

CM PRODUCTION, LLC
RICE LEASE ENVIRONMENTAL ASSESSMENT REPORT

COGCC REMEDIATION PROJECT NUMBERS
8444, 8461, AND 8517
CLIFF UNIT, LOGAN COUNTY, COLORADO

Prepared for:

CM Production, LLC
390 Union Boulevard, Suite 620
Denver, Colorado 80228

Prepared by:

Olsson Associates
4690 Table Mountain Drive, Suite 200
Golden, Colorado 80403

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1.0 Introduction

CM Production, LLC (CM Production), operator # 10352, retained Olsson Associates, Inc. (Olsson) to perform a site assessment of the Rice Production Facility in response to a notice of alleged violation (NOAV) #200399090 located at the central tank battery located in the southwest ¼ of the northwest ¼ of Section 33, Township 12 North, Range 54 West of the 6th Principal Meridian, in Logan County, Colorado. A site location map is provided as Figure 1.

1.1 Background

According to the Colorado Oil and Gas Conservation Commission (COGCC) online documents, the Rice #2 oil well was drilled and completed in June 1955. CM Production purchased the Rice Lease from the Estate of Rex Monahan in October 2010. An anonymous report was made to the COGCC that oily waste had been buried on the Rice production facility location. The COGCC inspected the site on January 8, 2014, and COGCC environmental staff inspected the site on January 14, 2014 at which time limited sampling was conducted with soil samples submitted to Test America Laboratories, Inc.

Oily waste was encountered at approximately four feet below ground surface (bgs) at the coordinates 40.97341 latitude and -103.42021 longitude, in the area where the source of the anonymous report had indicated. CM Production is the Operator of Record since 2010, and maintains that this waste was present prior to the purchase of the property. The laboratory analytical results for the COGCC soil samples showed that the concentrations of petroleum hydrocarbon constituents were above the COGCC Series Rule 900 - Table 910-1 concentration levels. The COGCC subsequently assigned the cleanup of the oily wastes Remediation #8517.

The NOAV also identified other issues which included possible releases of produced water to an ephemeral drainage located east of the production facility resulted in salt impacts. The COGCC records for this site indicate that produced water was historically discharged to this drainage, which was allowed at that time. The COGCC has requested that CM Production demonstrate that the operation of the pits is not continuing to release produced water to the drainage. CM Production and Olsson prepared a sensitive area determination evaluation report submitted on May 27, 2014. The COGCC has assigned Remediation #8461 to the investigation of the potential produced water impacts.

A produced water spill occurred on April 1, 2014 as a result of an animal (badger) burrowing through the south berm of the south pit resulting in a release of four barrels produced water that impacted the berm. The produced water spill from the bermed area spill was assigned Remediation #8444 and is in the area south of the south pit (Pit #116281) where COGCC observed a lack of vegetation during the January 14, 2014 inspection. Soil sample was collected by COGCC on January 14, 2014 (sample number 0750221 SO05) from this area that had a sodium adsorption ratio (SAR) of 130, which is above the COGCC Table 910-1 SAR value of 12.

CM Production has since re-constructed the south berm and constructed a perimeter containment ditch to capture any produced water that might be released during the repairs to the inside of the south pit berm.

1.2 Approved Work Plan – Tank Bottoms Excavation (REM #8517)

The COGCC conditionally approved the Form 27 – Site Investigation and Remediation Work Plan for the assessment and remediation of the oily waste (tank bottoms) that was located near the northwest corner of the south produced water pit. The Form 27 (Document #2141591) was signed on June 30, 2014, by Mr. James W. Hix – Olsson Associates, as agent for CM Production, and was signed by Mr. John Noto – Northeast Regional Environmental Protection Specialist on July 1, 2014. Commission correspondence is included in Attachment A.

The oily waste Remediation #8517 is separate from the remediation area determination and produced water impacts. The COGCC concurred with the proposed excavation and sampling plan with the conditions that the excavation work be completed with confirmation sample results provided to the COGCC by September 12, 2014, and a Form 27 for land treatment (if planned) be submitted to COGCC by September 19, 2014. Additionally, the COGCC was to be notified in advance if unexpected or adverse conditions prevented these dates from being met. The excavation work was initiated on July 22, 2014.

1.3 Approved Work Plan – Sensitive Area Evaluation (REM #8461)

The COGCC reviewed the Sensitive Area Evaluation performed by Olsson (submitted May 27, 2014) that indicates the site was not located in a sensitive area as defined by COGCC's *Sensitive Area Identification Guidance Document*. The COGCC NOAV # 200399090 issued to CM Production on March 18, 2014 required corrective actions based on the analytical results of soil samples collected by the COGCC during the January 14, 2014 site inspection that suggested produced water impacted the drainage east of the southeast pit during the operation of the produced water pits. As presented in the sensitive area evaluation, the ephemeral drainage formerly received produced water discharged from the pits from the 1950s to 1970s. The discharge of produced water to the drainage was not regulated at that time. Area records indicate that groundwater, if present, is expected to be greater than 130 feet bgs.

The COGCC indicated that while the sensitive area evaluation prepared by Olsson presented good information, site specific data was lacking to determine whether operation of the pits are continuing to release produced water to the ephemeral drainage located to the east of the site. A Form 27 (document #2141171) was received by the COGCC on May 27, 2014 for the sensitive area determination and proposed remediation work plan.

2.0 Rice Oily Waste Assessment

On July 22 and July 23, 2014, Olsson met with CM Production's pumper Mr. Randy Cleveland and an equipment operator to excavate the oily waste. Approximately 10 cubic yards of impacted materials were placed on plastic sheeting northeast of the excavation and another stockpile of overburden soils were placed on the east side of the excavation. CM Production excavated the tank bottom wastes using a John Deere 35 mini-excavator.

The tank bottoms excavation measured approximately 10 feet wide by 15 feet long and was eight feet deep. The pit was located approximately eight feet northeast of the northwest wooden fence post for the south pit (Pit #116281); 41 feet north of the south pit, and was approximately eight feet east of the fence line.

2.1 Field Observations

The soils in the pit side walls and base did not exhibit any apparent staining or odor. The impacted materials consisted of oily waste and stained soils, placed on plastic sheeting at the time of the site investigation. A berm was to be constructed around the perimeter of the waste stockpile using some of the overburden soils stockpile. The overburden soil stockpile did not exhibit staining or odor. Site photographs are included in Attachment B.

2.2 Soil Sampling

Olsson directed the sampling and collected confirmation soil samples from the mini-excavator bucket. Sidewall samples were collected from each of the four corners of the excavation at a depth of six feet bgs (TBE-NE @ 6', TBE-SW @ 6', TBE-SE @ 6', TBE-NW @ 6'). One confirmation soil sample was collected from the base of the excavation at a depth of eight feet bgs (TBE-B @ 8'). Groundwater was not encountered in the excavation. Soil samples were submitted for laboratory analysis of the COGCC Table 910-1 soil parameters.

A waste characterization sample, TBE-WC, was collected from the oily waste stockpile, and a composite soil sample, TBE-CO, was collected from the overburden soil stockpile. Soil samples were also collected from these locations and submitted for laboratory analysis of the COGCC Table 910-1 soil parameters. The laboratory results for the soil sample are summarized in attached Table 1 and Table 2. Maps depicting the approximate soil sampling locations and the corresponding analytical results are included on attached Figure 2 and Figure 3.

2.3 Soil Sample Analyses

The soil samples were collected in laboratory-provided containers and stored in a plastic cooler on ice pending delivery at the laboratory. Olsson hand delivered the soil samples to Accutest Mountain States Laboratories (Accutest) in Wheat Ridge, Colorado under chain of custody on July 24, 2014.

Olsson requested the samples be analyzed for the soil parameters listed in COGCC Table 910-1. These included the following analytes and laboratory analytical methods:

- Total petroleum hydrocarbons (TPH) as gasoline range organics (GRO) by EPA Method 8260, and diesel range organics (DRO) by EPA modified Method 8015
- Benzene, toluene, ethylbenzene, and total xylenes (BTEX) by EPA Method 8260
- Polycyclic aromatic hydrocarbons (PAHs) including acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3,c,d) pyrene, naphthalene, and pyrene by EPA Method 8270C-selective ion monitoring (SIM)
- Total metals concentrations for arsenic (Method SW 846 6020A), barium, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc (Method SW 846 6010C), and mercury by Method 7471B

The soil samples were submitted for these analyses on a standard turn-around time from the laboratory. The laboratory results summarized in Table 2 and Table 3 are discussed in Section 2.4. A copy of the Accutest laboratory report is provided in Appendix C.

2.4 Soil Sample Analytical Results

The laboratory analytical results for confirmation soil samples TBE-NE @ 6', TBE-SW @ 6', TBE-SE @ 6' and TBE-B @ 8' reported concentrations were either not detected or were below their respective COGCC Table 910-1 concentration levels. The laboratory results for TBE-NW @ 6' soil sample showed that concentrations of benzene, toluene, ethylbenzene, and total xylenes were not detected at or above their respective laboratory reporting limits. The GRO were reported at 47.1 milligrams per kilogram (mg/kg) and DRO concentration in the TBE-NW @ 6' soil sample was reported at 8,080 mg/kg which is above the COGCC concentration level of 500 mg/kg. The PAH compounds benzo(b)fluoranthene, chrysene, fluoranthene, fluorene, naphthalene, and pyrene were reported in the TBE-NW @ 6' soil sample, but were below their respective Table 910-1 concentration levels.

Total metals results for barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc were all below the COGCC Table 910-1 concentrations. The arsenic results were reported at concentrations above the Table 910-1 concentration level of 0.39 mg/kg, and ranged from 4.1 mg/kg to 4.5 mg/kg.

Background arsenic levels are known to be naturally elevated in Colorado soils. According to the June 2011 Colorado Department of Public Health and Environment (CDPHE) Risk Management Guidance of Evaluating Arsenic Concentrations in Soil states that average arsenic concentration in native grassland, rangeland or agriculture range from 3 mg/kg to 14 mg/k and the average arsenic concentration for all land uses is 11 mg/kg. If the results are less than 11 mg/kg, arsenic is not a chemical of concern.

3.0 Produced Water Impacts Assessment

The COGCC requested collecting site specific data to assess the produced water impacted soils and potential for shallow groundwater to be present in the ephemeral drainage east of the southeast pit.

3.1 Temporary Piezometer Installation

Olsson personnel used a hand auger to advance a boring to a depth of 10 feet bgs at a location down from the southeast corner of the southeast pit, and approximately three feet above the bottom of the drainage. The boring was advanced on the west bank of the drainage and soils encountered consisted of silt, silty-sand and sand mixtures down to the total depth. Soils were observed to be moist in the bottom two-thirds of the boring. The hand auger boring was advanced to at least 8 feet below the bottom of the main drainage.

The hand auger boring was completed as temporary piezometer, PZ-1 (Figure 4). Ten feet of 1-inch diameter polyvinyl chloride (PVC) pipe was placed in the boring. Slots were cut in the bottom two feet of the PVC pipe using a hand saw. The pipe was fitted with a PVC slip cap on the bottom. Silt and sand cuttings from the hand auger hole were placed around the annular space of the pipe. A second slip cap was placed on top of the PZ-1 casing and allowed time for groundwater to come into the piezometer. Prior to leaving Olsson personnel checked PZ-1 for the presence of groundwater; however, the piezometer remained dry at the time of the assessment.

Moisture was observed as “seepage” on both the east and west banks of the drainage. The location of PZ-1 was selected at a point south of the gathering pipeline crossing where moisture was observed in the soil and rock outcrop. According to CM Production personnel, there had been a lot of rain prior to the field assessment, and the grasses around the site were green, when normally at this time in July they would have dried out and browned.

3.2 Surface Water Sampling

Olsson observed the presence of standing water in the side drainage down from the northeast corner of the north pit where the side drainage joined the main drainage. A grab sample of the surface water was collected (water sample NPD-SW) and submitted for laboratory analysis of the COGCC Table 910-1 inorganic water quality parameters and included:

- Chlorides by EPA 300.0
- Sulfates by EPA 300.0
- Total Dissolved Solids (TDS) by SM 2540C

The water did not have any apparent petroleum sheen or odor. The water sample was placed into Accutest laboratory-provided poly bottles and placed in the cooler and stored on ice.

3.3 Southeast Pit Water Sampling

Olsson collected a water sample (SE-Pit) from the southeast pit for COGCC Table 910-1 inorganic water quality parameters chlorides, sulfates, and TDS. The produced water in the southeast pit did not exhibit any apparent petroleum sheen or odor. The sample was collected in Accutest-provided poly bottles, stored on ice in a plastic cooler pending delivery to the laboratory under chain of custody.

3.4 Water Analytical Results

The laboratory reported surface water sample NPD-SW chloride at 8,380 mg/l, sulfate was not detected above the laboratory reporting limit of 50 mg/l, and the TDS were reported at 15,100 mg/l.

The results for the southeast pit water sample, SE-Pit, reported chloride at 5,800 mg/l, sulfate at 38.9 mg/l, and the TDS at 11,900 mg/l. The results for both samples indicate high levels of salts; however, the results may be due to the historic produced water discharge into the drainage. Olsson was not able to collect a water sample from temporary piezometer PZ-1 located down gradient from the pits for comparison.

3.5 South Pit Soil Sampling and Analysis

An area that was observed to be lacking vegetation, as compared to the surrounding areas, is located on the south side of the south pit. The COGCC collected a soil sample from this area that had a SAR result of 130 during the January 14, 2014 inspection.

Olsson collected four surface soil samples to assess the extent of potential impacts in the area south of the south pit:

- SAE-SP 0-1": east/northeast side of the area (SAR 7.46)
- SAC-SP 0-1": north central part of the area (SAR **115**)
- SAW-SP 0-1": west/northwest side of the area (SAR 4.56)
- SAS-SP 0-1": south side of the area (SAR **84.6**)

The surface soil from 0 to 1 inch was collected and placed into laboratory-provided glass jars for analysis of calcium, magnesium, and sodium in order to calculate the sodium adsorption ratio (SAR) by USDA Handbook 60 Method.

The laboratory reported soil sample SAE-SP 0-1" had a SAR result of 7.46 and soil sample SAW-SP 0-1" SAR was reported at 4.56, below the COGCC Table 910-1 level of 12. The SAR results for soil sample SAC-SP 0-1" were reported at 115 and soil sample SAS-SP 0-1" at 84.6.

4.0 Conclusions and Recommendations

The following sections summarize the findings of the environmental site assessment of the Rice Lease and present conclusions and recommendations.

4.1 Tank Bottoms Excavation

The grab confirmation soil sample results show that the extent of the impacts from the wastes have been defined and removed from the base, northeast, southeast, and southwest. However, the DRO soil concentrations indicate that additional excavation is required for the northwest corner of the excavation. The DRO concentration of 8,080 mg/kg for soil sample collected in the northwest corner of the excavation are above the COGCC Table 910-1 concentration level of 500 mg/kg. The GRO concentration reported at 47.1 mg/kg is below the Table 910-1 concentration level. Benzene, toluene, ethylbenzene, total xylenes were not detected in the TBE-NW @ 6' soil sample.

The grab waste characterization sample for the materials stockpiled on plastic show that the tank bottom wastes exhibit concentrations of petroleum hydrocarbons that are above the Table 910-1 concentration levels for GRO (830 mg/kg) and DRO (22,900 mg/kg). Benzene and toluene were not detected. Ethylbenzene, total xylenes, and PAH compounds benzo(b)fluoranthene, chrysene, fluoranthene, fluorene, naphthalene, and pyrene were detected, but at concentrations below their respective Table 910-1 concentration levels.

Benzene, toluene, ethylbenzene and total xylenes were not reported in the overburden soil stockpile composite grab sample TBE-CO, but GRO was reported at 17.7 mg/kg, and DRO was reported at 4,890 mg/kg. The reported DRO concentration in the overburden soils is above the Table 910-1 concentration level of 500 mg/kg. These soils should be landfarmed on location under a COGCC approved work plan or disposed along with the oily wastes at a Colorado-regulated landfill facility.

4.2 East Drainage Assessment

A limited subsurface assessment was conducted in the east drainage which included installation of a temporary piezometer and collection of a surface water sample from a side drainage downhill from the north pit at the confluence with the main drainage. A temporary piezometer, PZ-1, was installed using a hand auger to advance a boring at a location approximately three feet above the base of the main drainage east of the southeast corner of the east pit. The temporary piezometer was located at an approximate elevation of 4,509 feet, above the base of the main drainage, but at an elevation where moisture was observed in the banks of the drainage. The east pit berm elevation is at approximately 4,525 feet, and the pit reportedly has a total depth of approximately six feet. The hand auger boring for temporary piezometer, PZ-1, was advanced to a total of ten feet below ground surface, with the bottom of PZ-1 about seven feet below the main drainage. The elevation at the total depth of PZ-1 is

approximately 4,499 feet. Temporary piezometer, PZ-1, was checked using a disposable mini-bailer at the end of the day, but remained dry during the July 23, 2014 site visit.

A surface water sample from rainfall was collected in the side drainage east of the north pit. The surface water sample results show indications of salt impacts. The TDS and chloride concentrations in the grab surface water sample are higher than those reported for the produced water sample collected from the east pit.

The elevated TDS and chloride impacts to soils and water in the drainage may be the result of historic produced water discharge to the drainage. Moisture seeping through the bedrock and soils was observed on both sides of the drainage as shown in the middle photograph on page B5 of Appendix B. This appears to be the result of recent rainfall and not seepage from the pits. The same wet soil and bedrock were observed in the ephemeral drainage to the north of the north pit indicating that the ephemeral drainage was wet due to recent precipitation runoff.

4.3 Soils and Vegetation South of the South Pit

Based on the limited soil sample results and the perimeter soil samples SAR values below the COGCC Table 910-1 level of 12, the area may be easier to restore than previously thought. Soil treatment options may include bringing in clean fill, topsoil, or manure and adding soil amendments including magnesium and calcium. Scarifying the soil to improve drainage may help to reduce the SAR levels. These may include the addition of gypsum (calcium sulfate dihydrate), Epsom salt (magnesium sulfate), or crushed agricultural limestone or dolomite, or a combination of these in the appropriate application rates to reduce sodium levels.

Alternatively, CM Production may request to use this area to land treat the tank bottom impacted soils in this area, pending approval from the Chimney Canyon Grazing Association and the COGCC. A Form 27 Site Investigation and Remediation Work Plan will be submitted to the COGCC if CM Production pursues remediating both areas in this manner. Field screening to show that the SAR and EC levels meet the Table 910-1 concentration levels may be needed to direct the remediation of these soils.

Once the area has been prepared as a seed bed, the area should be resampled to show that the SAR levels are less than 12, and then the area should be seeded using a mixture of blue grama, western wheatgrass, buffalo grass, sand drop seed, winterfat (white sage), and fourwing saltbush as described in the Logan County Colorado Soil Survey. Addition of a bulking agent such as crimping straw or hay may also help with retention of moisture and drainage.

