

State of Colorado  
Oil and Gas Conservation Commission

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Report taken by:  
BOB CHESSON

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 checked="" 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 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>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:

- |  |  |  |
|--|--|--|
| <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 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	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 ):

Please refer to the Form 27 Update Report submitted to the Colorado Oil and Gas Conservation Commission (COGCC) on May 10, 2011.

### Proposed Groundwater Sampling

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

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 ):

Please refer to the Form 27 Update Report submitted to the COGCC on May 10, 2011, for initial surface water sampling activities. Surface water monitoring from locations SW03 and SW07 has been conducted on a quarterly basis since March 2010.

### 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 353  
Was extent of groundwater contaminated delineated? No  
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

52 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?

Based on the surveyed groundwater flow direction and a recent benzene exceedance in well MW16, an additional monitoring well will be installed to the north in order to regain point of compliance.

# 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.

Please refer to the Form 27 Update Report submitted to the COGCC on May 10, 2011.

## 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.

Since the submittal of the Form 27 Update Report to the COGCC on May 10, 2011, an air sparging (AS) system was installed at the site due to persistent, elevated BTEX concentrations in multiple site monitoring wells. 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 of the full-scale AS system occurred between April 2016 and November 2017.

The AS system started up in April 2016. The 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 as-built layout of the full-scale AS system is depicted on the Site Map attached as Figure 1. Boring logs for the AS wells are attached.

Due to recent benzene exceedances in monitoring wells MW09 and MW16, the installation of additional AS wells is under evaluation.

## 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.

Since the Form 27 Update Report submittal to the COGCC on May 10, 2011, five additional groundwater monitoring wells (MW12 through MW16) and three replacement monitoring wells (MW10R, MW10R2, and MW11R) were installed at the site. Destroyed monitoring wells MW01R, MW02, and MW04 were not replaced because benzene, toluene, ethylbenzene, and total xylenes (BTEX) concentrations have not exceeded the COGCC Table 910-1 allowable levels for four or more quarterly monitoring events. Soil boring logs with monitoring well completion diagrams are included as an attachment.

Groundwater monitoring wells MW03R, MW05 through MW09, MW10R2, MW11R, and MW13 through MW16 and surface water locations SW03 and SW07 are sampled on a quarterly basis and submitted for laboratory analysis of BTEX. The monitoring well and surface water locations are depicted on Figure 1. The Groundwater Elevation Contour Map generated using the May 2018 survey data is provided as Figure 2. The groundwater and surface water analytical results are summarized in Table 1 and Table 2, respectively. The laboratory analytical report for the May 2018 monitoring event is attached.

Groundwater and surface water monitoring will continue on a quarterly basis until a No Further Action status request is warranted.

# REMEDIATION PROGRESS UPDATE

## PERIODIC REPORTING

Frequency:  Quarterly  Semi-Annually  Annually  Other \_\_\_\_\_

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:

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? No \_\_\_\_\_

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? No \_\_\_\_\_

Is additional groundwater monitoring to be conducted? Yes \_\_\_\_\_

## 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 Noble Energy production facility remains at the site.

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. \_\_\_\_\_

### REMEDIAL ACTION DATES

Date of commencement of Remediation. 09/04/2009  
 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: Phil Hamlin Title: Senior HSE Representative  
 Submit Date: 07/31/2018 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: BOB CHESSON Date: 07/31/2018  
 Remediation Project Number: 4348

<u>COA Type</u>	<u>Description</u>

### **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.

<u>Att Doc Num</u>	<u>Name</u>
401598307	FORM 27-SUPPLEMENTAL-SUBMITTED
401661760	LOGS
401695462	ANALYTICAL RESULTS
401701442	GROUND WATER ELEVATION MAP
401720200	SITE MAP

Total Attach: 5 Files

### **General Comments**

<u>User Group</u>	<u>Comment</u>	<u>Comment Date</u>
		Stamp Upon Approval

Total: 0 comment(s)