrocarbon impacts was conducted in September and October 2009.

On February 2, 2010, a surface casing release occurred while attempting to plug and abandon the Aristocrat Angus Ranch #1 well. Approximately 35 barrels (bbls) of water-based bentonitic drilling mud and 0.5 bbl of condensate were released onto the ground surface around the wellhead. The petroleum hydrocarbon impacted soil was excavated in March 2010.

## **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 ):

In September and October 2009, 20 soil samples and three pothole soil samples were collected from the 2009 excavation for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and total xylenes (BTEX) analysis. Laboratory results indicated that TPH and BTEX concentrations were in full compliance with COGCC Table 910-1 allowable levels at the northern, western, and southern extents of the excavation. Impacted soil was left in place along the eastern sidewall.

In March 2010, 15 soil samples were collected from the 2010 excavation for TPH and BTEX analysis. Laboratory results indicated that TPH and BTEX concentrations were in full compliance with COGCC Table 910-1 allowable levels at the lateral extent of the excavation. The 2010 excavation overlapped with the eastern extent (northern half) of the 2009 tank battery excavation, removing the impacted soil in place. The soil sample locations are depicted on Figure 1. The soil sample results are summarized on Table 1.

### **Proposed Groundwater Sampling**

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

On August 25, 2009, groundwater sample GW01 was collected from the 2009 tank battery excavation for laboratory analysis of BTEX. Laboratory analytical results indicated sample GW01 exceeded the COGCC Table 910-1 allowable level for benzene at a concentration of 410 micrograms per liter (µg/L). On March 11, 2010, groundwater sample GW01 was collected from the 2010 wellhead excavation for BTEX analysis. Laboratory analytical results indicated sample GW01 exceeded the COGCC Table 910-1 allowable level for benzene at a concentration of 1,300 µg/L. On March 16, 2010, following the removal of impacted groundwater, sample GW02 was collected from the wellhead excavation and was in full compliance with COGCC Table 910-1 allowable levels for BTEX. The excavation groundwater sample locations are depicted on Figure 1. The groundwater sample analytical results are summarized in Table 2.

Groundwater monitoring has been conducted on a quarterly basis since April 2008.

### **Proposed Surface Water Sampling**

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

In March 2010, six surface water samples (SW01 through SW06) were collected from the wetland located south of the wellhead. Samples SW01 and SW02 exceeded the COGCC Table 910-1 allowable levels for benzene and/or toluene. Please refer to the Form 27 Update Report submitted to the COGCC on May 10, 2011, for additional details.

Surface water monitoring from locations SW03 and SW07 has been conducted on a quarterly basis since March 2010. The surface water sample locations are depicted on Figure 2. The surface water sample analytical results are summarized in Table 3.

## **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 38  
Number of soil samples exceeding 910-1 17  
Was the areal and vertical extent of soil contamination delineated? Yes  
Approximate areal extent (square feet) 14210

### NA / ND

-- Highest concentration of TPH (mg/kg) 2400  
NA Highest concentration of SAR           
BTEX > 910-1 Yes  
Vertical Extent > 910-1 (in feet) 7

### Groundwater

Number of groundwater samples collected 398  
Was extent of groundwater contaminated delineated? Yes  
Depth to groundwater (below ground surface, in feet) 2'  
Number of groundwater monitoring wells installed 21  
Number of groundwater samples exceeding 910-1 80

-- Highest concentration of Benzene (µg/l) 5100  
-- Highest concentration of Toluene (µg/l) 2100  
-- Highest concentration of Ethylbenzene (µg/l) 430  
-- Highest concentration of Xylene (µg/l) 3600  
NA Highest concentration of Methane (mg/l)         

### Surface Water

60 Number of surface water samples collected  
2 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?

Groundwater impacts were detected in the adjoining rangeland and agricultural field north and east of the excavation. Surface water impacts were detected in two of the initial surface water samples (SW01 and SW02) in the wetland south of the wellhead.