TABLES

Table 1
ANALYTICAL SUMMARY - ORGANIC COMPOUNDS IN SOIL

Tank Bottoms Excavation - Oily Waste
CM Production LLC - Cliff Unit / Rice Lease
Section 33 Township 12 North, Range 54 West
Logan County, Colorado

Volatile Organic Compounds and Hydrocarbons							
Sample ID	Date	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	GRO (mg/kg)	DRO (mg/kg)
COGCC T 910-1		0.17	85	100	175	500	500
TBE-NE @ 6'	7/23/2014	< 0.066	< 0.13	< 0.13	< 0.26	< 13	< 7.7
TBE-SW @ 6'	7/23/2014	< 0.068	< 0.14	< 0.14	< 0.27	< 14	18.4
TBE-SE @ 6'	7/23/2014	< 0.068	< 0.14	< 0.14	< 0.27	< 14	< 7.9
TBE-B @ 8'	7/23/2014	< 0.062	< 0.12	< 0.12	< 0.25	< 12	< 7.5
TBE-NW @ 6'	7/23/2014	< 0.068	< 0.14	< 0.14	< 0.27	47.1	8,080
TBE - WC	7/23/2014	< 0.069	< 0.14	0.401	19.6	830	22,900
TBE - CO	7/23/2014	< 0.064	< 0.13	< 0.13	< 0.25	17.7	4,890

Polycyclic Aromatic Hydrocarbons														
Sample ID	Date	Acenaphthene (mg/kg)	Anthracene (mg/kg)	Benzo(a) anthracene (mg/kg)	Benzo(b) fluoranthene (mg/kg)	Benzo(k) fluoranthene (mg/kg)	Benzo(a) pyrene (mg/kg)	Chrysene (mg/kg)	Dibenzo(a,h) anthracene (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno (1,2,3-cd) pyrene (mg/kg)	Naphthalene (mg/kg)	Pyrene (mg/kg)
COGCC T 910-1		1000	0.22	0.22	2.2	0.022	0.022	22	0.022	1000	1000	0.22	23	1000
TBE-NE @ 6'	7/23/2014	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
TBE-SW @ 6'	7/23/2014	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0151	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051
TBE-SE @ 6'	7/23/2014	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051
TBE-B @ 8'	7/23/2014	< 0.0049	< 0.0049	< 0.0049	< 0.0049	< 0.0049	< 0.0049	< 0.0049	< 0.0049	< 0.0049	< 0.0049	< 0.0049	< 0.0049	< 0.0049
TBE-NW @ 6'	7/23/2014	< 0.100	< 0.020	< 0.020	0.202	< 0.020	< 0.020	0.782	< 0.020	< 0.020	0.759	< 0.020	0.122	0.514
TBE - WC	7/23/2014	< 0.078	< 0.078	< 0.078	0.49	< 0.078	< 0.078	2.19	< 0.078	0.51	< 0.078	< 0.078	8.31	1.42
TBE - CO	7/23/2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

mg/kg - milligrams per kilogram

GRO: gasoline range organics

DRO: diesel range organics

TPH: Total petroleum hydrocarbons (Sum of GRO plus DRO concentrations)

BOLD - Above Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 concentration levels

< - Analyte was not detected at or above the laboratory reporting limit

NA - Analyte was not analyzed

See attached map for soil sample locations:

TBE-NE @ 6': Confirmation soil sample from the northeast corner at 6 feet below ground surface (bgs)

TBE-SW @ 6': Confirmation soil sample from the southwest corner at 6 feet bgs

TBE-SE @ 6': Confirmation soil sample from the southeast corner at 6 feet bgs

TBE-B @ 8': Confirmation soil sample from the base of the buried tank bottoms excavation at 8 feet bgs

TBE-NW @ 6': Confirmation soil sample from the northwest corner at 8 feet bgs

TBE - WC: Tank Bottoms Excavation - Waste Characterization soil sample

TBE - CO: Tank Bottoms Excavation - Composite Overburden soil sample

**Table 2
INORGANIC COMPOUNDS IN SOIL**

**Tank Bottoms Excavation - Oily Waste
CM Production LLC - Cliff Unit/ Rice Lease
Section 33 Township 12 North, Range 54 West
Logan County, Colorado**

Sample ID	Date	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Total Chromium (mg/kg)	Hexavalent Chromium (mg/kg)	Trivalent Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	pH (s.u.)	Redox Potential (mV)
COGCC T 910-1		0.39	15,000	70	120,000	23	120,000	3,100	400	23	1,600	390	390	23,000	6 to 9	N/A
TBE-NE @ 6'	7/23/2014	4.5	261	< 1.2	4.6	< 1.0	4.6	5.6	< 5.8	< 0.097	5.1	< 5.8	< 3.5	19.4	8.12	482
TBE-SW @ 6'	7/23/2014	4.1	234	< 1.2	4.9	< 1.0	4.9	6.1	< 5.8	< 0.099	5.4	< 5.8	< 3.5	21.4	8.66	445
TBE-SE @ 6'	7/23/2014	4.2	290	< 1.1	4.8	< 1.0	4.8	6.2	6.8	< 0.095	5.3	< 5.5	< 3.3	21.1	8.65	461
TBE-B @ 8'	7/23/2014	4.2	266	< 1.1	4.7	< 1.0	4.7	5.7	5.7	< 0.091	5.2	< 5.7	< 3.4	20.5	8.83	448
TBE-NW @ 6'	7/23/2014	4.1	229	< 1.1	4.9	< 1.0	4.9	6.1	< 5.6	< 0.0097	5.3	< 5.6	< 3.4	20.7	9.07	413

BOLD - Above Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 concentration levels

mg/kg - milligrams per kilogram

mV - Millivolts

< - Analyte was not detected above the laboratory reporting limit

s.u - Standard units

**Table 3
ANALYTICAL SUMMARY - INORGANIC COMPOUNDS IN WATER**

**Surface and Southeast Pit Water Samples
CM Production LLC - Cliff Unit / Rice Lease
Section 33 Township 12 North, Range 54 West
Logan County, Colorado**

Sample ID	Date	Chloride (mg/l)	TDS (mg/L)	Sulfate (mg/L)	Sample Collection Point
COGCC T 910-1		250 mg/L ¹	< 1.25 x Background	250 mg/L ¹	
NPD - SW	7/23/2014	8380	15100	< 50	Water sample from the drainage down from the north pit near the confluence with the main drainage.
SE - Pit	7/23/2014	5800	11900	38.9	Water sample from the southeast pit

Note: Background established by the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission (WQCC) Regulation 41 - The Basic Standards for Groundwater.

¹ - Domestic drinking water standard

BOLD - Above Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 concentration levels

The sample results for the SE - Pit sample are also above the Table 910-1 concentration levels; however, this sample was collected from a permitted pit. The COGCC records indicate that historically produced water was discharged to the ephemeral drainage east of the site. This practice was not regulated at that time. There was recent rainfall and evidence of moisture/seepage in both banks of the drainage adjacent to the facility and north of the facility.

Table 4
ANALYTICAL SUMMARY - INORGANIC COMPOUNDS IN SURFICIAL SOIL

Area South of the South Pit
CM Production LLC - Cliff Unit / Rice Lease
Section 33 Township 12 North, Range 54 West
Logan County, Colorado

Sample ID	Date	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	SAR
COGCC T 910-1		N/A	N/A	N/A	< 12
SAE-SP 0-1"	7/23/2014	293	36.1	509	7.46
SAC-SP 0-1"	7/23/2014	5,530	421	33,000	115
SAW-SP 0-1"	7/23/2014	7,100	662	1500	4.56
SAS-SP 0-1"	7/23/2014	1,320	107	11,900	84.6

SAR - Sodium Adsorption Ratio

BOLD

- Above Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 concentration levels

N/A - Not Applicable

mg/l - milligrams per liter

See site map for sample locations

SAE-SP 0-1": South Area, east, south pit from 0 to 1 inch (surface soils)

SAC-SP 0-1": South Area, central, south pit from 0 to 1 inch

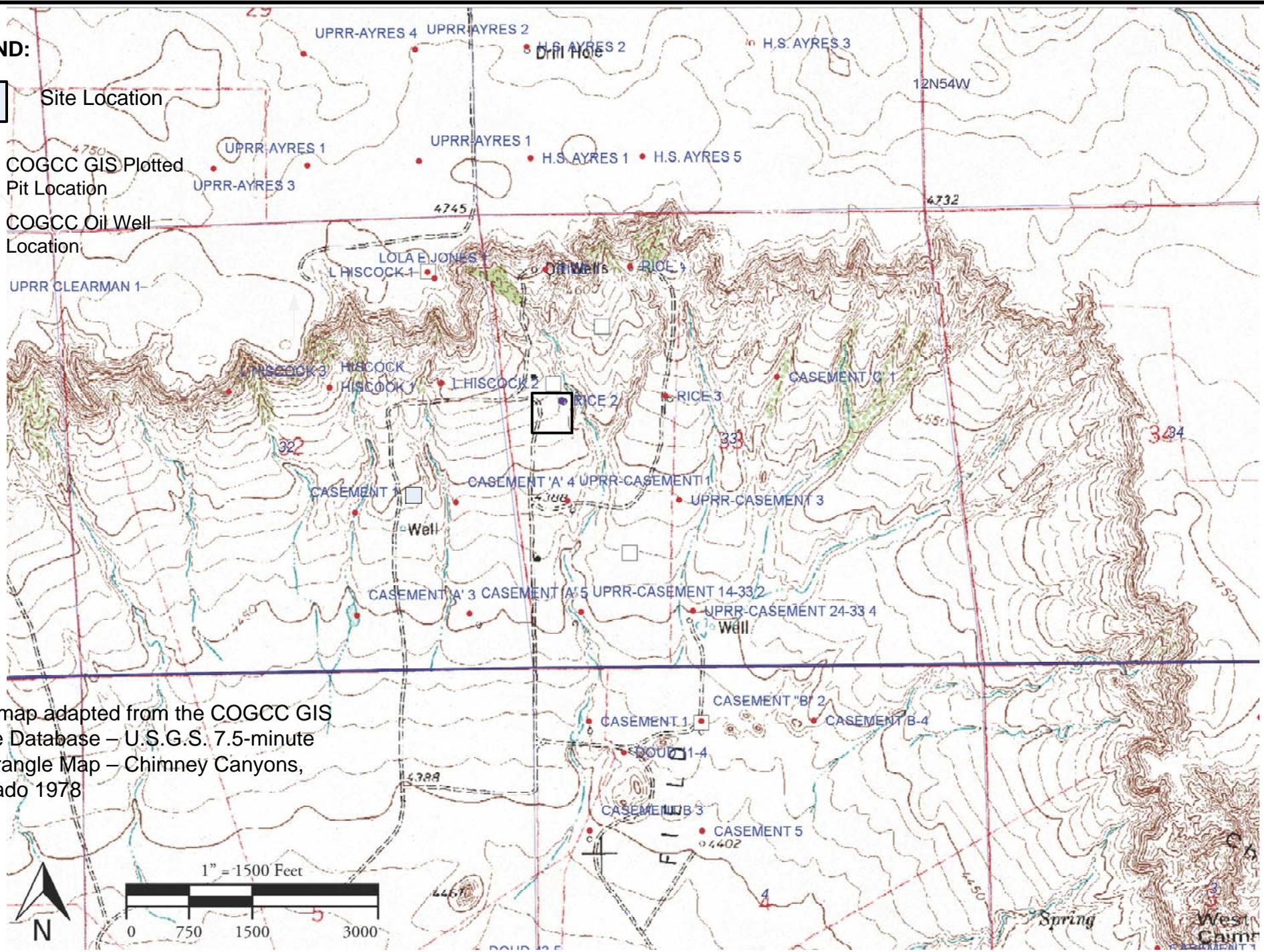
SAW-SP 0-1": South Area, west, south pit from 0 to 1 inch

SAS-SP 0-1": South Area, south, south pit from 0 to 1 inch

FIGURES

LEGEND:

- Site Location
- COGCC GIS Plotted Pit Location
- COGCC Oil Well Location



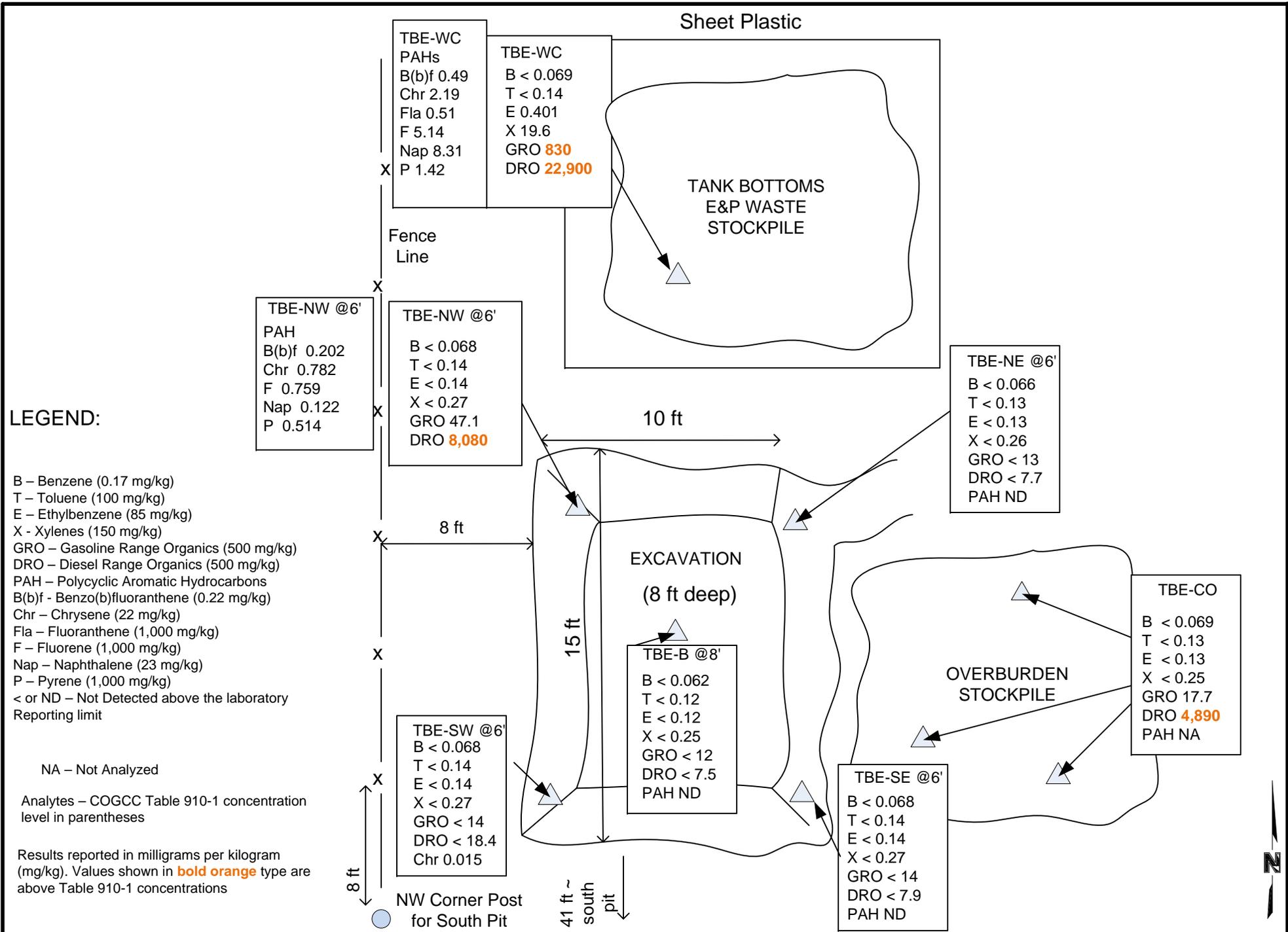
Base map adapted from the COGCC GIS Online Database – U.S.G.S. 7.5-minute Quadrangle Map – Chimney Canyons, Colorado 1978

PROJECT NO:	014-0704
DRAWN BY:	JWH
DATE:	08/20/2014

General Site Location Map
 CM Production, LLC
 Cliff Field, Rice Lease, Logan County, Colorado



4690 Table Mountain Drive #200
 Golden, Colorado 80403
 TEL 303.237.2072
 FAX 303.237.2659



PROJECT NO:	014-0704
DRAWN BY:	JWH
DATE:	08/09/2014

CM Production, LLC
 Organic Compounds in Soil
 Cliff Unit – Rice Lease Tank Bottoms Excavation
 Logan County, Colorado

OLSSON ASSOCIATES
 4690 Table Mountain Drive #200
 Golden, Colorado 80403
 TEL 303.237.2072
 FAX 303.237.2659

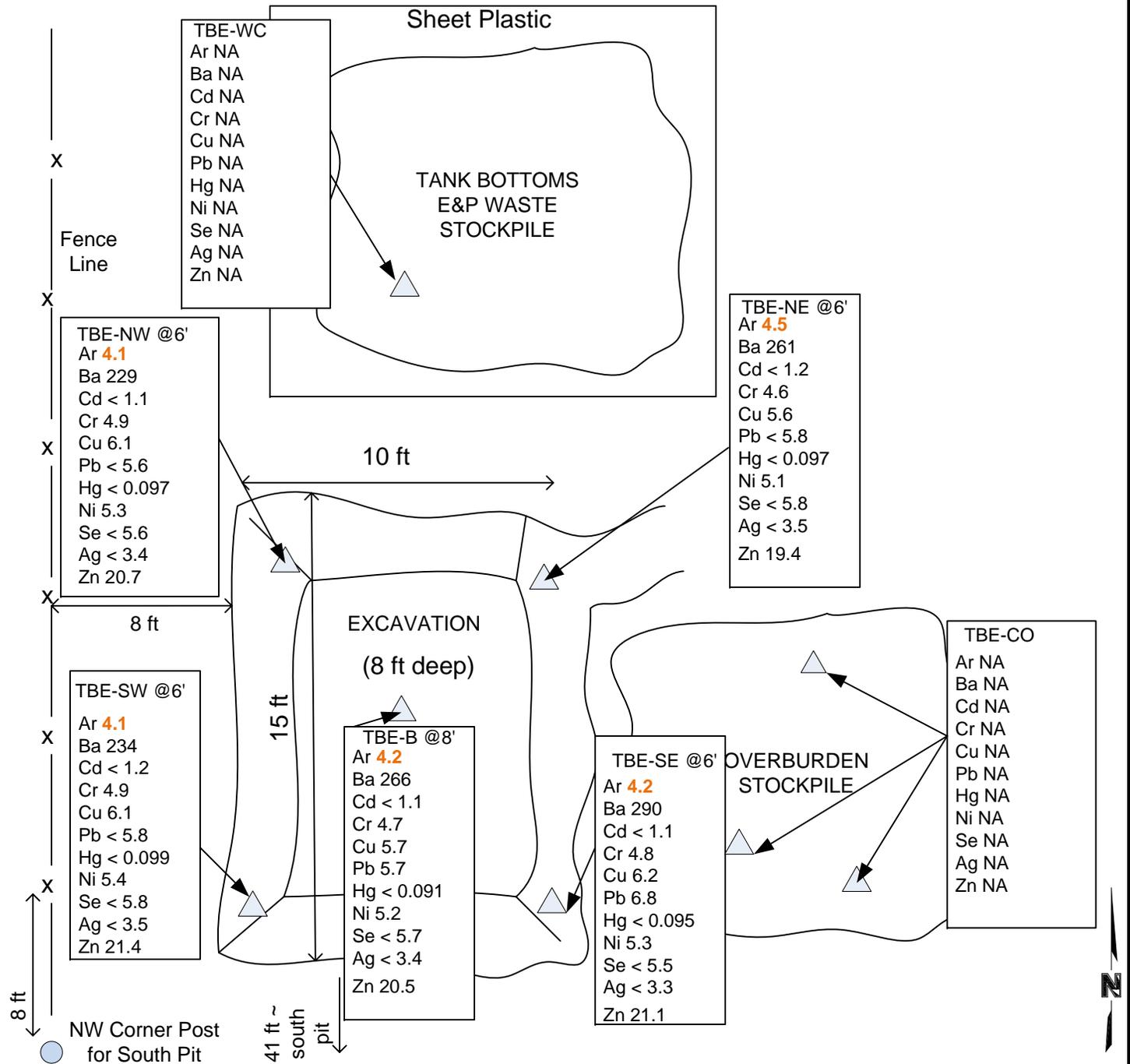
LEGEND:

- Ar – Arsenic (0.39)
- Ba – Barium (15,000)
- Cd – Cadmium (70)
- Cr – Chromium (120,000)
- Cu – Copper (3,100)
- Pb – Lead (400)
- Hg – Mercury (23)
- Ni – Nickel (1,600)
- Se – Selenium (390)
- Ag – Silver (390)
- Zn – Zinc (23,000)

NA – Not Analyzed

Analytes – COGCC Table 910-1 concentration level in parentheses

Results reported in milligrams per kilogram (mg/kg). Values shown in **orange** type are above COGCC Table 910-1 concentrations

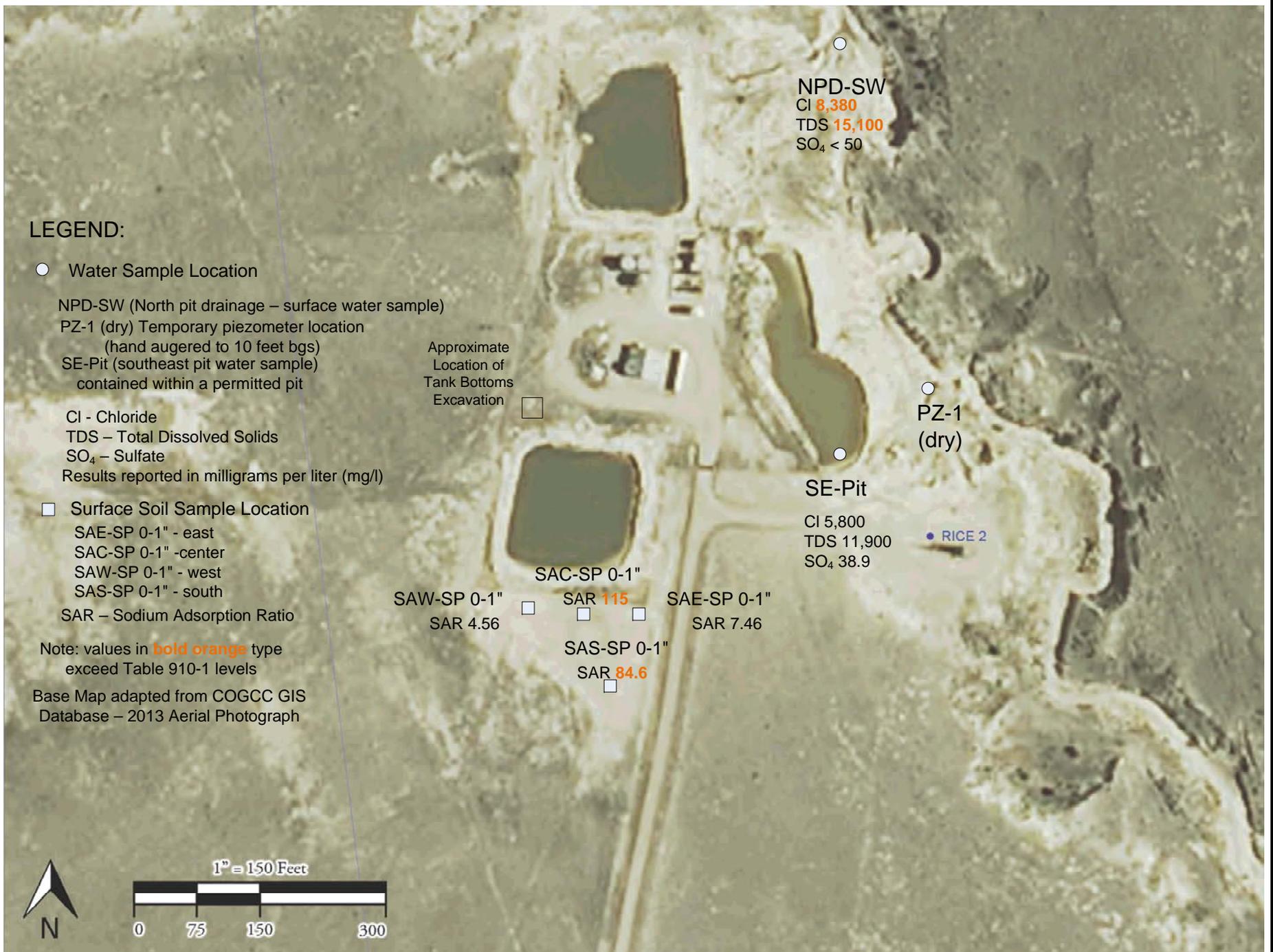


PROJECT NO:	014-0704
DRAWN BY:	JWH
DATE:	08/09/2014

CM Production, LLC
 Cliff Unit – Rice Lease Tank Bottoms Excavation Metals in Soil
 Logan County, Colorado

OLSSON
 ASSOCIATES

4690 Table Mountain Drive #200
 Golden, Colorado 80403
 TEL 303.237.2072
 FAX 303.237.2659



PROJECT NO:	014-0704
DRAWN BY:	JWH
DATE:	08/11/2014

CM Production, LLC - Cliff Unit Rice Lease
 South Pit Area Soil/Drainage Water Sample Results
 Logan County, Colorado

OLSSON
 ASSOCIATES

4690 Table Mountain Drive #200
 Golden, Colorado 80403
 TEL 303.237.2072
 FAX 303.237.2659

APPENDIX A
AGENCY CORRESPONDENCE

James Hix

From: Noto - DNR, John <john.noto@state.co.us>
Sent: Tuesday, February 18, 2014 3:47 PM
To: Teff, John
Cc: john.axelson@state.co.us; mike.leonard@state.co.us; kym.schure@state.co.us; James Hix
Subject: Re: COGCC FIELD INSPECTION REPORT [Doc#670600199]
Attachments: CM_RICE_Sample_results_01_14_2014.pdf; CM Prod Rice Sample Locations (3).pdf

John,

The sample results and sample location map are in the Attached Documents section of the Inspection under these Document Numbers -

Attached Documents

You can go to COGCC Images (<https://cogcc.state.co.us/weblink/>) and search by document number:

Date Run: 2/14/2014 Doc [#670600199]

Inspector Name: NOTO, JOHN

Document Num	Description	URL
670600225	CM Rice Sample Locations	http://ogccweblink.state.co.us/DownloadDocumentPDF.aspx?Doc
670600226	COGCC Sample Results	http://ogccweblink.state.co.us/DownloadDocumentPDF.aspx?Doc
670600227	COGCC Sample Chain of Custody	http://ogccweblink.state.co.us/DownloadDocumentPDF.aspx?Doc

The map and results are also attached to this email.

I am currently reviewing the other requests/questions. We would also like to meet with you in the COGCC office prior to visiting the locations. I will contact you tomorrow afternoon to let you know our availability and to check when it is convenient for you.

Thank you,

John Noto

On Tue, Feb 18, 2014 at 12:34 PM, Teff, John <johnt@cmproductionllc.com> wrote:

James Hix

From: Noto - DNR, John <john.noto@state.co.us>
Sent: Thursday, March 06, 2014 7:39 AM
To: James Hix; Teff, John
Subject: CM Production Rice Facility, COGCC Sample Analytical Reports
Attachments: 280-51152-1_Qua08.csv; 280-51152-1_TalStandard.csv; J51152-1 UDS Level 2 Report Final Report.pdf

James and John,

The requested laboratory report and data are attached.

--

John Noto, P.G.
Environmental Protection Specialist
Colorado Oil and Gas Conservation Commission
(303) 400-6136 or (720) 498-5298 (cell)

CM Production Rice Lease Logan County



James Hix

From: Axelson - DNR, John <john.axelson@state.co.us>
Sent: Thursday, April 03, 2014 7:28 AM
To: James Hix
Cc: john.noto@state.co.us; Kym.Schure@state.co.us; Teff, John (johnt@cmproductionllc.com); Kirk.mueller@dgsllaw.com
Subject: Re: CM Production, LLC : Produced Water Release - South Pit at the Cliff Field/Rice Lease 24-Hour Notice (Facility #116281)

James,

This is to confirm COGCC receipt of the 24-hour spill notification related to Facility ID #116281. If you can't log into the eForm 19, a PDF version of the Form 19 with the spill location map is still acceptable.

Thank you,
John

John E. Axelson, P.G.
East Environmental Supervisor



P 303.894.2100 x5115 | F 303.894.2109 | C 303-877-9964

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.axelson@state.co.us | www.colorado.gov/cogcc

On Wed, Apr 2, 2014 at 5:20 PM, James Hix <jhix@olssonassociates.com> wrote:

John and Kym,

I am notifying the COGCC of a spill that occurred yesterday on the south produced water pit at CM Production's Rice Lease – Cliff Field facility Pit #116281. It appears that an animal that burrowed into the pit berm caused the release of approximately four (4) barrels of produced water. CM Production used an excavator to stop the spill and to compact the damaged area of the berm to prevent it from reoccurring. This email is submitted to satisfy the requirement for 24-hour notification of the spill. Attached is a picture of the spill location on the south berm of the south pit.

I am working on preparing the Form 19 and will submit the initial form within the 72-hours. I am unable to login to the COGCC website to complete the eForm 19, but will work on gaining access or will submit a PDF version of the Form 19.

James

James W. Hix, PG| **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



James Hix

From: Axelson - DNR, John <john.axelson@state.co.us>
Sent: Friday, April 04, 2014 1:04 PM
To: James Hix
Cc: John Noto - DNR
Subject: Re: CM Production, LLC : Produced Water Release - South Pit at the Cliff Field/Rice Lease 24-Hour Notice (Facility #116281)
Attachments: 008.JPG; 019.JPG; 032.JPG

James,

Attached are three pictures that might indicate seepage from the two pits adjacent the drainage. John N. also had several pictures attached to the inspection he did that might have other pictures you can reference.

008 = from top of north pit looking east into drainage.

019 = from drainage below north pit looking west back at the pit.

032 = below south pit adjacent drainage looking west/southwest at SE corner of pit.

John

John E. Axelson, P.G.
East Environmental Supervisor



P 303.894.2100 x5115 | F 303.894.2109 | C 303-877-9964

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.axelson@state.co.us | www.colorado.gov/cogcc

On Thu, Apr 3, 2014 at 10:21 AM, James Hix <jhix@olssonassociates.com> wrote:

Thanks John,

John Teff has signed the Form 1A, and I attended Chris Canfield's eForm 19 class on March 11, so I will give it a shot. If not I have the PDF version completed and will prepare the topographic map showing the spill location.







In our last meeting you showed a picture that you said might indicate seepage from one of the pits. Could I get a copy of that picture(s)? I am researching the sensitive area determination and have provided a draft copy to CM Production and to Kirk Mueller with DG&S. John Teff and I were at the Rice field a week ago after I finished the skim pit assessments at the Oliver Warren and the S.J. Warren.

James

James W. Hix, PG | **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



From: Axelson - DNR, John [mailto:john.axelson@state.co.us]

Sent: Thursday, April 03, 2014 7:28 AM

To: James Hix

Cc: john.noto@state.co.us; Kym.Schure@state.co.us; Teff, John (johnt@cmproductionllc.com); Kirk.mueller@dgslaw.com

Subject: Re: CM Production, LLC : Produced Water Release - South Pit at the Cliff Field/Rice Lease 24-Hour Notice (Facility #116281)

James,

This is to confirm COGCC receipt of the 24-hour spill notification related to Facility ID #116281. If you can't log into the eForm 19, a PDF version of the Form 19 with the spill location map is still acceptable.

Thank you,

John

John E. Axelson, P.G.
East Environmental Supervisor



P [303.894.2100](tel:303.894.2100) x5115 | F [303.894.2109](tel:303.894.2109) | C [303-877-9964](tel:303-877-9964)

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.axelson@state.co.us | www.colorado.gov/cogcc

On Wed, Apr 2, 2014 at 5:20 PM, James Hix <jhix@olssonassociates.com> wrote:

John and Kym,

I am notifying the COGCC of a spill that occurred yesterday on the south produced water pit at CM Production's Rice Lease – Cliff Field facility Pit #116281. It appears that an animal that burrowed into the pit berm caused the release of approximately four (4) barrels of produced water. CM Production used an excavator to stop the spill and to compact the damaged area of the berm to prevent it from reoccurring. This email is submitted to satisfy the requirement for 24-hour notification of the spill. Attached is a picture of the spill location on the south berm of the south pit.

I am working on preparing the Form 19 and will submit the initial form within the 72-hours. I am unable to login to the COGCC website to complete the eForm 19, but will work on gaining access or will submit a PDF version of the Form 19.

James

James W. Hix, PG| **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



James Hix

From: Noto - DNR, John <john.noto@state.co.us>
Sent: Tuesday, April 08, 2014 4:18 PM
To: James Hix
Cc: john.axelson@state.co.us; Kym.Schure@state.co.us; Teff, John (johnt@cmproductionllc.com); Kirk.mueller@dgslaw.com; Jeremy.Ferrin@state.co.us; OGCC EnviroScan - DNR
Subject: Re: CM Production, LLC Form 19: Cliff Field, Rice Lease, South Produced Water Pit Spill Pit #116281, 4 bbls on 04/01/2014

CM Production, Rice Lease, Spill #2148452

James,

COGCC has assigned Spill #2148452 to the produced water spill at the Rice Lease, Pit #116281. Please refer to this number in future correspondence.

CM Production may submit a supplemental Form 19 within 10 days of the discovery of the spill with information not previously reported and with initial mitigation and remediation measures. COGCC may contact CM Production for the submittal of a Form 27, Site Investigation and Remediation Workplan after an evaluation of the initial assessment and initial mitigation measures. The operator shall remediate the spill in accordance with Rule 906.c.

Following removal of impacted soils, collect a sufficient number of confirmation soil samples to verify that remaining soils meet Table 910-1. Initial analysis for BTEX, TPH, SAR, EC, and pH is acceptable. Provide COGCC with a sample location diagram and an analytical summary sheet/table comparing soil confirmation sample results to Table 910-1 Standards. The excavation may remain open prior to receiving sample results unless there are safety or other concerns. Treat or dispose the excavated waste in accordance with Rule 907. Provide COGCC with waste disposal documentation for all E&P waste generated from cleanup activities.

Storm water controls shall be maintained on a regular basis for the duration of the project to prevent additional erosion. Perform routine maintenance to prevent wind erosion for duration of project. Weeds shall be controlled in accordance with COGCC Rule 1004.e. for the duration of the project.

Please call or email if you have questions or concerns.

Thank you,

John Noto

Cc: Spill #2148452

On Thu, Apr 3, 2014 at 5:03 PM, James Hix <jhix@olssonassociates.com> wrote:

Gentlemen:

Attached is the Form 19 for the 4 bbl produced water spill that occurred on 04/01/2014 as a result of an animal burrowing into the berm of the south produced water pit (Pit #116281) on the Rice Lease – Cliff Field. CM Production, LLC personnel responded to the spill using an excavator, scraped up surface soils, and compacted the area where the leak occurred.

James

James W. Hix, PG | **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



--

John Noto P.G.

Environmental Protection Specialist



P 303.400-6136 | F 303.400.6197 | C 720.498-5298

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.noto@state.co.us | www.colorado.gov/cogcc

James Hix

From: Noto - DNR, John <john.noto@state.co.us>
Sent: Wednesday, May 28, 2014 3:20 PM
To: James Hix
Cc: john.axelson@state.co.us; Kym.Schure@state.co.us; Teff, John (johnt@cmproductionllc.com); Kirk.mueller@dglaw.com; Jeremy.Ferrin@state.co.us; OGCC EnviroScan - DNR
Subject: Re: CM Production, LLC Form 27 Cliff Field, Rice Lease, South Produced Water Pit Spill Pit #116281, 4 bbls on 04/01/2014

CM Production, Rice Lease, Spill #2148452, Remediation #8444 Conditions of Approval

James,

COGCC has assigned DOC #2148997 to the Form 27 and Remediation #8444 for the produced water spill at the Rice Lease, Pit #116281. Please refer to these numbers in future correspondence regarding this project. The Form 19, Spill Report, will be closed.

COGCC concurs with the plans for excavation and restoration. Because the site will be assessed for recent and historic releases under a separate Form 27, sample collection and analysis will not be necessary for the 8'x4' excavated area. Please provide a diagram that shows the impacted area and the excavation footprint and depth. Include the location of the stockpiled soil on the diagram. Also include the location of the planned trench below the produced water pit and the restoration area. Implement controls to prevent wind erosion and storm water runoff, and control weeds in accordance with **COGCC** Rule 1004.e. for the duration of the project.

Although reclamation options for previous produced water spills are mentioned in this Form 27, **COGCC** will conditionally approve the proposed sampling, analysis and reclamation plans in the separate Form 27.

Please call or email if you have questions or concerns.

Thank you,

John **Noto**

Cc: Spill #2148997

Remediation #8444

On Fri, May 23, 2014 at 2:54 PM, James Hix <jhix@olssonassociates.com> wrote:

John,

Attached is the form 27 Workplan for the 4 barrel produced water spill (Spill #2148452) that occurred on April 1, 2014 as a result of an animal (badger) burrowing into the earthen berm of the south produced water pit (Pit #116281) at the Rice Lease. The exterior burrow was patched and the impacted soils were scraped up and placed on the berm at the time of discovery. These temporary repairs were made at the time to prevent further produced water spills; however, CM Production is proposing to use a larger excavator to patch the hole from the inside of the pit. A trench will be excavated at the exterior base of the south pit to contain any produced water that would spill over the top, and a vacuum truck will be used to remove any produced water contained within the trench.

James

James W. Hix, PG | **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



From: Noto - DNR, John [mailto:john.noto@state.co.us]

Sent: Tuesday, April 08, 2014 4:18 PM

To: James Hix

Cc: john.axelson@state.co.us; Kym.Schure@state.co.us; Teff, John (johnt@cmproductionllc.com);

Kirk.mueller@dgsllaw.com; Jeremy.Ferrin@state.co.us; OGCC EnviroScan - DNR

Subject: Re: CM Production, LLC Form 19: Cliff Field, Rice Lease, South Produced Water Pit Spill Pit #116281, 4 bbls on 04/01/2014

CM Production, Rice Lease, Spill #2148452

James,

COGCC has assigned Spill #2148452 to the produced water spill at the Rice Lease, Pit #116281. Please refer to this number in future correspondence.

CM Production may submit a supplemental Form 19 within 10 days of the discovery of the spill with information not previously reported and with initial mitigation and remediation measures. COGCC may contact CM Production for the submittal of a Form 27, Site Investigation and Remediation Workplan after an evaluation of the initial assessment and initial mitigation measures. The operator shall remediate the spill in accordance with Rule 906.c.

Following removal of impacted soils, collect a sufficient number of confirmation soil samples to verify that remaining soils meet Table 910-1. Initial analysis for BTEX, TPH, SAR, EC, and pH is acceptable. Provide COGCC with a sample location diagram and an analytical summary sheet/table comparing soil confirmation sample results to Table 910-1 Standards. The excavation may remain open prior to receiving sample results unless there are safety or other concerns. Treat or dispose the excavated waste in accordance with Rule 907. Provide COGCC with waste disposal documentation for all E&P waste generated from cleanup activities.

Storm water controls shall be maintained on a regular basis for the duration of the project to prevent additional erosion. Perform routine maintenance to prevent wind erosion for duration of project. Weeds shall be controlled in accordance with COGCC Rule 1004.e. for the duration of the project.

Please call or email if you have questions or concerns.

Thank you,

John Noto

Cc: Spill #2148452

On Thu, Apr 3, 2014 at 5:03 PM, James Hix <jhix@olssonassociates.com> wrote:

Gentlemen:

Attached is the Form 19 for the 4 bbl produced water spill that occurred on 04/01/2014 as a result of an animal burrowing into the berm of the south produced water pit (Pit #116281) on the Rice Lease – Cliff Field. CM Production, LLC personnel responded to the spill using an excavator, scraped up surface soils, and compacted the area where the leak occurred.

James

James W. Hix, PG| **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



--

John Noto P.G.

Environmental Protection Specialist



P [303.400-6136](tel:303.400.6136) | F [303.400.6197](tel:303.400.6197) | C [720.498-5298](tel:720.498.5298)

James Hix

From: Noto - DNR, John <john.noto@state.co.us>
Sent: Thursday, May 01, 2014 11:22 AM
To: Teff, John
Cc: Jeremy Ferrin - DNR; John Axelson - DNR; Kirk.mueller@dgsllaw.com; Roger Freeman (roger.freeman@dgsllaw.com) (roger.freeman@dgsllaw.com); James Hix; OGCC EnviroScan - DNR
Subject: CM Production LLC, Rice #2 Well and Production Facility, API#05-121-07216, NOAV# 200399090

Mr. Teff,

Please submit a Form 27, Site Investigation and Remediation Workplan, to COGCC for the Sensitive Area Determination at the Rice Production Facility. Form 27 submittal is a required action in NOAV #200399090. Upon receipt and approval of the Form 27, COGCC will assign a Remediation Number for referencing the plans, reports and correspondence related to activities at the Rice Facility.

Thank you for submitting the Sensitive Area Determination Report, prepared by Olsson Associates in March 2014. The report and other documents were submitted to COGCC on April 21, 2014. COGCC will review the report and documents in the context of the required corrective actions in the NOAV and will provide comments to CM Production.

Please feel free to call or email if you have questions about the Form 27 or the required corrective actions.

Best regards,

John Noto

Cc: NOAV #200399090

--

John Noto P.G.

Environmental Protection Specialist



P 303.400-6136 | F 303.400.6197 | C [720.498-5298](tel:720.498.5298)

James Hix

From: Noto - DNR, John <john.noto@state.co.us>
Sent: Friday, May 23, 2014 2:59 PM
To: James Hix
Cc: john.axelson@state.co.us; Kym.Schure@state.co.us; Teff, John (johnt@cmproductionllc.com); Kirk.mueller@dgsllaw.com; Jeremy.Ferrin@state.co.us; OGCC EnviroScan - DNR
Subject: Re: CM Production, LLC Form 27 Cliff Field, Rice Lease, South Produced Water Pit Spill Pit #116281, 4 bbls on 04/01/2014

James

I will have the Form 27 entered into the system. I'll email a the Remediation # and Document # when ready.