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?

## 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.

Approximately 6,520 cubic yards of petroleum hydrocarbon impacted soil from the 2009 tank battery excavation were transported to the Kerr-McGee Land Treatment Facility in Weld County, Colorado, for recycling. Approximately 305 cubic yards of petroleum hydrocarbon impacted soil from the 2010 wellhead excavation were transported to Buffalo Ridge Landfill in Keenesburg, Colorado, for disposal. The impacted soil was excavated into the capillary and phreatic zones to address potential hydrocarbon impacts that may have been present below the current groundwater table due to seasonal fluctuations. Approximately 950 cubic yards of petroleum hydrocarbon impacted groundwater were removed from the 2010 excavation and transported to a licensed disposal facility. The general site layout and 2009 and 2010 excavation footprints are depicted on the Site Map provided as Figure 2.

## **REMIEDIATION 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.

Prior to backfilling the 2009 excavation, 20 gallons of MicroBlaze®, a concentrated solution of facultative microbes, nutrients, and surfactants designed to bioremediate petroleum hydrocarbons, were applied to the groundwater and exposed smear zone soil in the open excavation. Prior to backfilling the 2010 excavation, 10 gallons of MicroBlaze® were applied to the groundwater and exposed smear zone soil in the open excavation.

Due to persistent, elevated BTEX concentrations in multiple site monitoring wells, an air sparging (AS) system was installed at the site. The AS system was designed to introduce ambient air into the subsurface water column to promote volatilization and aerobic microbial decomposition of dissolved-phase petroleum hydrocarbons. Installation and start-up of the full-scale AS system occurred in April 2016. In January 2017, two additional AS wells were installed and tied into the system.

The AS system is comprised of 14 AS wells connected by a combination of surface and subsurface high-density polyethylene piping to a tow-behind air compressor powered by diesel. The remediation system included valves at all of the AS wellheads to allow for uninterrupted flow control, measurement, and adjustment. AS was accomplished using a 49-horsepower-driven John Deere, rotary-screw compressor. The system was shut down on August 27, 2018, for static groundwater monitoring. The AS wells are depicted on the Site Map attached as Figure 2. Boring logs for the AS wells are included as an attachment.

## **Soil Remediation Summary**

In Situ

Ex Situ

         Bioremediation ( or enhanced bioremediation )

Yes Excavate and offsite disposal

         Chemical oxidation

If Yes: Estimated Volume (Cubic Yards)         6825

         Air sparge / Soil vapor extraction

Name of Licensed Disposal Facility or COGCC Facility ID #         149007

         Natural Attenuation

No Excavate and onsite remediation

         Other                                 

         Land Treatment

         Bioremediation (or enhanced bioremediation)

         Chemical oxidation

         Other                                 

## **Groundwater Remediation Summary**

Yes Bioremediation ( or enhanced bioremediation )

No Chemical oxidation

Yes Air sparge / Soil vapor extraction

Yes Natural Attenuation

Yes Other Groundwater Removal and  
MicroBlaze® Application (2009  
and 2010 Excavations)                                 

## **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.

Between April 2008 and July 2014, groundwater monitoring wells MW01 through MW16 and replacement monitoring wells MW03R, MW10R, MW10R2, and MW11R were installed at the site. Boring logs with well completion diagrams are included as an attachment.

On November 11, 2013, monitoring wells MW02 through MW12 were surveyed to obtain the relative groundwater and top-of-casing well elevation data. The survey data indicated the groundwater flow direction at the site is to the north-northwest. On May 21, 2014 and April 10, 2018, the monitoring wells MW10R2 and MW13 through MW16 were tied into the survey data. The survey data indicated the groundwater flow direction at the site is to the north-northwest and the north-northeast. Relative groundwater elevations are provided in Table 2. Groundwater Elevation Contour Maps for the third quarter 2018 through second quarter 2019 monitoring events are provided as Figures 3A through 3D, respectively.

As of the May 2019 quarterly monitoring event, BTEX concentrations in monitoring wells MW03R, MW05 through MW09, MW10R2, MW11R, and MW13 through MW16 and surface water locations SW03 and SW07 were in full compliance with COGCC Table 910-1 allowable levels for four consecutive quarterly monitoring events. The groundwater and surface water analytical results are summarized in Table 2 and Table 3, respectively. The laboratory analytical reports for the four compliant groundwater and surface water monitoring events are attached.

## REMEDIATION PROGRESS UPDATE

### PERIODIC REPORTING

Frequency:  Quarterly  Semi-Annually  Annually  Other Final Report \_\_\_\_\_  
Report Type:  Groundwater Monitoring  Land Treatment Progress Report  O&M Report  
 Other NFA Status Request \_\_\_\_\_

### 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:

Approximately 6,520 cubic yards of petroleum hydrocarbon impacted soil from the 2009 excavation were transported to the Kerr-McGee Land Treatment Facility in Weld County, Colorado, for recycling. Approximately 305 cubic yards of petroleum hydrocarbon impacted soil from the 2010 excavation were transported to Buffalo Ridge Landfill in Keenesburg, Colorado, for disposal.

Volume of E&P Waste (solid) in cubic yards \_\_\_\_\_ 6825

E&P waste (solid) description Petroleum hydrocarbon impacted soil

COGCC Disposal Facility ID #, if applicable: \_\_\_\_\_ 149007

Non-COGCC Disposal Facility: Buffalo Ridge Landfill in Keenesburg, Colorado (2010 Excavation)

Volume of E&P Waste (liquid) in barrels \_\_\_\_\_ 950

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

COGCC Disposal Facility ID #, if applicable: \_\_\_\_\_ 159443

Non-COGCC Disposal 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.

The site was restored to its pre-release grade. The site will be reclaimed in accordance with COGCC 1000 Series Reclamation Rules.

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. 04/07/2008

### **SITE INVESTIGATION DATES**

Date of Initial Actions described in Site Investigation Plan (start date). 04/07/2008

Date of commencement of Site Investigation. 04/07/2008

Date of completion of Site Investigation. 08/01/2014

### **REMEDIAL ACTION DATES**

Date of commencement of Remediation. 09/04/2009

Date of completion of Remediation. 05/10/2019

### **SITE RECLAMATION DATES**

Date of commencement of Reclamation. \_\_\_\_\_

Date of completion of Reclamation. \_\_\_\_\_

**OPERATOR COMMENT**

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

Signed: Phil Hamlin \_\_\_\_\_

Title: Senior Environmental Rep. \_\_\_\_\_

Submit Date: 07/30/2019 \_\_\_\_\_

Email: Phil.Hamlin@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: Candice (Nikki) Graber \_\_\_\_\_

Date: 08/05/2019 \_\_\_\_\_

Remediation Project Number: 4348 \_\_\_\_\_

**COA Type****Description**

	<p>Based on the information presented, it appears that no further action is necessary at this time and the COGCC approves the closure request. However, should future conditions at the site indicate contaminant concentrations in soils exceeding COGCC standards or if groundwater is found to be impacted, then further investigation and/or remediation activities may be required. In addition, the surface area disturbed by the remediation activity shall be reclaimed in accordance with the 1000 Series Reclamation Rules.</p> <p>For locations with active ongoing oil and gas operations, comply with Rule 1003 interim reclamation requirements and for locations that will no longer have active oil and gas operations, comply with Rule 1004 Final Reclamation requirements.</p>
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**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**

402049591	FORM 27-SUPPLEMENTAL-SUBMITTED
402049954	LOGS
402050441	ANALYTICAL RESULTS
402081297	GROUND WATER ELEVATION MAP
402081298	SOIL SAMPLE LOCATION MAP
402081299	SITE MAP

Total Attach: 6 Files

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

		Stamp Upon Approval
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Total: 0 comment(s)