Thank you,

John Noto

On Fri, May 23, 2014 at 2:54 PM, James Hix <jhix@olssonassociates.com> wrote:

John,

Attached is the form 27 Workplan for the 4 barrel produced water spill (Spill #2148452) that occurred on April 1, 2014 as a result of an animal (badger) burrowing into the earthen berm of the south produced water pit (Pit #116281) at the Rice Lease. The exterior burrow was patched and the impacted soils were scraped up and placed on the berm at the time of discovery. These temporary repairs were made at the time to prevent further produced water spills; however, CM Production is proposing to use a larger excavator to patch the hole from the inside of the pit. A trench will be excavated at the exterior base of the south pit to contain any produced water that would spill over the top, and a vacuum truck will be used to remove any produced water contained within the trench.

James

James W. Hix, PG | **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



From: Noto - DNR, John [mailto:john.noto@state.co.us]

Sent: Tuesday, April 08, 2014 4:18 PM

To: James Hix

Cc: john.axelson@state.co.us; Kym.Schure@state.co.us; Teff, John (johnt@cmproductionllc.com);

Kirk.mueller@dgslaw.com; Jeremy.Ferrin@state.co.us; OGCC EnviroScan - DNR

Subject: Re: CM Production, LLC Form 19: Cliff Field, Rice Lease, South Produced Water Pit Spill Pit #116281, 4 bbls on 04/01/2014

CM Production, Rice Lease, Spill #2148452

James,

COGCC has assigned Spill #2148452 to the produced water spill at the Rice Lease, Pit #116281. Please refer to this number in future correspondence.

CM Production may submit a supplemental Form 19 within 10 days of the discovery of the spill with information not previously reported and with initial mitigation and remediation measures. COGCC may contact CM Production for the submittal of a Form 27, Site Investigation and Remediation Workplan after an evaluation of the initial assessment and initial mitigation measures. The operator shall remediate the spill in accordance with Rule 906.c.

Following removal of impacted soils, collect a sufficient number of confirmation soil samples to verify that remaining soils meet Table 910-1. Initial analysis for BTEX, TPH, SAR, EC, and pH is acceptable. Provide COGCC with a sample location diagram and an analytical summary sheet/table comparing soil confirmation sample results to Table 910-1 Standards. The excavation may remain open prior to receiving sample results unless there are safety or other concerns. Treat or dispose the excavated waste in accordance with Rule 907. Provide COGCC with waste disposal documentation for all E&P waste generated from cleanup activities.

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Thank you,

John Noto

Cc: Spill #2148452

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Gentlemen:

Attached is the Form 19 for the 4 bbl produced water spill that occurred on 04/01/2014 as a result of an animal burrowing into the berm of the south produced water pit (Pit #116281) on the Rice Lease – Cliff Field. CM Production, LLC personnel responded to the spill using an excavator, scraped up surface soils, and compacted the area where the leak occurred.

James

James W. Hix, PG| **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



James Hix

From: Noto - DNR, John <john.noto@state.co.us>
Sent: Thursday, June 05, 2014 8:18 AM
To: James Hix
Cc: Teff, John; Jeremy Ferrin - DNR; John Axelson - DNR; Kirk.mueller@dgsllaw.com; Roger Freeman (roger.freeman@dgsllaw.com) (roger.freeman@dgsllaw.com); OGCC EnviroScan - DNR; Greg Deranleau - DNR
Subject: Re: Form 27 - Sensitive Area Determination CM Production LLC, Rice #2 Well and Production Facility, API#05-121-07216, NOAV#200399090
Attachments: Form 27 Sensitive Area Determination FNL Binder 052714 signed.pdf

**CM Production LLC, Rice #2 Well and Production Facility, API#05-121-07216,
NOAV#200399090, Remediation #8461, Document #2141171**

James,

COGCC has assigned Remediation #8461 and Document #2141171 to the Form 27 for the CM Production Rice Production Facility. Comments and Conditions of Approval for the Form 27 are detailed below. A copy of the signed Form 27 is also attached for your records.

The COGCC inspection performed on January 14, 2014 (Document # 670600199) included sampling and analysis of soil and sediment collected adjacent to the facility. The findings from this limited assessment revealed apparent impacts from produced water. Based on these findings and other site conditions, COGCC prepared a Notice of Alleged Violation (NOAV), document #200399090, which was issued to CM Production on March 18, 2014. Specific abatement or corrective actions were listed on the NOAV with corrective action dates.

A Form 27, Site Investigation and Remediation Workplan was required by April 11, 2014 either for pit closure or for planning a Sensitive Area Determination if CM planned to continue using the pits. Olsson Associates submitted a Site Assessment Determination Report to COGCC in April 2014. COGCC received a Form 27 on May 27, 2014 for a Sensitive Area Determination and remediation work. The implementation schedule on the Form 27 was not filled out.

The Sensitive Area Determination Assessment Report partially fulfilled the Sensitive Area Determination in accordance with Rules 901.c. and 901.e. The Assessment Report included site specific information about the background and operational history. The Assessment Report also included a description of the regional geology, hydrogeology, and an evaluation of surface water drainages via topographic maps. However, the Assessment Report did not include site-specific groundwater conditions or characterization of potential/actual impacts to the nearby intermittent streams. The Assessment Report did not include a sampling/analysis plan to evaluate potential impacts to soil, groundwater and surface water.

The following information is necessary for completion of the Sensitive Area Determination in accordance with Rules 901.c. and 901.e. :

1. Install a temporary well or boring to log subsurface lithologies and to measure the depth to shallow groundwater or to verify that shallow groundwater is not present. Submit a map with the proposed location to COGCC and complete the boring/well no later than July 3, 2014.

2. If shallow groundwater is present or if pathways to deeper groundwater are indicated, submit a plan with proposed groundwater monitoring locations, sampling, and analysis plan. The investigation shall be performed and results reported no later than 60 days after completion of the initial shallow groundwater determination.
3. Collect and analyze samples from the intermittent drainage east of the production facility to map the extent of the produced water impacts identified by COGCC and documented in Inspection #670600199. Complete the sampling/analysis by July 3, 2014.

The samples collected east of and adjacent to produced water pit bank by COGCC had elevated SAR and pH that may be from prior pit overflows or pit seepage. Determine if the produced water pits are actively seeping into the intermittent drainage to the east. Complete this study and report the findings to COGCC by July 3, 2014. If active seeps are occurring, provide a plan to COGCC for halting any seepage into the drainage. Also implement procedures to maintain a minimum of 2-feet of freeboard in the produced water pits in accordance with Rule 902.b.

Remediate/reclaim the impacted area south of the south produced water pit to establish uniform vegetative cover that reflects at least 80% of pre-disturbance levels excluding noxious weeds. Implement best management practices to prevent erosion and control weeds during reclamation. Begin remediation by July 7, 2014.

Please call or email if you have questions or concerns.

Thank you,

John Noto

Cc: Remediation #8461

On Tue, May 27, 2014 at 9:05 AM, James Hix <jhix@olssonassociates.com> wrote:

John,

Attached is the requested Form 27 and the Sensitive Area determination per rule 901.e for the produced water pits at the Rice Lease – Cliff Field located in Logan County, Colorado.

James

James W. Hix, PG | **Olsson Associates**

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From: Noto - DNR, John [mailto:john.noto@state.co.us]

Sent: Thursday, May 01, 2014 11:22 AM

To: Teff, John

Cc: Jeremy Ferrin - DNR; John Axelson - DNR; Kirk.mueller@dgsllaw.com; Roger Freeman (roger.freeman@dgsllaw.com) (roger.freeman@dgsllaw.com); James Hix; OGCC EnviroScan - DNR

Subject: CM Production LLC, Rice #2 Well and Production Facility, API#05-121-07216, NOAV#200399090

Mr. Teff,

Please submit a Form 27, Site Investigation and Remediation Workplan, to COGCC for the Sensitive Area Determination at the Rice Production Facility. Form 27 submittal is a required action in NOAV #200399090. Upon receipt and approval of the Form 27, COGCC will assign a Remediation Number for referencing the plans, reports and correspondence related to activities at the Rice Facility.

Thank you for submitting the Sensitive Area Determination Report, prepared by Olsson Associates in March 2014. The report and other documents were submitted to COGCC on April 21, 2014. COGCC will review the report and documents in the context of the required corrective actions in the NOAV and will provide comments to CM Production.

Please feel free to call or email if you have questions about the Form 27 or the required corrective actions.

Best regards,

John Noto

Cc: NOAV #200399090

--

John Noto P.G.

Environmental Protection Specialist



P [303.400-6136](tel:303.400.6136) | F [303.400.6197](tel:303.400.6197) | C [720.498-5298](tel:720.498-5298)

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.noto@state.co.us | www.colorado.gov/cogcc

--

John Noto P.G.

Environmental Protection Specialist



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State of Colorado
Oil and Gas Conservation Commission



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

FOR OGCC USE ONLY

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.

OGCC Employee:
 Spill Complaint
 Inspection NOAV
 Tracking No:

CAUSE OF CONDITION BEING INVESTIGATED AND REMEDIATED

Spill or Release Plug & Abandon Central Facility Closure Site/Facility Closure Other (describe): Rice Sensitive Area Determination

OGCC Operator Number: <u>10352</u>	Contact Name and Telephone: <u>Mr. John Teff</u>
Name of Operator: <u>CM Production, LLC</u>	No: <u>303.534.0199</u>
Address: <u>600 17th Street, #2800 South</u>	Fax: <u>303.479.1318</u>
City: <u>Denver</u> State: <u>CO</u> Zip: <u>80202</u>	

API Number: <u>05-075-07216</u>	County: <u>Logan</u>
Facility Name: <u>Rice Production Facility</u>	Facility Number: <u>116281</u>
Well Name: <u>Rice #2</u>	Well Number: _____
Location: (QtrQtr, Sec, Twp, Rng, Meridian): <u>SW NW 33 12N 54W</u>	Latitude: <u>40.973494</u> Longitude: <u>-103.418794</u>

TECHNICAL CONDITIONS

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

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.): Rangeland and Wildlife Habitat

Soil type, if not previously identified on Form 2A or Federal Surface Use Plan: Badland, Mitchell - Keota loams (Unit #70)

Potential receptors (water wells within 1/4 mi, surface waters, etc.): No permitted water wells within one mile of the site.

An unnamed intermittent drainage is located to the east of the site. The drainage does not connect to live waters.

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>Erosion and historic EC/SAR impacts</u>	<u>Visual/COGCC Sampling on 01/14/2014</u>
<input type="checkbox"/> Vegetation	_____	_____
<input type="checkbox"/> Groundwater	_____	_____
<input type="checkbox"/> Surface Water	_____	_____

REMEDIALTION WORKPLAN

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

Olsson has prepared a Sensitive Area Determination consistent with COGCC Rule 901.e. It was previously determined to be in a Non-Sensitive Area. The site is in a Non-Sensitive Area based on a review of the the current criteria.

Describe how source is to be removed:

CM Production proposes to re-construct the earthen berms surrounding the produced water pits, and install stormwater BMPs to prevent erosion from contributing sediment or potential pollutants to the adjacent drainage from the Rice #2 well pad and the Rice production facility. BMPs may include either covering the berms with gravel or a preparing a seed bed, and planting a native grass seed mixture, and erosion control blankets. Other BMPs may include terracing or benching the slope down from the north and east produced water pits to the drainage.

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.:

According to the COGCC records, previous operators historically discharged produced water to the adjacent drainage. It is unknown how long this practice continued. CM Production has not had any produced water releases. The only way to remediate the electrical conductance (EC) and sodium adsorption ratio (SAR) impacted soils from historic releases to the adjacent drainage is to flush the soils with fresh water. The purpose of this would be to drive the salts down below the root depth or dilute the salts out. The badland soils in the drainage do not support vegetation due to erodibility, the shallow depth to bedrock, and a lack of top soil.



Tracking Number: Name of Operator: OGCC Operator No: Received Date: Well Name & No: Facility Name & No:

REMEDIATION WORKPLAN (Cont.)

OGCC Employee:

If groundwater has been impacted, describe proposed monitoring plan (# of wells or sample points, sampling schedule, analytical methods, etc.):

The depth to groundwater is reportedly greater than 100 feet. The bedrock exposed near the surface consists of the Brule Formation of the Tertiary age White River Group. According to published geologic sources, the Brule Formation is a confining member for the High Plains aquifer which consists of the overlying Arikaree and Ogallala Formations. The Brule Formation consists of impermeable claystone and is not considered part of the High Plains aquifer.

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.

Areas adjacent to the eastern produced water pit along the bank of the intermittent drainage could be seeded with a native seed mixture as a stormwater BMP. However, this would require terracing the slope, hauling in topsoil to prepare a seed bed, planting with native grasses, and covering with erosion control blankets. Vegetation growth is dependent on precipitation. Alternatively, CM Production could use permanent BMPs consisting of repairing the berm, benching the slope adjacent to the berm, and covering the earthen berm with gravel.

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:

The COGCC collected soil samples on January 14, 2014 from areas in the intermittent drainage to the east of the site that show EC and SAR levels above the Table 910-1 concentration levels. The purpose of these parameters is to remediate produced water impacts to restore cropland. According to the Logan County soil survey, these are Badland soils that are erodible and do not support vegetation. The intermittent drainage does not flow three months out of the year, there is not a significant nexus to live waters, and has no defined connection to waters of the state. CM Production has not had any releases of produced water to the drainage.

Final disposition of E&P waste (landtreated and disposed onsite, name of licensed disposal facility, recycling, reuse, etc.):

The impacted soils are the result of historic produced water discharge to the intermittent drainage adjacent to the east produced water pit. There is also an area to the south of the south produced water pit that appears to have produced water impacts, but these also appear to have occurred prior to CM Production's ownership/operation of the site based on a review of aerial photos (Google Earth July 2003). Any remedy would require the approval of the Castle Canyon Grazing Association (surface owner), but would likely require the use of large volumes of fresh water to flush the salts out of the soils. Due to the erodible nature of these soils and shallow depth to bedrock this would have to be done slowly and the outcome of the end result is questionable. Alternatively soil amendment with Epsom salt and crushed dolomite and limestone could be applied to impacted soil to adjust the SAR and topsoil hauled to the site would be needed to reduce the EC. A seed bed would need to be disked and seeded with a native grass mixture consisting of blue grama, sand dropseed, buffalograss, four-wing saltbush, and winterfat (white sage).

IMPLEMENTATION SCHEDULE

Date Site Investigation Began: Date Site Investigation Completed: Date Remediation Plan Submitted: Remediation Start Date: Anticipated Completion Date: 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: James Hix as Agent for CM Production, LLC Signed: James Hix as Agent for CM Production, LLC Title: Senior Geologist - Olsson Associates Date: 05/27/14

OGCC Approved: Title: Date:

James Hix

From: Ferrin - DNR, Jeremy <jeremy.ferrin@state.co.us>
Sent: Tuesday, June 17, 2014 8:43 AM
To: Mueller, Kirk
Cc: John Noto - DNR; John Axelson - DNR; James Hix
Subject: Re: CM Conference Call

Kirk,
After speaking last week I believe you were going to get us an update on the Form 27 for the oily waste and also a summary of the path forward agreed to during the June 6 call. When can we expect that?

Jeremy I Ferrin
Enforcement Officer



P 303.894.2100 x5186 | F 303.894.2109
1120 Lincoln Street, Suite 801, Denver, CO 80203
jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

On Fri, Jun 6, 2014 at 3:22 PM, Ferrin - DNR, Jeremy <jeremy.ferrin@state.co.us> wrote:

Gents,
I want to thank everyone for participating in today's call. I think we cleared a few things up to everyone's benefit.
On another note, and correct me if I'm wrong, but have we seen a Form 27 for remediation of the oily waste (tank bottoms) at the rice site?
Thanks,

Jeremy I Ferrin
Enforcement Officer



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jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

On Thu, Jun 5, 2014 at 2:50 PM, Ferrin - DNR, Jeremy <jeremy.ferrin@state.co.us> wrote:
Great. Just call [303.894.2100 x7641](tel:303.894.2100) at 1pm and we should be able to conference everyone in.

Jeremy I Ferrin
Enforcement Officer



P 303.894.2100 x5186 | F 303.894.2109
1120 Lincoln Street, Suite 801, Denver, CO 80203
jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

On Thu, Jun 5, 2014 at 2:47 PM, Mueller, Kirk <Kirk.Mueller@dgsllaw.com> wrote:

Thanks, 1:00 works for us (or soon thereafter, suit yourselves).

R. KIRK MUELLER ATTORNEY

P: [303.892.7456](tel:303.892.7456) ▪ C: [303.517.5004](tel:303.517.5004) ▪ [vcard](#)

Davis Graham & Stubbs LLP

1550 17th Street, Suite 500 ▪ Denver, CO 80202

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A LexMundi Member

From: Ferrin - DNR, Jeremy [mailto:jeremy.ferrin@state.co.us]
Sent: Thursday, June 05, 2014 2:43 PM
To: Mueller, Kirk; John Noto - DNR; John Axelson - DNR; James Hix
Subject: CM Conference Call

We are all available after 1pm tomorrow. Please pick a time and we can set up a conference number.

Jeremy I Ferrin
Enforcement Officer



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State of Colorado
Oil and Gas Conservation Commission



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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.

OGCC Employee:
 Spill Complaint
 Inspection NOAV
 Tracking No:

CAUSE OF CONDITION BEING INVESTIGATED AND REMEDIATED

Spill or Release Plug & Abandon Central Facility Closure Site/Facility Closure Other (describe): Investigation buried E&P waste

OGCC Operator Number: <u>10352</u>	Contact Name and Telephone: <u>John Teff</u>
Name of Operator: <u>CM Production LLC</u>	No: <u>(303) 534-0199 x 207</u>
Address: <u>390 Union Boulevard</u>	Fax: <u>(303) 479-1318</u>
City: <u>Lakewood</u> State: <u>CO</u> Zip: <u>80228</u>	

API Number: _____	County: <u>Logan</u>
Facility Name: <u>RICE-612N54W/33SEW</u>	Facility Number: <u>312243</u>
Well Name: _____	Well Number: _____
Location: (QtrQtr, Sec, Twp, Rng, Meridian): <u>SE NW 33 12N 54W</u>	Latitude: <u>40.97303</u> Longitude: <u>-103.414</u>

TECHNICAL CONDITIONS

Type of Waste Causing Impact (crude oil, condensate, produced water, etc): Crude Oil (Alleged Burial of Tank Bottoms)

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.): Range land - Cattle Grazing

Soil type, if not previously identified on Form 2A or Federal Surface Use Plan: Mitchell-Keota Loams (Unit#70)/Badland (Unit #13)

Potential receptors (water wells within 1/4 mi, surface waters, etc.): Unnamed ephemeral drainage - Approximately 450 feet east

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>Unknown - Needs Assessment/Characterization</u>	<u>Anonymous Tip/COGCC Sample HA-02 (01/14/2014)</u>
<input type="checkbox"/> Vegetation	_____	_____
<input type="checkbox"/> Groundwater	_____	_____
<input type="checkbox"/> Surface Water	_____	_____

REMEDIATION WORKPLAN

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

The nature and extent of the buried oily waste (tank bottoms) needs to be assessed and characterized. CM Production proposes to excavate the wastes in the area to delineate the area where the E&P waste was allegedly buried near the south produced water pit at 40.97341 -103.42021.

Describe how source is to be removed:

The E&P waste and impacted soil will be excavated and removed using a mini-excavator. The E&P waste and impacted soil will be placed within a lined and bermed containment cell on location.

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.:

The E&P waste will be managed in accordance with Rule 907. It is expected that the E&P waste will be land treated on site, or will be hauled to a commercial landfill (Logan County or WM facility) once the nature and extent of the waste has been defined. If the waste is land treated, a follow-up Form 27 and workplan will be submitted to the COGCC describing how the methods used to meet Table 910-1 concentration levels will be achieved. If the soils are hauled to a commercial landfill, waste manifests and documentation will be provided to the COGCC pending receipt.



Tracking Number: _____
 Name of Operator: _____
 OGCC Operator No: _____
 Received Date: _____
 Well Name & No: _____
 Facility Name & No: _____

REMIEDIATION WORKPLAN (Cont.)

OGCC Employee: _____

If groundwater has been impacted, describe proposed monitoring plan (# of wells or sample points, sampling schedule, analytical methods, etc.):

Groundwater is not expected to be impacted based on a review of available data for groundwater resources in the area and characteristics of the Brule Formation bedrock. Assessment and characterization of the oily wastes and soil impacts must be performed first in order to define the nature and extent of the impacts before initiating remediation activities. It is expected that land treatment of the oily wastes to meet Table 910-1 concentration levels or by hauling the E&P wastes (tank bottoms) offsite to a commercial landfill (Logan County landfill or WM facility) will be considered as remediation options.

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 area where the E&P wastes (tank bottoms) were allegedly buried will be excavated and either land treated onsite or disposed offsite at a commercial landfill as described above. The COGCC will be notified at least 72 hours prior to initiating the work to be able to inspect the open excavation. If necessary, CM Production will request expedited laboratory turn-around on characterization samples so as not to leave the excavation open for an extended period of time. The confirmation soil samples will be analyzed for the Table 910-1 soil parameters. The excavation will be secured with barricades as appropriate to keep livestock, wildlife, and persons out of the excavation. Upon receipt of the confirmation soil sample laboratory results documenting that insitu soils are below the Table 910-1 concentration levels, the pit will be filled with clean soils, compacted with the excavation equipment, and returned to grade. A seed bed will be prepared over the area where the wastes were buried and will be planted with a native seed mix consisting of blue grama (45%), western wheatgrass (20%), buffalograss (5%), sand dropseed (5%), winterfat (white sage(5%)), and fourwing saltbush (10%). Noxious weeds will be prevented by obtaining a seed mixture from a commercial seed company and through an ongoing eradication program as required for the site.

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:

Further sample is required. Currently there are only the sample results for the one sample (0750221 HA02) that the COGCC collected from one location (COGCC Document #670600225 and 670600226) onsite during the inspection conducted on January 14, 2014. The COGCC sample location map indicates an HA01 location, but apparently no samples were submitted from this location. The nature and extent of the E&P wastes needs to be defined. CM Production maintains that these wastes were buried prior to it acquiring the location in 2010. CM Production is also considering collection of forensic samples to assess the length of time that the wastes may have been buried in this location.

Final disposition of E&P waste (landtreated and disposed onsite, name of licensed disposal facility, recycling, reuse, etc.):

The location and depth of the alleged buried E&P wastes must be assessed and the nature and extent of the E&P wastes characterized prior to discussion of final disposition of E&P wastes. Wastes are expected to be buried at depths of more than 4 feet bgs. It is expected that the E&P wastes will be either land treated on location following COGCC Rule 907 under a COGCC approved Form 27 Workplan, or will be excavated and hauled offsite to a commercial landfill (Logan County or WM Facility) pending approval. Remediation results will be sent to the COGCC documenting land treatment progress. A request for "No Further Action" will be submitted once the treated E&P wastes and soil are below the Table 910-1 concentration levels. If the E&P wastes are disposed at a commercial landfill facility, copies of the waste manifests will be provided to the COGCC once received from the landfill.

IMPLEMENTATION SCHEDULE

Date Site Investigation Began: 01/14/2014 Date Site Investigation Completed: Est. 08/2014 Date Remediation Plan Submitted: 06/30/2014
 Remediation Start Date: _____ Anticipated Completion Date: _____ 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: James Hix - As Agent for CM Production, LLC Signed: James W. Hix as Agent for CM Production, LLC
 Title: Senior Geologist - Olsson Associates Date: 06/30/2014

OGCC Approved: _____ Title: _____ Date: _____

James Hix

From: Noto - DNR, John <john.noto@state.co.us>
Sent: Wednesday, June 25, 2014 1:50 PM
To: James Hix
Cc: Ferrin - DNR, Jeremy; john.axelson@state.co.us; Teff, John (johnt@cmproductionllc.com); Kirk.mueller@dgsllaw.com
Subject: Re: CM Production - Rice Lease NOAV #200399090 (issued 03/18/14) and Remediation #8461

James,

Please resubmit the Form 27 for oily waste at Rice Lease with a signature from the operator (or agent) and the Implementation Schedule filled out.

Thank you,

John Noto

On Tue, Jun 24, 2014 at 11:30 AM, James Hix <jhix@olssonassociates.com> wrote:

Jeremy,

Attached is the Form 27 for the oily wastes buried on the northwest corner of the south produced water pit at the Rice Lease facility. We will set up a schedule to excavate the impacted soil and place them within a containment berm in the near future.

James

James W. Hix, PG | **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



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Sent: Tuesday, June 17, 2014 8:43 AM
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Subject: Re: CM Conference Call

Kirk,

After speaking last week I believe you were going to get us an update on the Form 27 for the oily waste and also a summary of the path forward agreed to during the June 6 call. When can we expect that?

Jeremy I Ferrin
Enforcement Officer



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Thanks,

Jeremy I Ferrin
Enforcement Officer



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jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

On Thu, Jun 5, 2014 at 2:50 PM, Ferrin - DNR, Jeremy <jeremy.ferrin@state.co.us> wrote:

Great. Just call [303.894.2100 x7641](tel:303.894.2100) at 1pm and we should be able to conference everyone in.

Jeremy I Ferrin
Enforcement Officer



P [303.894.2100](tel:303.894.2100) x5186 | F [303.894.2109](tel:303.894.2109)
1120 Lincoln Street, Suite 801, Denver, CO 80203
jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

On Thu, Jun 5, 2014 at 2:47 PM, Mueller, Kirk <Kirk.Mueller@dgsllaw.com> wrote:

Thanks, 1:00 works for us (or soon thereafter, suit yourselves).

R. KIRK MUELLER ATTORNEY

P: [303.892.7456](tel:303.892.7456) ▪ C: [303.517.5004](tel:303.517.5004) ▪ [vcard](#)

Davis Graham & Stubbs LLP

1550 17th Street, Suite 500 ▪ Denver, CO 80202

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A LexMundi Member

From: Ferrin - DNR, Jeremy [mailto:jeremy.ferrin@state.co.us]
Sent: Thursday, June 05, 2014 2:43 PM

To: Mueller, Kirk; John Noto - DNR; John Axelson - DNR; James Hix
Subject: CM Conference Call

We are all available after 1pm tomorrow. Please pick a time and we can set up a conference number.

Jeremy I Ferrin
Enforcement Officer



P [303.894.2100](tel:303.894.2100) x5186 | F [303.894.2109](tel:303.894.2109)
1120 Lincoln Street, Suite 801, Denver, CO 80203
jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

--

John Noto P.G.

Environmental Protection Specialist



P 303.400-6136 | F 303.400.6197 | C 720.498-5298

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.noto@state.co.us | www.colorado.gov/cogcc

James Hix

From: Noto - DNR, John <john.noto@state.co.us>
Sent: Monday, July 14, 2014 10:19 AM
To: James Hix
Cc: Ferrin - DNR, Jeremy; john.axelson@state.co.us; Teff, John (johnt@cmproductionllc.com); Kirk.mueller@dgsllaw.com; Curtis Ditzell (curtisd@cmproductionllc.com); OGCC EnviroScan - DNR
Subject: Re: CM Production - Rice Lease NOAV #200399090 (issued 03/18/14) and Remediation #8461
Attachments: Form 27 Rice Lease 312243 Oily Wastes Binder Signed 063014 signed jn.pdf

CM Production, Rice Production Facility, API 05-075-07216, Remediation #8517, Buried Oily Waste Remediation

James,

COGCC has assigned Remediation #8517 and Document # 2141591 to the Form 27, Site Investigation and Remediation Workplan for the buried oily waste remediation at the Rice Production Facility. Please reference these numbers in future correspondence. Please note that the oily waste remediation is under a separate Remediation Number from the Sensitive Area Determination and produced water impacts. COGCC concurs with the proposed excavation and sampling plan and approves the plan with the conditions that excavation work is completed with confirmation sample results provided to COGCC by September 12, 2014, and a Form 27 for land treatment (if planned) is submitted to COGCC by September 19, 2014. COGCC must be notified in advance if unexpected or adverse conditions prevent these dates from being met.

Please feel free to call or email if you have questions or concerns. A copy of the signed/approved Form 27 is attached for your records.

Thank you,

John Noto

Cc: Remediation #8517

On Mon, Jun 30, 2014 at 5:05 PM, James Hix <jhix@olssonassociates.com> wrote:

John,

Attached is the signed Form 27 for the Rice Lease (#312243) for the oily waste that was buried on the northwest corner of the south pit identified in NOAV #200399090 (03/18/2014) and assigned remediation #8461.

James

James W. Hix, PG | **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



From: Noto - DNR, John [mailto:john.noto@state.co.us]

Sent: Wednesday, June 25, 2014 1:50 PM

To: James Hix

Cc: Ferrin - DNR, Jeremy; john.axelson@state.co.us; Teff, John (johnt@cmproductionllc.com); Kirk.mueller@dgslaw.com

Subject: Re: CM Production - Rice Lease NOAV #200399090 (issued 03/18/14) and Remediation #8461

James,

Please resubmit the Form 27 for oily waste at Rice Lease with a signature from the operator (or agent) and the Implementation Schedule filled out.

Thank you,

John Noto

On Tue, Jun 24, 2014 at 11:30 AM, James Hix <jhix@olssonassociates.com> wrote:

Jeremy,

Attached is the Form 27 for the oily wastes buried on the northwest corner of the south produced water pit at the Rice Lease facility. We will set up a schedule to excavate the impacted soil and place them within a containment berm in the near future.

James

James W. Hix, PG | **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



From: Ferrin - DNR, Jeremy [mailto:jeremy.ferrin@state.co.us]
Sent: Tuesday, June 17, 2014 8:43 AM
To: Mueller, Kirk
Cc: John Noto - DNR; John Axelson - DNR; James Hix
Subject: Re: CM Conference Call

Kirk,

After speaking last week I believe you were going to get us an update on the Form 27 for the oily waste and also a summary of the path forward agreed to during the June 6 call. When can we expect that?

Jeremy I Ferrin
Enforcement Officer



P [303.894.2100](tel:303.894.2100) x5186 | F [303.894.2109](tel:303.894.2109)
1120 Lincoln Street, Suite 801, Denver, CO 80203
jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

On Fri, Jun 6, 2014 at 3:22 PM, Ferrin - DNR, Jeremy <jeremy.ferrin@state.co.us> wrote:

Gents,

I want to thank everyone for participating in today's call. I think we cleared a few things up to everyone's benefit.

On another note, and correct me if I'm wrong, but have we seen a Form 27 for remediation of the oily waste (tank bottoms) at the rice site?

Thanks,

Jeremy I Ferrin
Enforcement Officer



P [303.894.2100](tel:303.894.2100) x5186 | F [303.894.2109](tel:303.894.2109)
1120 Lincoln Street, Suite 801, Denver, CO 80203
jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

On Thu, Jun 5, 2014 at 2:50 PM, Ferrin - DNR, Jeremy <jeremy.ferrin@state.co.us> wrote:

Great. Just call [303.894.2100](tel:303.894.2100) x7641 at 1pm and we should be able to conference everyone in.

Jeremy I Ferrin
Enforcement Officer



P [303.894.2100](tel:303.894.2100) x5186 | F [303.894.2109](tel:303.894.2109)
1120 Lincoln Street, Suite 801, Denver, CO 80203
jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

On Thu, Jun 5, 2014 at 2:47 PM, Mueller, Kirk <Kirk.Mueller@dgsllaw.com> wrote:

Thanks, 1:00 works for us (or soon thereafter, suit yourselves).

R. KIRK MUELLER ATTORNEY

P: [303.892.7456](tel:303.892.7456) ▪ C: [303.517.5004](tel:303.517.5004) ▪ [vcard](#)

Davis Graham & Stubbs LLP

1550 17th Street, Suite 500 ▪ Denver, CO 80202

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A LexMundi Member

From: Ferrin - DNR, Jeremy [mailto:jeremy.ferrin@state.co.us]
Sent: Thursday, June 05, 2014 2:43 PM
To: Mueller, Kirk; John Noto - DNR; John Axelson - DNR; James Hix
Subject: CM Conference Call

We are all available after 1pm tomorrow. Please pick a time and we can set up a conference number.

Jeremy I Ferrin
Enforcement Officer



P [303.894.2100](tel:303.894.2100) x5186 | F [303.894.2109](tel:303.894.2109)
1120 Lincoln Street, Suite 801, Denver, CO 80203
jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

--

John Noto P.G.

Environmental Protection Specialist



P [303.400-6136](tel:303.400.6136) | F [303.400.6197](tel:303.400.6197) | C [720.498-5298](tel:720.498.5298)

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.noto@state.co.us | www.colorado.gov/cogcc

--

John Noto P.G.

Environmental Protection Specialist



P [303.400-6136](tel:303.400.6136) | F [303.400.6197](tel:303.400.6197) | C [720.498-5298](tel:720.498.5298)

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.noto@state.co.us | www.colorado.gov/cogcc

James Hix

From: Ferrin - DNR, Jeremy <jeremy.ferrin@state.co.us>
Sent: Wednesday, July 23, 2014 2:10 PM
To: Mueller, Kirk; James Hix; John Axelson - DNR; John Noto - DNR
Subject: Fwd: Form 27 - Sensitive Area Determination CM Production LLC, Rice #2 Well and Production Facility, API#05-121-07216, NOAV#200399090
Attachments: Form 27 Sensitive Area Determination FNL Binder 052714 signed.pdf

James/Kirk,
As I prepare the CM AOC, I need an update on the progress of the following highlighted requirements for the Rice SAD.
Thanks,

Jeremy I Ferrin
Enforcement Officer



P 303.894.2100 x5186 | F 303.894.2109
1120 Lincoln Street, Suite 801, Denver, CO 80203
jeremy.ferrin@state.co.us | www.colorado.gov/cogcc

----- Forwarded message -----

From: Noto - DNR, John <john.noto@state.co.us>
Date: Thu, Jun 5, 2014 at 8:18 AM
Subject: Re: Form 27 - Sensitive Area Determination CM Production LLC, Rice #2 Well and Production Facility, API#05-121-07216, NOAV#200399090
To: James Hix <jhix@olssonassociates.com>
Cc: "Teff, John" <johnt@cmproductionllc.com>, Jeremy Ferrin - DNR <jeremy.ferrin@state.co.us>, John Axelson - DNR <john.axelson@state.co.us>, "Kirk.mueller@dgsllaw.com" <Kirk.mueller@dgsllaw.com>, "Roger Freeman (roger.freeman@dgsllaw.com) (roger.freeman@dgsllaw.com)" <roger.freeman@dgsllaw.com>, OGCC EnviroScan - DNR <OGCC.EnviroScan@state.co.us>, Greg Deranleau - DNR <greg.deranleau@state.co.us>

**CM Production LLC, Rice #2 Well and Production Facility, API#05-121-07216,
NOAV#200399090, Remediation #8461, Document #2141171**

James,

COGCC has assigned Remediation #8461 and Document #2141171 to the Form 27 for the CM Production Rice Production Facility. Comments and Conditions of Approval for the Form 27 are detailed below. A copy of the signed Form 27 is also attached for your records.

The COGCC inspection performed on January 14, 2014 (Document # 670600199) included sampling and analysis of soil and sediment collected adjacent to the facility. The findings from this limited assessment revealed apparent impacts from produced water. Based on these findings and other site conditions, COGCC prepared a Notice of Alleged Violation (NOAV), document #200399090, which was issued to CM Production on March 18, 2014. Specific abatement or corrective actions were listed on the NOAV with corrective action dates.

A Form 27, Site Investigation and Remediation Workplan was required by April 11, 2014 either for pit closure or for planning a Sensitive Area Determination if CM planned to continue using the pits. Olsson Associates submitted a Site Assessment Determination Report to COGCC in April 2014. COGCC received a Form 27 on May 27, 2014 for a Sensitive Area Determination and remediation work. The implementation schedule on the Form 27 was not filled out.

The Sensitive Area Determination Assessment Report partially fulfilled the Sensitive Area Determination in accordance with Rules 901.c. and 901.e. The Assessment Report included site specific information about the background and operational history. The Assessment Report also included a description of the regional geology, hydrogeology, and an evaluation of surface water drainages via topographic maps. However, the Assessment Report did not include site-specific groundwater conditions or characterization of potential/actual impacts to the nearby intermittent streams. The Assessment Report did not include a sampling/analysis plan to evaluate potential impacts to soil, groundwater and surface water.

The following information is necessary for completion of the Sensitive Area Determination in accordance with Rules 901.c. and 901.e. :

1. Install a temporary well or boring to log subsurface lithologies and to measure the depth to shallow groundwater or to verify that shallow groundwater is not present. Submit a map with the proposed location to COGCC and complete the boring/well no later than July 3, 2014.
2. If shallow groundwater is present or if pathways to deeper groundwater are indicated, submit a plan with proposed groundwater monitoring locations, sampling, and analysis plan. The investigation shall be performed and results reported no later than 60 days after completion of the initial shallow groundwater determination.
3. Collect and analyze samples from the intermittent drainage east of the production facility to map the extent of the produced water impacts identified by COGCC and documented in Inspection #670600199. Complete the sampling/analysis by July 3, 2014.

The samples collected east of and adjacent to produced water pit bank by COGCC had elevated SAR and pH that may be from prior pit overflows or pit seepage. Determine if the produced water pits are actively seeping into the intermittent drainage to the east. Complete this study and report the findings to COGCC by July 3, 2014. If active seeps are occurring, provide a plan to COGCC for halting any seepage into the drainage. Also implement procedures to maintain a minimum of 2-feet of freeboard in the produced water pits in accordance with Rule 902.b.

Remediate/reclaim the impacted area south of the south produced water pit to establish uniform vegetative cover that reflects at least 80% of pre-disturbance levels excluding noxious weeds. Implement best management practices to prevent erosion and control weeds during reclamation. Begin remediation by July 7, 2014.

Please call or email if you have questions or concerns.

Thank you,

John Noto

Cc: Remediation #8461

On Tue, May 27, 2014 at 9:05 AM, James Hix <jhix@olssonassociates.com> wrote:

John,

Attached is the requested Form 27 and the Sensitive Area determination per rule 901.e for the produced water pits at the Rice Lease – Cliff Field located in Logan County, Colorado.

James

James W. Hix, PG | **Olsson Associates**

4690 Table Mountain Drive, Suite 200 | Golden, CO 80403 | jhix@olssonassociates.com

TEL [303.237.2072](tel:303.237.2072) | DIR [303.374.3139](tel:303.374.3139) | CELL [303.589.1572](tel:303.589.1572) | FAX [303.237.2659](tel:303.237.2659)



From: Noto - DNR, John [mailto:john.noto@state.co.us]

Sent: Thursday, May 01, 2014 11:22 AM

To: Teff, John

Cc: Jeremy Ferrin - DNR; John Axelson - DNR; Kirk.mueller@dgsllaw.com; Roger Freeman (roger.freeman@dgsllaw.com) (roger.freeman@dgsllaw.com); James Hix; OGCC EnviroScan - DNR

Subject: CM Production LLC, Rice #2 Well and Production Facility, API#05-121-07216, NOAV#200399090

Mr. Teff,

Please submit a Form 27, Site Investigation and Remediation Workplan, to COGCC for the Sensitive Area Determination at the Rice Production Facility. Form 27 submittal is a required action in NOAV

#200399090. Upon receipt and approval of the Form 27, COGCC will assign a Remediation Number for referencing the plans, reports and correspondence related to activities at the Rice Facility.

Thank you for submitting the Sensitive Area Determination Report, prepared by Olsson Associates in March 2014. The report and other documents were submitted to COGCC on April 21, 2014. COGCC will review the report and documents in the context of the required corrective actions in the NOAV and will provide comments to CM Production.

Please feel free to call or email if you have questions about the Form 27 or the required corrective actions.

Best regards,

John Noto

Cc: NOAV #200399090

--

John Noto P.G.

Environmental Protection Specialist



P [303.400-6136](tel:303.400.6136) | F [303.400.6197](tel:303.400.6197) | C [720.498-5298](tel:720.498-5298)

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.noto@state.co.us | www.colorado.gov/cogcc

--

John Noto P.G.

Environmental Protection Specialist



P 303.400-6136 | F 303.400.6197 | C [720.498-5298](tel:7204985298)

1120 Lincoln Street, Suite 801, Denver, CO 80203

john.noto@state.co.us | www.colorado.gov/cogcc

APPENDIX B
SITE PHOTOGRAPHS



Subject: A John Deere 35D Was used to excavate the tank bottoms oily waste from an area northwest of the south produced water pit.

Date: 07/23/2014

View: East



Subject: A trench was excavated around the perimeter of the south produced water pit, oily waste excavation. Impacted soils and E&P waste removed from the excavation were placed on plastic.

Date: 07/23/2014

View: West



Subject: Impacted soils and E&P oily wastes/tank bottoms were placed on plastic.

Date: 07/23/2014

View: West



Subject: Impacted soils and E&P tank bottoms oily wastes were stockpiled on plastic. Approximately 10 cubic yards of impacted materials were estimated to have been removed.

Date: 07/23/2014

View: Northeast



Subject: Photograph shows the excavation for the tank bottom wastes. The excavation measured approximately 10 feet wide by 15 feet in length and was approximately 8 feet deep.

Date: 07/23/2014

View: West



Subject: The excavation for the tank bottom wastes did not exhibit any apparent staining.

Date: 07/23/2014

View: South



Subject: Photograph shows the location of hand auger hole for piezometer, PZ-1, looking up the main drainage from the southeast corner of the southeast pit. Moisture was observed along both banks of the drainage.

Date: 07/23/2014

View: Northwest



Subject: Photograph shows the location of the hand auger hole and 1" diameter by ten feet PVC casing for piezometer, PZ-1.

Date: 07/23/2014

View: Southwest



Subject: Photograph shows the piezometer, PZ-1, and hand auger after being set and the elevation above the base of the drainage. The piezometer remained dry during the site visit.

Date: 07/23/2014

View: Northwest



Subject: The excavator was used to collect soil samples from the side walls and base of the tank bottom waste excavation.

Date: 07/23/2014

View: East



Subject: Photograph shows the location of the sampling points in the tank bottom oily waste excavation.

Date: 07/23/2014

View: South



Subject: Photograph shows the location of the sampling points in the tank bottom oily waste excavation. No apparent staining was observed in the sidewalls or the base of the excavation and excavated soils did not exhibit any odor.

Date: 07/23/2014

View: North



Subject: Photograph shows the main drainage from the bench near the Rice #2 well and the southeast pit.

Date: 07/23/2014

View: North



Subject: Moisture was observed in the banks on both sides of the drainage. The pits are shown on the right side of the photograph. Moisture is shown seeping on the east side of the drainage on the left side of the photograph. The Rice #2 oil well is shown at the center left.

Date: 07/23/2014

View: Southwest



Subject: Photograph shows vegetation along the drainage near the north pit.

Date: 07/23/2014

View: Northwest



Subject: Moisture was observed in the banks along both sides of the main drainage near the north end of the southeast pit.

Date: 07/23/2014

View: North



Subject: Moisture and standing water was observed in a side drainage down from the north pit.

Date: 07/23/2014

View: West



Subject: A grab water sample was collected from the water in the side drainage down from the north pit near where it met the main drainage. There was no apparent sheen on the water or odor.

Date: 07/23/2014

View: North



Subject: An area lacking vegetation was observed on the south side of the south pit.

Date: 07/23/2014

View: Northwest



Subject: Photograph shows the area south of the south pit that lacks vegetation. Four surface soil samples were collected from this area and submitted for analysis of sodium adsorption ratio (SAR) to assess historical produced water impacts.

Date: 07/23/2014

View: West



Subject: A trench and berm were constructed along the perimeter of the south pit to contain produced water during the repairs to the south berm.

Date: 07/23/2014

View: West

APPENDIX C
ACCUTEST LABORATORIES
SOIL SAMPLE RESULTS

Technical Report for

Olsson Associates - Denver

CM Production LLC, Rice Lease Logan County Co

014-0704

Accutest Job Number: D60078

Sampling Date: 07/23/14

Report to:

**Olsson Associates
4690 Table Mountain Drive #200 Suite 200
Golden, CO 80403
jhix@olssonassociates.com**

ATTN: James Hix

Total number of pages in report: 120



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.



**Scott Heideman
Laboratory Director**

Client Service contact: Renea Jackson 303-425-6021

Certifications: CO (CO00049), ID, NE (CO00049), ND (R-027), NJ (CO 0007), OK (D9942), UT (NELAP CO00049), TX (T104704511)

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Test results relate only to samples analyzed.

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Sample Summary

Olsson Associates - Denver

Job No: D60078

CM Production LLC, Rice Lease Logan County Co
 Project No: 014-0704

Sample Number	Collected		Received	Matrix		Client Sample ID
	Date	Time By		Code	Type	
D60078-1	07/23/14	14:15 JWH	07/24/14	SO	Soil	TBE-NE @6'
D60078-2	07/23/14	14:23 JWH	07/24/14	SO	Soil	TBE-SW @6'
D60078-3	07/23/14	14:27 JWH	07/24/14	SO	Soil	TBE-SE @6'
D60078-4	07/23/14	14:40 JWH	07/24/14	SO	Soil	TBE-B @8'
D60078-5	07/23/14	14:52 JWH	07/24/14	SO	Soil	TBE-NW @6'
D60078-6	07/23/14	15:13 JWH	07/24/14	SO	Soil	TBE-WC
D60078-7	07/23/14	15:22 JWH	07/24/14	SO	Soil	TBE-CO
D60078-8	07/23/14	12:44 JWH	07/24/14	AQ	Water	NPD-SW
D60078-9	07/23/14	13:50 JWH	07/24/14	AQ	Water	SE PIT
D60078-10A	07/23/14	15:41 JWH	07/24/14	SO	Soil	SAE-SP-0-1"
D60078-11A	07/23/14	15:43 JWH	07/24/14	SO	Soil	SAC-SP-0-1"
D60078-12A	07/23/14	15:44 JWH	07/24/14	SO	Soil	SAW-SP-0-1"
D60078-13A	07/23/14	15:47 JWH	07/24/14	SO	Soil	SAS-SP-0-1"

Soil samples reported on a dry weight basis unless otherwise indicated on result page.



CASE NARRATIVE / CONFORMANCE SUMMARY

Client: Olsson Associates - Denver

Job No D60078

Site: CM Production LLC, Rice Lease Logan County Co

Report Date 8/4/2014 9:54:12 AM

On 07/24/2014, 13 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 5.1 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D60078 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Volatiles by GCMS By Method SW846 8260B

Matrix SO	Batch ID: V3V1852
------------------	--------------------------

- All samples were analyzed within the recommended method holding time.
- Sample(s) D60124-2MS, D60124-2MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

Matrix SO	Batch ID: V3V1853
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- All samples were analyzed within the recommended method holding time.
- Sample(s) D60162-1MS, D60162-2DUP were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

Extractables by GCMS By Method SW846 8270C BY SIM

Matrix SO	Batch ID: OP10310
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- All samples were extracted and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D60078-2MS, D60078-2MSD were used as the QC samples indicated.
- D60078-6: Elevated reporting limits due to sample matrix, dilution required during sample prep and analysis.
- D60078-5: Dilution required due to matrix interference. Internal standard failure without dilution.

Volatiles by GC By Method SW846 8015B

Matrix SO	Batch ID: GGA1271
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- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D60133-1MS, D60133-1MSD were used as the QC samples indicated.
- Sample(s) D60078-5, D60078-6, D60078-7 have surrogates outside control limits. Probable cause due to matrix interference.
- D60078-5,-6,-7 for 1,2,4 Trichlorobenzene: Outside control limits due to possible matrix interference.

Extractables by GC By Method SW846-8015B

Matrix SO	Batch ID: OP10309
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- All samples were extracted and analyzed within the recommended method holding time.
- Sample(s) D60078-1MS, D60078-1MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

Matrix SO	Batch ID: OP10318
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- All samples were extracted and analyzed within the recommended method holding time.
- Sample(s) D60162-3MS, D60162-3MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

Metals By Method SW846 6010C

Matrix AQ	Batch ID: MP13579
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- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D60227-3MS, D60227-3MSD, D60227-3SDL were used as the QC samples for the metals analysis.
- The matrix spike (MS) recovery(s) of Sodium are outside control limits. Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

Matrix SO	Batch ID: MP13542
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- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D60044-1MS, D60044-1MSD, D60044-1SDL were used as the QC samples for the metals analysis.
- The matrix spike (MS) recovery(s) of Barium, Silver are outside control limits. Spike recovery indicates possible matrix interference.
- The matrix spike duplicate (MSD) recovery(s) of Silver are outside control limits. Probable cause due to matrix interference.
- The serial dilution RPD(s) for Cadmium, Lead, Barium, Nickel, Zinc are outside control limits for sample MP13542-SD1. Percent difference acceptable due to low initial sample concentration (< 50 times IDL).
- MP13542-SD1 for Zinc, Nickel, Barium: Serial dilution indicates possible matrix interference.

Metals By Method SW846 6020A

Matrix SO	Batch ID: MP13546
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- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D60044-1MS, D60044-1MSD, D60044-1SDL were used as the QC samples for the metals analysis.
- The serial dilution RPD(s) for Arsenic are outside control limits for sample MP13546-SD1. Probable cause due to sample homogeneity.
- MP13546-SD1 for Arsenic: Serial dilution indicates possible matrix interference.

Metals By Method SW846 7471B

Matrix SO	Batch ID: MP13583
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- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D60078-1MS, D60078-1MSD were used as the QC samples for the metals analysis.

Wet Chemistry By Method ASTM D1498-76M

Matrix SO	Batch ID: GN25749
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- Sample(s) D60078-1DUP were used as the QC samples for the Redox Potential Vs H2 analysis.

Wet Chemistry By Method EPA 300.0/SW846 9056

Matrix AQ	Batch ID: GP13145
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- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D60119-5MS, D60119-5MSD were used as the QC samples for the Chloride, Sulfate, Chloride analysis.
- D60078-8 for Sulfate: Elevated detection limit due to matrix interference.

Wet Chemistry By Method SM 2540C-2011

Matrix AQ	Batch ID: GN25761
------------------	--------------------------

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D60078-9DUP were used as the QC samples for the Solids, Total Dissolved analysis.

Wet Chemistry By Method SM2540G-2011 M

Matrix SO	Batch ID: GN25729
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- The data for SM2540G-2011 M meets quality control requirements.

Wet Chemistry By Method SW846 3060A/7196A

Matrix SO	Batch ID: GP13184
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- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D60078-4DUP, D60078-4MS, D60078-4MSD were used as the QC samples for the Chromium, Hexavalent analysis.

Wet Chemistry By Method SW846 3060A/7196A M

Matrix SO	Batch ID: R22910
------------------	-------------------------

- The data for SW846 3060A/7196A M meets quality control requirements.
- D60078-5 for Chromium, Trivalent: Calculated as: (Chromium) - (Chromium, Hexavalent)

Matrix SO	Batch ID: R22911
------------------	-------------------------

- The data for SW846 3060A/7196A M meets quality control requirements.
- D60078-4 for Chromium, Trivalent: Calculated as: (Chromium) - (Chromium, Hexavalent)

Matrix SO	Batch ID: R22912
------------------	-------------------------

- The data for SW846 3060A/7196A M meets quality control requirements.
- D60078-1 for Chromium, Trivalent: Calculated as: (Chromium) - (Chromium, Hexavalent)

Matrix SO	Batch ID: R22913
------------------	-------------------------

- The data for SW846 3060A/7196A M meets quality control requirements.
- D60078-2 for Chromium, Trivalent: Calculated as: (Chromium) - (Chromium, Hexavalent)

Matrix SO	Batch ID: R22914
------------------	-------------------------

- The data for SW846 3060A/7196A M meets quality control requirements.
- D60078-3 for Chromium, Trivalent: Calculated as: (Chromium) - (Chromium, Hexavalent)

Wet Chemistry By Method SW846 9045D

Matrix SO

Batch ID: GN25735

- The following samples were run outside of holding time for method SW846 9045D: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Wet Chemistry By Method USDA HANDBOOK 60

Matrix SO

Batch ID: MP13579

- D60078-10A for Sodium Adsorption Ratio: Calculated as: $(\text{Na meq/L}) / \sqrt{[(\text{Ca meq/L})+(\text{Mg meq/L})/2]}$
- D60078-11A,-12A,13A for Sodium Adsorption Ratio: Calculated as: $(\text{Na meq/L}) / \sqrt{[(\text{Ca meq/L})+(\text{Mg meq/L})/2]}$

AMS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting AMS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

AMS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by AMS indicated via signature on the report cover.

Summary of Hits

Job Number: D60078
Account: Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co
Collected: 07/23/14



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
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D60078-1 TBE-NE @6'

Arsenic	4.5	0.12			mg/kg	SW846 6020A
Barium	261	1.2			mg/kg	SW846 6010C
Chromium	4.6	1.2			mg/kg	SW846 6010C
Copper	5.6	1.2			mg/kg	SW846 6010C
Nickel	5.1	3.5			mg/kg	SW846 6010C
Zinc	19.4	3.5			mg/kg	SW846 6010C
Chromium, Trivalent ^a	4.6	2.2			mg/kg	SW846 3060A/7196A M
Redox Potential Vs H2	482				mv	ASTM D1498-76M
pH	8.12				su	SW846 9045D

D60078-2 TBE-SW @6'

Chrysene	15.1	5.1	2.5		ug/kg	SW846 8270C BY SIM
TPH-DRO (C10-C28)	18.4	7.9	5.9		mg/kg	SW846-8015B
Arsenic	4.1	0.12			mg/kg	SW846 6020A
Barium	234	1.2			mg/kg	SW846 6010C
Chromium	4.9	1.2			mg/kg	SW846 6010C
Copper	6.1	1.2			mg/kg	SW846 6010C
Nickel	5.4	3.5			mg/kg	SW846 6010C
Zinc	21.4	3.5			mg/kg	SW846 6010C
Chromium, Trivalent ^a	4.9	2.2			mg/kg	SW846 3060A/7196A M
Redox Potential Vs H2	445				mv	ASTM D1498-76M
pH	8.66				su	SW846 9045D

D60078-3 TBE-SE @6'

Arsenic	4.2	0.11			mg/kg	SW846 6020A
Barium	290	1.1			mg/kg	SW846 6010C
Chromium	4.8	1.1			mg/kg	SW846 6010C
Copper	6.2	1.1			mg/kg	SW846 6010C
Lead	6.8	5.5			mg/kg	SW846 6010C
Nickel	5.3	3.3			mg/kg	SW846 6010C
Zinc	21.1	3.3			mg/kg	SW846 6010C
Chromium, Trivalent ^a	4.8	2.1			mg/kg	SW846 3060A/7196A M
Redox Potential Vs H2	461				mv	ASTM D1498-76M
pH	8.65				su	SW846 9045D

D60078-4 TBE-B @8'

Arsenic	4.2	0.11			mg/kg	SW846 6020A
Barium	266	1.1			mg/kg	SW846 6010C
Chromium	4.7	1.1			mg/kg	SW846 6010C
Copper	5.7	1.1			mg/kg	SW846 6010C

Summary of Hits

Job Number: D60078
Account: Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co
Collected: 07/23/14



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
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Lead		5.7	5.7		mg/kg	SW846 6010C
Nickel		5.2	3.4		mg/kg	SW846 6010C
Zinc		20.5	3.4		mg/kg	SW846 6010C
Chromium, Trivalent ^a		4.7	2.1		mg/kg	SW846 3060A/7196A M
Redox Potential Vs H2		448			mv	ASTM D1498-76M
pH		8.83			su	SW846 9045D

D60078-5 TBE-NW @6'

Benzo(b)fluoranthene ^b		202	20	13	ug/kg	SW846 8270C BY SIM
Chrysene ^b		782	20	9.9	ug/kg	SW846 8270C BY SIM
Fluorene ^b		759	100	73	ug/kg	SW846 8270C BY SIM
Naphthalene ^b		122	20	12	ug/kg	SW846 8270C BY SIM
Pyrene ^b		514	20	12	ug/kg	SW846 8270C BY SIM
TPH-GRO (C6-C10)		47.1	14	6.8	mg/kg	SW846 8015B
TPH-DRO (C10-C28)		8080	390	300	mg/kg	SW846-8015B
Arsenic		4.1	0.11		mg/kg	SW846 6020A
Barium		229	1.1		mg/kg	SW846 6010C
Chromium		4.9	1.1		mg/kg	SW846 6010C
Copper		6.1	1.1		mg/kg	SW846 6010C
Nickel		5.3	3.4		mg/kg	SW846 6010C
Zinc		20.7	3.4		mg/kg	SW846 6010C
Chromium, Trivalent ^a		4.9	2.1		mg/kg	SW846 3060A/7196A M
Redox Potential Vs H2		413			mv	ASTM D1498-76M
pH		9.07			su	SW846 9045D

D60078-6 TBE-WC

Ethylbenzene		401	140	26	ug/kg	SW846 8260B
Xylene (total)		19600	280	140	ug/kg	SW846 8260B
Benzo(b)fluoranthene ^c		490	78	48	ug/kg	SW846 8270C BY SIM
Chrysene ^c		2190	78	38	ug/kg	SW846 8270C BY SIM
Fluoranthene ^c		510	78	44	ug/kg	SW846 8270C BY SIM
Fluorene ^c		5140	78	56	ug/kg	SW846 8270C BY SIM
Naphthalene ^c		8310	78	47	ug/kg	SW846 8270C BY SIM
Pyrene ^c		1420	78	45	ug/kg	SW846 8270C BY SIM
TPH-GRO (C6-C10)		830	140	69	mg/kg	SW846 8015B
TPH-DRO (C10-C28)		22900	790	600	mg/kg	SW846-8015B

D60078-7 TBE-CO

TPH-GRO (C6-C10)		17.7	13	6.4	mg/kg	SW846 8015B
TPH-DRO (C10-C28)		4890	300	230	mg/kg	SW846-8015B

Summary of Hits

Job Number: D60078
Account: Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co
Collected: 07/23/14



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
D60078-8	NPD-SW					
Chloride		8380	500		mg/l	EPA 300.0/SW846 9056
Solids, Total Dissolved		15100	10		mg/l	SM 2540C-2011
D60078-9	SE PIT					
Chloride		5800	250		mg/l	EPA 300.0/SW846 9056
Solids, Total Dissolved		11900	10		mg/l	SM 2540C-2011
Sulfate		38.9	1.0		mg/l	EPA 300.0/SW846 9056
D60078-10A	SAE-SP-0-1"					
Calcium		293	2.0		mg/l	SW846 6010C
Magnesium		36.1	1.0		mg/l	SW846 6010C
Sodium		509	2.0		mg/l	SW846 6010C
Sodium Adsorption Ratio ^d		7.46			ratio	USDA HANDBOOK 60
D60078-11A	SAC-SP-0-1"					
Calcium		5530	20		mg/l	SW846 6010C
Magnesium		421	1.0		mg/l	SW846 6010C
Sodium		33000	20		mg/l	SW846 6010C
Sodium Adsorption Ratio ^d		115			ratio	USDA HANDBOOK 60
D60078-12A	SAW-SP-0-1"					
Calcium		7100	20		mg/l	SW846 6010C
Magnesium		662	1.0		mg/l	SW846 6010C
Sodium		1500	20		mg/l	SW846 6010C
Sodium Adsorption Ratio ^d		4.56			ratio	USDA HANDBOOK 60
D60078-13A	SAS-SP-0-1"					
Calcium		1320	20		mg/l	SW846 6010C
Magnesium		107	1.0		mg/l	SW846 6010C
Sodium		11900	20		mg/l	SW846 6010C
Sodium Adsorption Ratio ^d		84.6			ratio	USDA HANDBOOK 60

- (a) Calculated as: (Chromium) - (Chromium, Hexavalent)
- (b) Dilution required due to matrix interference. Internal standard failure without dilution.
- (c) Elevated reporting limits due to sample matrix, dilution required during sample prep and analysis.
- (d) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID: TBE-NE @6'	
Lab Sample ID: D60078-1	Date Sampled: 07/23/14
Matrix: SO - Soil	Date Received: 07/24/14
Method: SW846 8260B	Percent Solids: 86.0
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3V31685.D	1	07/25/14	JL	n/a	n/a	V3V1852
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.01 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	66	25	ug/kg	
108-88-3	Toluene	ND	130	66	ug/kg	
100-41-4	Ethylbenzene	ND	130	25	ug/kg	
1330-20-7	Xylene (total)	ND	260	130	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	91%		64-130%
460-00-4	4-Bromofluorobenzene	99%		62-131%
17060-07-0	1,2-Dichloroethane-D4	101%		70-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.1
4

Report of Analysis

Client Sample ID: TBE-NE @6'		
Lab Sample ID: D60078-1		Date Sampled: 07/23/14
Matrix: SO - Soil		Date Received: 07/24/14
Method: SW846 8270C BY SIM SW846 3546		Percent Solids: 86.0
Project: CM Production LLC, Rice Lease Logan County Co		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G20661.D	1	07/25/14	DC	07/25/14	OP10310	E3G1024
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

COGCC Table 910-1 PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	5.0	3.9	ug/kg	
120-12-7	Anthracene	ND	5.0	3.5	ug/kg	
56-55-3	Benzo(a)anthracene	ND	5.0	2.4	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	5.0	3.1	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	5.0	2.5	ug/kg	
50-32-8	Benzo(a)pyrene	ND	5.0	2.4	ug/kg	
218-01-9	Chrysene	ND	5.0	2.4	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	5.0	2.4	ug/kg	
206-44-0	Fluoranthene	ND	5.0	2.8	ug/kg	
86-73-7	Fluorene	ND	5.0	3.6	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	5.0	2.4	ug/kg	
91-20-3	Naphthalene	ND	5.0	3.0	ug/kg	
129-00-0	Pyrene	ND	5.0	2.9	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	64%		11-164%
321-60-8	2-Fluorobiphenyl	70%		14-138%
1718-51-0	Terphenyl-d14	78%		35-139%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.1
 4

Report of Analysis

Client Sample ID: TBE-NE @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-1	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 86.0
Method: SW846 8015B	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GA22763.D	1	07/29/14	BR	n/a	n/a	GGA1271
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.0 g	5.0 ml	100 ul
Run #2			

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	13	6.6	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	94%		60-140%		

ND = Not detected MDL = Method Detection Limit
 RL = Reporting Limit
 E = Indicates value exceeds calibration range

J = Indicates an estimated value
 B = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

4.1
4

Report of Analysis

Client Sample ID: TBE-NE @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-1	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 86.0
Method: SW846-8015B SW846 3546	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI14589.D	1	07/25/14	JS	07/25/14	OP10309	GFI878
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	7.7	5.8	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	71%		20-130%		

ND = Not detected MDL = Method Detection Limit
 RL = Reporting Limit
 E = Indicates value exceeds calibration range

J = Indicates an estimated value
 B = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

4.1
4

Report of Analysis

Client Sample ID: TBE-NE @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-1	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 86.0
Project: CM Production LLC, Rice Lease Logan County Co	

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	4.5	0.12	mg/kg	5	07/28/14	07/28/14 NT	SW846 6020A ²	SW846 3050B ⁶
Barium	261	1.2	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Cadmium	< 1.2	1.2	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Chromium	4.6	1.2	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Copper	5.6	1.2	mg/kg	1	07/28/14	07/29/14 KV	SW846 6010C ³	SW846 3050B ⁵
Lead	< 5.8	5.8	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Mercury	< 0.097	0.097	mg/kg	1	08/01/14	08/01/14 SM	SW846 7471B ⁴	SW846 7471B ⁷
Nickel	5.1	3.5	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Selenium	< 5.8	5.8	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Silver	< 3.5	3.5	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Zinc	19.4	3.5	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵

- (1) Instrument QC Batch: MA5031
- (2) Instrument QC Batch: MA5035
- (3) Instrument QC Batch: MA5039
- (4) Instrument QC Batch: MA5052
- (5) Prep QC Batch: MP13542
- (6) Prep QC Batch: MP13546
- (7) Prep QC Batch: MP13583

RL = Reporting Limit

4.1
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Report of Analysis

Client Sample ID: TBE-NE @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-1	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 86.0
Project: CM Production LLC, Rice Lease Logan County Co	

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
%solids							
Solids, Percent	86		%	1	07/25/14	SWT	SM2540G-2011 M
Chromium, Hexavalent	< 1.0	1.0	mg/kg	1	08/01/14	AK	SW846 3060A/7196A
Chromium, Trivalent ^a	4.6	2.2	mg/kg	1	08/01/14	AK	SW846 3060A/7196A M
Redox Potential Vs H2	482		mv	1	07/28/14	JD	ASTM D1498-76M
pH	8.12		su	1	07/25/14 11:15	JB	SW846 9045D

(a) Calculated as: (Chromium) - (Chromium, Hexavalent)

RL = Reporting Limit

4.1
 4

Report of Analysis

Client Sample ID: TBE-SW @6'	
Lab Sample ID: D60078-2	Date Sampled: 07/23/14
Matrix: SO - Soil	Date Received: 07/24/14
Method: SW846 8260B	Percent Solids: 84.1
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3V31686.D	1	07/25/14	JL	n/a	n/a	V3V1852
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.07 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	68	26	ug/kg	
108-88-3	Toluene	ND	140	68	ug/kg	
100-41-4	Ethylbenzene	ND	140	26	ug/kg	
1330-20-7	Xylene (total)	ND	270	140	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	91%		64-130%
460-00-4	4-Bromofluorobenzene	95%		62-131%
17060-07-0	1,2-Dichloroethane-D4	97%		70-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.2
4

Report of Analysis

Client Sample ID: TBE-SW @6'		
Lab Sample ID: D60078-2		Date Sampled: 07/23/14
Matrix: SO - Soil		Date Received: 07/24/14
Method: SW846 8270C BY SIM SW846 3546		Percent Solids: 84.1
Project: CM Production LLC, Rice Lease Logan County Co		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G20658.D	1	07/25/14	DC	07/25/14	OP10310	E3G1024
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.2 g	1.0 ml
Run #2		

COGCC Table 910-1 PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	5.1	3.9	ug/kg	
120-12-7	Anthracene	ND	5.1	3.5	ug/kg	
56-55-3	Benzo(a)anthracene	ND	5.1	2.5	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	5.1	3.2	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	5.1	2.5	ug/kg	
50-32-8	Benzo(a)pyrene	ND	5.1	2.5	ug/kg	
218-01-9	Chrysene	15.1	5.1	2.5	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	5.1	2.5	ug/kg	
206-44-0	Fluoranthene	ND	5.1	2.9	ug/kg	
86-73-7	Fluorene	ND	5.1	3.7	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	5.1	2.5	ug/kg	
91-20-3	Naphthalene	ND	5.1	3.1	ug/kg	
129-00-0	Pyrene	ND	5.1	3.0	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	79%		11-164%
321-60-8	2-Fluorobiphenyl	88%		14-138%
1718-51-0	Terphenyl-d14	84%		35-139%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.2
4

Report of Analysis

Client Sample ID: TBE-SW @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-2	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 84.1
Method: SW846 8015B	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GA22764.D	1	07/29/14	BR	n/a	n/a	GGA1271
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.1 g	5.0 ml	100 ul
Run #2			

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	14	6.8	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	91%		60-140%		

ND = Not detected MDL = Method Detection Limit
 RL = Reporting Limit
 E = Indicates value exceeds calibration range

J = Indicates an estimated value
 B = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

4.2
4

Report of Analysis

Client Sample ID: TBE-SW @6'		Date Sampled: 07/23/14
Lab Sample ID: D60078-2		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: 84.1
Method: SW846-8015B SW846 3546		
Project: CM Production LLC, Rice Lease Logan County Co		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI14602.D	1	07/25/14	JS	07/25/14	OP10309	GFI877
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.2 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	18.4	7.9	5.9	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	78%		20-130%		

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.2
4

Report of Analysis

Client Sample ID: TBE-SW @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-2	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 84.1
Project: CM Production LLC, Rice Lease Logan County Co	

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	4.1	0.12	mg/kg	5	07/28/14	07/28/14 NT	SW846 6020A ²	SW846 3050B ⁶
Barium	234	1.2	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Cadmium	< 1.2	1.2	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Chromium	4.9	1.2	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Copper	6.1	1.2	mg/kg	1	07/28/14	07/29/14 KV	SW846 6010C ³	SW846 3050B ⁵
Lead	< 5.8	5.8	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Mercury	< 0.099	0.099	mg/kg	1	08/01/14	08/01/14 SM	SW846 7471B ⁴	SW846 7471B ⁷
Nickel	5.4	3.5	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Selenium	< 5.8	5.8	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Silver	< 3.5	3.5	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Zinc	21.4	3.5	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵

(1) Instrument QC Batch: MA5031

(2) Instrument QC Batch: MA5035

(3) Instrument QC Batch: MA5039

(4) Instrument QC Batch: MA5052

(5) Prep QC Batch: MP13542

(6) Prep QC Batch: MP13546

(7) Prep QC Batch: MP13583

RL = Reporting Limit

Report of Analysis

Client Sample ID: TBE-SW @6'		Date Sampled: 07/23/14
Lab Sample ID: D60078-2		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: 84.1
Project: CM Production LLC, Rice Lease Logan County Co		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
%solids							
Solids, Percent	84.1		%	1	07/25/14	SWT	SM2540G-2011 M
Chromium, Hexavalent	< 1.0	1.0	mg/kg	1	08/01/14	AK	SW846 3060A/7196A
Chromium, Trivalent ^a	4.9	2.2	mg/kg	1	08/01/14	AK	SW846 3060A/7196A M
Redox Potential Vs H2	445		mv	1	07/28/14	JD	ASTM D1498-76M
pH	8.66		su	1	07/25/14 11:15	JB	SW846 9045D

(a) Calculated as: (Chromium) - (Chromium, Hexavalent)

RL = Reporting Limit

4.2
4

Report of Analysis

Client Sample ID: TBE-SE @6'	
Lab Sample ID: D60078-3	Date Sampled: 07/23/14
Matrix: SO - Soil	Date Received: 07/24/14
Method: SW846 8260B	Percent Solids: 84.5
Project: CM Production LLC, Rice Lease Logan County Co	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3V31687.D	1	07/25/14	JL	n/a	n/a	V3V1852
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.03 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	68	26	ug/kg	
108-88-3	Toluene	ND	140	68	ug/kg	
100-41-4	Ethylbenzene	ND	140	26	ug/kg	
1330-20-7	Xylene (total)	ND	270	140	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	90%		64-130%
460-00-4	4-Bromofluorobenzene	97%		62-131%
17060-07-0	1,2-Dichloroethane-D4	107%		70-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.3
4

Report of Analysis

Client Sample ID: TBE-SE @6'		
Lab Sample ID: D60078-3		Date Sampled: 07/23/14
Matrix: SO - Soil		Date Received: 07/24/14
Method: SW846 8270C BY SIM SW846 3546		Percent Solids: 84.5
Project: CM Production LLC, Rice Lease Logan County Co		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G20662.D	1	07/25/14	DC	07/25/14	OP10310	E3G1024
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.2 g	1.0 ml
Run #2		

COGCC Table 910-1 PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	5.1	3.9	ug/kg	
120-12-7	Anthracene	ND	5.1	3.5	ug/kg	
56-55-3	Benzo(a)anthracene	ND	5.1	2.5	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	5.1	3.1	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	5.1	2.5	ug/kg	
50-32-8	Benzo(a)pyrene	ND	5.1	2.5	ug/kg	
218-01-9	Chrysene	ND	5.1	2.5	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	5.1	2.5	ug/kg	
206-44-0	Fluoranthene	ND	5.1	2.9	ug/kg	
86-73-7	Fluorene	ND	5.1	3.6	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	5.1	2.5	ug/kg	
91-20-3	Naphthalene	ND	5.1	3.1	ug/kg	
129-00-0	Pyrene	ND	5.1	3.0	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	66%		11-164%
321-60-8	2-Fluorobiphenyl	72%		14-138%
1718-51-0	Terphenyl-d14	73%		35-139%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.3
 4

Report of Analysis

Client Sample ID: TBE-SE @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-3	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 84.5
Method: SW846 8015B	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GA22765.D	1	07/29/14	BR	n/a	n/a	GGA1271
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.0 g	5.0 ml	100 ul
Run #2			

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	14	6.8	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	93%		60-140%		

ND = Not detected MDL = Method Detection Limit
 RL = Reporting Limit
 E = Indicates value exceeds calibration range

J = Indicates an estimated value
 B = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

4.3
4

Report of Analysis

Client Sample ID: TBE-SE @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-3	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 84.5
Method: SW846-8015B SW846 3546	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI14604.D	1	07/25/14	JS	07/25/14	OP10309	GFI877
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	7.9	5.9	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	41%		20-130%		

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.3
4

Report of Analysis

Client Sample ID: TBE-SE @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-3	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 84.5
Project: CM Production LLC, Rice Lease Logan County Co	

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	4.2	0.11	mg/kg	5	07/28/14	07/28/14 NT	SW846 6020A ²	SW846 3050B ⁶
Barium	290	1.1	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Cadmium	< 1.1	1.1	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Chromium	4.8	1.1	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Copper	6.2	1.1	mg/kg	1	07/28/14	07/29/14 KV	SW846 6010C ³	SW846 3050B ⁵
Lead	6.8	5.5	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Mercury	< 0.095	0.095	mg/kg	1	08/01/14	08/01/14 SM	SW846 7471B ⁴	SW846 7471B ⁷
Nickel	5.3	3.3	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Selenium	< 5.5	5.5	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Silver	< 3.3	3.3	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Zinc	21.1	3.3	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵

- (1) Instrument QC Batch: MA5031
- (2) Instrument QC Batch: MA5035
- (3) Instrument QC Batch: MA5039
- (4) Instrument QC Batch: MA5052
- (5) Prep QC Batch: MP13542
- (6) Prep QC Batch: MP13546
- (7) Prep QC Batch: MP13583

RL = Reporting Limit

4.3
 4

Report of Analysis

Client Sample ID: TBE-SE @6'		Date Sampled: 07/23/14
Lab Sample ID: D60078-3		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: 84.5
Project: CM Production LLC, Rice Lease Logan County Co		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
%solids							
Solids, Percent	84.5		%	1	07/25/14	SWT	SM2540G-2011 M
Chromium, Hexavalent	< 1.0	1.0	mg/kg	1	08/01/14	AK	SW846 3060A/7196A
Chromium, Trivalent ^a	4.8	2.1	mg/kg	1	08/01/14	AK	SW846 3060A/7196A M
Redox Potential Vs H2	461		mv	1	07/28/14	JD	ASTM D1498-76M
pH	8.65		su	1	07/25/14 11:15	JB	SW846 9045D

(a) Calculated as: (Chromium) - (Chromium, Hexavalent)

RL = Reporting Limit

4.3
4

Report of Analysis

Client Sample ID: TBE-B @8'	Date Sampled: 07/23/14
Lab Sample ID: D60078-4	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 88.4
Method: SW846 8260B	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3V31688.D	1	07/25/14	JL	n/a	n/a	V3V1852
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.09 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	62	24	ug/kg	
108-88-3	Toluene	ND	120	62	ug/kg	
100-41-4	Ethylbenzene	ND	120	24	ug/kg	
1330-20-7	Xylene (total)	ND	250	120	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	89%		64-130%
460-00-4	4-Bromofluorobenzene	96%		62-131%
17060-07-0	1,2-Dichloroethane-D4	105%		70-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.4
4

Report of Analysis

Client Sample ID: TBE-B @8'		Date Sampled: 07/23/14
Lab Sample ID: D60078-4		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: 88.4
Method: SW846 8270C BY SIM SW846 3546		
Project: CM Production LLC, Rice Lease Logan County Co		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G20663.D	1	07/25/14	DC	07/25/14	OP10310	E3G1024
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.2 g	1.0 ml
Run #2		

COGCC Table 910-1 PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	4.9	3.7	ug/kg	
120-12-7	Anthracene	ND	4.9	3.4	ug/kg	
56-55-3	Benzo(a)anthracene	ND	4.9	2.4	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	4.9	3.0	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	4.9	2.4	ug/kg	
50-32-8	Benzo(a)pyrene	ND	4.9	2.4	ug/kg	
218-01-9	Chrysene	ND	4.9	2.4	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	4.9	2.4	ug/kg	
206-44-0	Fluoranthene	ND	4.9	2.7	ug/kg	
86-73-7	Fluorene	ND	4.9	3.5	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	4.9	2.4	ug/kg	
91-20-3	Naphthalene	ND	4.9	2.9	ug/kg	
129-00-0	Pyrene	ND	4.9	2.8	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	79%		11-164%
321-60-8	2-Fluorobiphenyl	84%		14-138%
1718-51-0	Terphenyl-d14	82%		35-139%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.4
4

Report of Analysis

Client Sample ID: TBE-B @8'	Date Sampled: 07/23/14
Lab Sample ID: D60078-4	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 88.4
Method: SW846 8015B	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GA22766.D	1	07/29/14	BR	n/a	n/a	GGA1271
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.1 g	5.0 ml	100 ul
Run #2			

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	12	6.2	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	94%		60-140%		

ND = Not detected MDL = Method Detection Limit
 RL = Reporting Limit
 E = Indicates value exceeds calibration range

J = Indicates an estimated value
 B = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

4.4
4

Report of Analysis

Client Sample ID: TBE-B @8'	Date Sampled: 07/23/14
Lab Sample ID: D60078-4	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 88.4
Method: SW846-8015B SW846 3546	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI14705.D	1	07/29/14	JS	07/28/14	OP10318	GFI882
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	7.5	5.7	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	69%		20-130%		

ND = Not detected MDL = Method Detection Limit
 RL = Reporting Limit
 E = Indicates value exceeds calibration range

J = Indicates an estimated value
 B = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

4.4
4

Report of Analysis

Client Sample ID: TBE-B @8'	Date Sampled: 07/23/14
Lab Sample ID: D60078-4	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 88.4
Project: CM Production LLC, Rice Lease Logan County Co	

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	4.2	0.11	mg/kg	5	07/28/14	07/28/14 NT	SW846 6020A ²	SW846 3050B ⁶
Barium	266	1.1	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Cadmium	< 1.1	1.1	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Chromium	4.7	1.1	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Copper	5.7	1.1	mg/kg	1	07/28/14	07/29/14 KV	SW846 6010C ³	SW846 3050B ⁵
Lead	5.7	5.7	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Mercury	< 0.091	0.091	mg/kg	1	08/01/14	08/01/14 SM	SW846 7471B ⁴	SW846 7471B ⁷
Nickel	5.2	3.4	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Selenium	< 5.7	5.7	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Silver	< 3.4	3.4	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Zinc	20.5	3.4	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵

- (1) Instrument QC Batch: MA5031
- (2) Instrument QC Batch: MA5035
- (3) Instrument QC Batch: MA5039
- (4) Instrument QC Batch: MA5052
- (5) Prep QC Batch: MP13542
- (6) Prep QC Batch: MP13546
- (7) Prep QC Batch: MP13583

RL = Reporting Limit

4.4
 4

Report of Analysis

Client Sample ID: TBE-B @8'		Date Sampled: 07/23/14
Lab Sample ID: D60078-4		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: 88.4
Project: CM Production LLC, Rice Lease Logan County Co		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
%solids							
Solids, Percent	88.4		%	1	07/25/14	SWT	SM2540G-2011 M
Chromium, Hexavalent	< 1.0	1.0	mg/kg	1	08/01/14	AK	SW846 3060A/7196A
Chromium, Trivalent ^a	4.7	2.1	mg/kg	1	08/01/14	AK	SW846 3060A/7196A M
Redox Potential Vs H2	448		mv	1	07/28/14	JD	ASTM D1498-76M
pH	8.83		su	1	07/25/14 11:15	JB	SW846 9045D

(a) Calculated as: (Chromium) - (Chromium, Hexavalent)

RL = Reporting Limit

4.4
4

Report of Analysis

Client Sample ID: TBE-NW @6'		Date Sampled: 07/23/14
Lab Sample ID: D60078-5		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: 84.4
Method: SW846 8260B		
Project: CM Production LLC, Rice Lease Logan County Co		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3V31689.D	1	07/25/14	JL	n/a	n/a	V3V1852
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.00 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	68	26	ug/kg	
108-88-3	Toluene	ND	140	68	ug/kg	
100-41-4	Ethylbenzene	ND	140	26	ug/kg	
1330-20-7	Xylene (total)	ND	270	140	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	90%		64-130%
460-00-4	4-Bromofluorobenzene	99%		62-131%
17060-07-0	1,2-Dichloroethane-D4	112%		70-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.5
4

Report of Analysis

Client Sample ID: TBE-NW @6'		
Lab Sample ID: D60078-5		Date Sampled: 07/23/14
Matrix: SO - Soil		Date Received: 07/24/14
Method: SW846 8270C BY SIM SW846 3546		Percent Solids: 84.4
Project: CM Production LLC, Rice Lease Logan County Co		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 ^a	3G20732.D	4	07/31/14	DC	07/25/14	OP10310	E3G1028
Run #2 ^a	3G20731.D	20	07/31/14	DC	07/25/14	OP10310	E3G1028

	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2	30.1 g	1.0 ml

COGCC Table 910-1 PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND ^b	100	79	ug/kg	
120-12-7	Anthracene	ND	20	14	ug/kg	
56-55-3	Benzo(a)anthracene	ND	20	9.9	ug/kg	
205-99-2	Benzo(b)fluoranthene	202	20	13	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	20	10	ug/kg	
50-32-8	Benzo(a)pyrene	ND	20	9.9	ug/kg	
218-01-9	Chrysene	782	20	9.9	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	20	9.9	ug/kg	
206-44-0	Fluoranthene	ND	20	12	ug/kg	
86-73-7	Fluorene	759 ^b	100	73	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	20	9.9	ug/kg	
91-20-3	Naphthalene	122	20	12	ug/kg	
129-00-0	Pyrene	514	20	12	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	82%	104%	11-164%
321-60-8	2-Fluorobiphenyl	62%	56%	14-138%
1718-51-0	Terphenyl-d14	55%	66%	35-139%

(a) Dilution required due to matrix interference. Internal standard failure without dilution.

(b) Result is from Run# 2

ND = Not detected MDL = Method Detection Limit

RL = Reporting Limit

E = Indicates value exceeds calibration range

J = Indicates an estimated value

B = Indicates analyte found in associated method blank

N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: TBE-NW @6'	
Lab Sample ID: D60078-5	Date Sampled: 07/23/14
Matrix: SO - Soil	Date Received: 07/24/14
Method: SW846 8015B	Percent Solids: 84.4
Project: CM Production LLC, Rice Lease Logan County Co	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GA22767.D	1	07/29/14	BR	n/a	n/a	GGA1271
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.0 g	5.0 ml	100 ul
Run #2			

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	47.1	14	6.8	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	221% ^a		60-140%		

(a) Outside control limits due to possible matrix interference.

ND = Not detected MDL = Method Detection Limit
 RL = Reporting Limit
 E = Indicates value exceeds calibration range

J = Indicates an estimated value
 B = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

4.5
4

Report of Analysis

Client Sample ID: TBE-NW @6'		Date Sampled: 07/23/14
Lab Sample ID: D60078-5		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: 84.4
Method: SW846-8015B SW846 3546		
Project: CM Production LLC, Rice Lease Logan County Co		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI14803.D	50	07/31/14	JJ	07/28/14	OP10318	GFI884
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	8080	390	300	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	52%		20-130%		

ND = Not detected	MDL = Method Detection Limit	J = Indicates an estimated value
RL = Reporting Limit		B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range		N = Indicates presumptive evidence of a compound

4.5
4

Report of Analysis

Client Sample ID: TBE-NW @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-5	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 84.4
Project: CM Production LLC, Rice Lease Logan County Co	

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	4.1	0.11	mg/kg	5	07/28/14	07/28/14 NT	SW846 6020A ²	SW846 3050B ⁶
Barium	229	1.1	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Cadmium	< 1.1	1.1	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Chromium	4.9	1.1	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Copper	6.1	1.1	mg/kg	1	07/28/14	07/29/14 KV	SW846 6010C ³	SW846 3050B ⁵
Lead	< 5.6	5.6	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Mercury	< 0.097	0.097	mg/kg	1	08/01/14	08/01/14 SM	SW846 7471B ⁴	SW846 7471B ⁷
Nickel	5.3	3.4	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Selenium	< 5.6	5.6	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Silver	< 3.4	3.4	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵
Zinc	20.7	3.4	mg/kg	1	07/28/14	07/28/14 KV	SW846 6010C ¹	SW846 3050B ⁵

- (1) Instrument QC Batch: MA5031
- (2) Instrument QC Batch: MA5035
- (3) Instrument QC Batch: MA5039
- (4) Instrument QC Batch: MA5052
- (5) Prep QC Batch: MP13542
- (6) Prep QC Batch: MP13546
- (7) Prep QC Batch: MP13583

RL = Reporting Limit

4.5
4

Report of Analysis

Client Sample ID: TBE-NW @6'	Date Sampled: 07/23/14
Lab Sample ID: D60078-5	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 84.4
Project: CM Production LLC, Rice Lease Logan County Co	

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
%solids							
Solids, Percent	84.4		%	1	07/25/14	SWT	SM2540G-2011 M
Chromium, Hexavalent	< 1.0	1.0	mg/kg	1	08/01/14	AK	SW846 3060A/7196A
Chromium, Trivalent ^a	4.9	2.1	mg/kg	1	08/01/14	AK	SW846 3060A/7196A M
Redox Potential Vs H2	413		mv	1	07/28/14	JD	ASTM D1498-76M
pH	9.07		su	1	07/25/14 11:15	JB	SW846 9045D

(a) Calculated as: (Chromium) - (Chromium, Hexavalent)

RL = Reporting Limit

4.5
 4

Report of Analysis

Client Sample ID: TBE-WC	Date Sampled: 07/23/14
Lab Sample ID: D60078-6	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 83.6
Method: SW846 8260B	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3V31690.D	1	07/25/14	JL	n/a	n/a	V3V1852
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.03 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	69	26	ug/kg	
108-88-3	Toluene	ND	140	69	ug/kg	
100-41-4	Ethylbenzene	401	140	26	ug/kg	
1330-20-7	Xylene (total)	19600	280	140	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	100%		64-130%
460-00-4	4-Bromofluorobenzene	123%		62-131%
17060-07-0	1,2-Dichloroethane-D4	99%		70-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.6
4

Report of Analysis

Client Sample ID: TBE-WC		
Lab Sample ID: D60078-6		Date Sampled: 07/23/14
Matrix: SO - Soil		Date Received: 07/24/14
Method: SW846 8270C BY SIM SW846 3546		Percent Solids: 83.6
Project: CM Production LLC, Rice Lease Logan County Co		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 ^a	3G20668.D	5	07/25/14	DC	07/25/14	OP10310	E3G1024
Run #2							

	Initial Weight	Final Volume
Run #1	30.0 g	3.0 ml
Run #2		

COGCC Table 910-1 PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	78	60	ug/kg	
120-12-7	Anthracene	ND	78	54	ug/kg	
56-55-3	Benzo(a)anthracene	ND	78	38	ug/kg	
205-99-2	Benzo(b)fluoranthene	490	78	48	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	78	38	ug/kg	
50-32-8	Benzo(a)pyrene	ND	78	38	ug/kg	
218-01-9	Chrysene	2190	78	38	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	78	38	ug/kg	
206-44-0	Fluoranthene	510	78	44	ug/kg	
86-73-7	Fluorene	5140	78	56	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	78	38	ug/kg	
91-20-3	Naphthalene	8310	78	47	ug/kg	
129-00-0	Pyrene	1420	78	45	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	116%		11-164%
321-60-8	2-Fluorobiphenyl	96%		14-138%
1718-51-0	Terphenyl-d14	101%		35-139%

(a) Elevated reporting limits due to sample matrix, dilution required during sample prep and analysis.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.6
4

Report of Analysis

Client Sample ID: TBE-WC	Date Sampled: 07/23/14
Lab Sample ID: D60078-6	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 83.6
Method: SW846 8015B	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GA22768.D	1	07/29/14	BR	n/a	n/a	GGA1271
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.0 g	5.0 ml	10.0 ul
Run #2			

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	830	140	69	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	167% ^a		60-140%		

(a) Outside control limits due to possible matrix interference.

ND = Not detected	MDL = Method Detection Limit	J = Indicates an estimated value
RL = Reporting Limit		B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range		N = Indicates presumptive evidence of a compound

4.6
4

Report of Analysis

Client Sample ID: TBE-WC	Date Sampled: 07/23/14
Lab Sample ID: D60078-6	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 83.6
Method: SW846-8015B SW846 3546	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI14805.D	50	07/31/14	JJ	07/28/14	OP10318	GFI884
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.2 g	2.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	22900	790	600	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	118%		20-130%		

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.6
4

Report of Analysis

Client Sample ID: TBE-CO		Date Sampled: 07/23/14
Lab Sample ID: D60078-7		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: 87.8
Method: SW846 8260B		
Project: CM Production LLC, Rice Lease Logan County Co		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3V31703.D	1	07/28/14	JL	n/a	n/a	V3V1853
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.02 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	64	24	ug/kg	
108-88-3	Toluene	ND	130	64	ug/kg	
100-41-4	Ethylbenzene	ND	130	24	ug/kg	
1330-20-7	Xylene (total)	ND	250	130	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	89%		64-130%
460-00-4	4-Bromofluorobenzene	97%		62-131%
17060-07-0	1,2-Dichloroethane-D4	101%		70-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.7
4

Report of Analysis

Client Sample ID: TBE-CO	Date Sampled: 07/23/14
Lab Sample ID: D60078-7	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 87.8
Method: SW846 8015B	
Project: CM Production LLC, Rice Lease Logan County Co	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GA22769.D	1	07/29/14	BR	n/a	n/a	GGA1271
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.0 g	5.0 ml	100 ul
Run #2			

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	17.7	13	6.4	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	160% ^a		60-140%		

(a) Outside control limits due to possible matrix interference.

ND = Not detected MDL = Method Detection Limit
 RL = Reporting Limit
 E = Indicates value exceeds calibration range

J = Indicates an estimated value
 B = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

4.7
4

Report of Analysis

Client Sample ID: TBE-CO	Date Sampled: 07/23/14
Lab Sample ID: D60078-7	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: 87.8
Method: SW846-8015B SW846 3546	
Project: CM Production LLC, Rice Lease Logan County Co	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI14801.D	40	07/30/14	JJ	07/28/14	OP10318	GFI884
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.2 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	4890	300	230	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	95%		20-130%		

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
 RL = Reporting Limit B = Indicates analyte found in associated method blank
 E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

4.7
4

Report of Analysis

Client Sample ID: NPD-SW	Date Sampled: 07/23/14
Lab Sample ID: D60078-8	Date Received: 07/24/14
Matrix: AQ - Water	Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co	

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Chloride	8380	500	mg/l	1000	07/26/14 20:26	JB	EPA 300.0/SW846 9056
Solids, Total Dissolved	15100	10	mg/l	1	07/29/14	JD	SM 2540C-2011
Sulfate ^a	< 50	50	mg/l	100	07/26/14 10:34	JB	EPA 300.0/SW846 9056

(a) Elevated detection limit due to matrix interference.

RL = Reporting Limit

4.8
 4

Report of Analysis

Client Sample ID: SE PIT	Date Sampled: 07/23/14
Lab Sample ID: D60078-9	Date Received: 07/24/14
Matrix: AQ - Water	Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co	

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Chloride	5800	250	mg/l	500	07/26/14 20:39	JB	EPA 300.0/SW846 9056
Solids, Total Dissolved	11900	10	mg/l	1	07/29/14	JD	SM 2540C-2011
Sulfate	38.9	1.0	mg/l	2	07/26/14 10:47	JB	EPA 300.0/SW846 9056

RL = Reporting Limit

4.9
4

Report of Analysis

Client Sample ID: SAE-SP-0-1"	Date Sampled: 07/23/14
Lab Sample ID: D60078-10A	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co	

SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	293	2.0	mg/l	1	07/31/14	07/31/14 KV	SW846 6010C ¹	SW846 3010A/M ²
Magnesium	36.1	1.0	mg/l	1	07/31/14	07/31/14 KV	SW846 6010C ¹	SW846 3010A/M ²
Sodium	509	2.0	mg/l	1	07/31/14	07/31/14 KV	SW846 6010C ¹	SW846 3010A/M ²

(1) Instrument QC Batch: MA5048

(2) Prep QC Batch: MP13579

RL = Reporting Limit

4.10
4

Report of Analysis

Client Sample ID: SAE-SP-0-1"	Date Sampled: 07/23/14
Lab Sample ID: D60078-10A	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co	

4.10
4

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio ^a	7.46		ratio	1	07/31/14 19:07	KV	USDA HANDBOOK 60

(a) Calculated as: $(Na \text{ meq/L}) / \sqrt{[(Ca \text{ meq/L}) + (Mg \text{ meq/L})/2]}$

RL = Reporting Limit

Report of Analysis

Client Sample ID: SAC-SP-0-1"		Date Sampled: 07/23/14
Lab Sample ID: D60078-11A		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co		

SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	5530	20	mg/l	10	07/31/14	08/01/14 KV	SW846 6010C ¹	SW846 3010A/M ²
Magnesium	421	1.0	mg/l	1	07/31/14	07/31/14 KV	SW846 6010C ¹	SW846 3010A/M ²
Sodium	33000	20	mg/l	10	07/31/14	08/01/14 KV	SW846 6010C ¹	SW846 3010A/M ²

(1) Instrument QC Batch: MA5048

(2) Prep QC Batch: MP13579

RL = Reporting Limit

4.11
4

Report of Analysis

Client Sample ID: SAC-SP-0-1"	Date Sampled: 07/23/14
Lab Sample ID: D60078-11A	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co	

4.11
4

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio ^a	115		ratio	1	08/01/14 08:53	KV	USDA HANDBOOK 60

(a) Calculated as: $(Na \text{ meq/L}) / \sqrt{[(Ca \text{ meq/L}) + (Mg \text{ meq/L})/2]}$

RL = Reporting Limit

Report of Analysis

Client Sample ID: SAW-SP-0-1"	Date Sampled: 07/23/14
Lab Sample ID: D60078-12A	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co	

SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	7100	20	mg/l	10	07/31/14	08/01/14 KV	SW846 6010C ¹	SW846 3010A/M ²
Magnesium	662	1.0	mg/l	1	07/31/14	07/31/14 KV	SW846 6010C ¹	SW846 3010A/M ²
Sodium	1500	20	mg/l	10	07/31/14	08/01/14 KV	SW846 6010C ¹	SW846 3010A/M ²

(1) Instrument QC Batch: MA5048

(2) Prep QC Batch: MP13579

RL = Reporting Limit

4.12
4

Report of Analysis

Client Sample ID: SAW-SP-0-1"		Date Sampled: 07/23/14
Lab Sample ID: D60078-12A		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co		

4.12
4

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio ^a	4.56		ratio	1	08/01/14 09:04	KV	USDA HANDBOOK 60

(a) Calculated as: $(Na \text{ meq/L}) / \sqrt{[(Ca \text{ meq/L}) + (Mg \text{ meq/L})/2]}$

RL = Reporting Limit

Report of Analysis

Client Sample ID: SAS-SP-0-1"	Date Sampled: 07/23/14
Lab Sample ID: D60078-13A	Date Received: 07/24/14
Matrix: SO - Soil	Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co	

SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	1320	20	mg/l	10	07/31/14	08/01/14 KV	SW846 6010C ¹	SW846 3010A/M ²
Magnesium	107	1.0	mg/l	1	07/31/14	07/31/14 KV	SW846 6010C ¹	SW846 3010A/M ²
Sodium	11900	20	mg/l	10	07/31/14	08/01/14 KV	SW846 6010C ¹	SW846 3010A/M ²

(1) Instrument QC Batch: MA5048

(2) Prep QC Batch: MP13579

RL = Reporting Limit

Report of Analysis

Client Sample ID: SAS-SP-0-1"		Date Sampled: 07/23/14
Lab Sample ID: D60078-13A		Date Received: 07/24/14
Matrix: SO - Soil		Percent Solids: n/a
Project: CM Production LLC, Rice Lease Logan County Co		

4.13
4

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio ^a	84.6		ratio	1	08/01/14 09:10	KV	USDA HANDBOOK 60

(a) Calculated as: $(Na \text{ meq/L}) / \sqrt{[(Ca \text{ meq/L}) + (Mg \text{ meq/L})/2]}$

RL = Reporting Limit

Misc. Forms

5

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

Accutest Laboratories Mountain States
4036 Youngfield Street Wheat Ridge, Co 80033
TEL: 303-425-6021 877-737-4521
FAX 303-425-6021

FED-EX Tracking #	Bottle Order Control #
Accutest Quote #	Accutest Job # D60078

Client / Reporting Information		Project Information										Requested Analysis (see TEST CODE sheet)										Matrix Codes
Company Name Olsson Associates		Project Name CM Production, LLC - Rice Lease Logan County, Colorado										<p style="writing-mode: vertical-rl; transform: rotate(180deg);"> TDS Chloride/Sulfate SAR </p>										DW - Drinking Water GW - Ground Water WW - Water SW - Surface Water SO - Soil SL - Sludge SED - Sediment OI - Oil LIQ - Other Liquid AIR - Air SOL - Other Solid WP - Wipe FB - Field Blank EB - Equipment Blank RB - Rinse Blank TB - Trip Blank
Street Address 4690 Table Mountain Dr. #200		Street CR70																				
City State Zip Golden CO 80403		Billing Information (If different from Report to) City: _____ State: _____ Zip: _____																				
Project Contact James Hix jhix@olssonassociates.com		Project # 014-0704																				
Phone # Fax # 303.237.2072 303.237.2659		Client PO# _____																				
Sampler(s) Name(s) Phone # James Hix 303 589 1592		Project Manager James Hix																				
Accutest Sample #	Field ID / Point of Collection	MEOH/DI Vial #	Collection		Sampled by	Matrix	# of bottles	Number of preserved bottles										LAB USE ONLY				
			Date	Time				HC	NaOH	HNO3	USDA	NONE	DI Water	MEOH	ENCORE	Bottle(s)						
	NPD-SW		07/23/14	1244	JWH	Ag	2															
	SE Pit		07/23/14	1350	JWH	Ag	2											08				
	SAE-SP-0-1"		07/23/14	1541	JWH	S	1											09				
	SAC-SP-0-1"		07/23/14	1543	JWH	S	1											10				
	SAW-SP-0-1"		07/23/14	1544	JWH	S	1											11				
	SAS-SP-0-1"		07/23/14	1547	JWH	S	1											12				
																		13				

Turnaround Time (Business days) <input checked="" type="checkbox"/> Std. 10 Business Days <input type="checkbox"/> Std. 5 Business Days (By Contract only) <input type="checkbox"/> 5 Day R/SH <input type="checkbox"/> 3 Day EMERGENCY <input type="checkbox"/> 2 Day EMERGENCY <input type="checkbox"/> 1 Day EMERGENCY		Approved By (Accutest P#): _____ Date: _____	<input type="checkbox"/> Commercial "A" (Level 1) <input type="checkbox"/> Commercial "B" (Level 2) <input type="checkbox"/> Commercial "B" - Narrative <input type="checkbox"/> FULLT1 (Level 3+4)	<input type="checkbox"/> State Forms <input type="checkbox"/> EDD Format <input type="checkbox"/> PDF	Comments / Special Instructions <p style="font-size: 1.2em;">Only one 4oz JAR for SAR el'd - p 2147</p>
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Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler: 1 James Hix	Date Time: 07/24/14 10:13	Received By: 1 Paul Porter 7/24/14 10:50	Relinquished By: 2	Date Time:	Received By:
Relinquished by Sampler: 3	Date Time:	Received By: 3	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5	Custody Seal # HD	<input checked="" type="checkbox"/> Intact <input type="checkbox"/> Not Intact	Preserved where applicable: 1000 On Ice: 2 Cooler Temp: 5/

D60078: Chain of Custody

Page 2 of 2

5.1 5

GC/MS Volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V3V1852-MB	3V31670.D	1	07/25/14	JL	n/a	n/a	V3V1852

The QC reported here applies to the following samples:

Method: SW846 8260B

D60078-1, D60078-2, D60078-3, D60078-4, D60078-5, D60078-6

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	50	19	ug/kg	
100-41-4	Ethylbenzene	ND	100	19	ug/kg	
108-88-3	Toluene	ND	100	50	ug/kg	
1330-20-7	Xylene (total)	ND	200	100	ug/kg	

CAS No.	Surrogate Recoveries	Limits	
2037-26-5	Toluene-D8	89%	64-130%
460-00-4	4-Bromofluorobenzene	97%	62-131%
17060-07-0	1,2-Dichloroethane-D4	98%	70-130%

Method Blank Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V3V1853-MB	3V31695.D	1	07/28/14	JL	n/a	n/a	V3V1853

The QC reported here applies to the following samples:

Method: SW846 8260B

D60078-7

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	50	19	ug/kg	
100-41-4	Ethylbenzene	ND	100	19	ug/kg	
108-88-3	Toluene	ND	100	50	ug/kg	
1330-20-7	Xylene (total)	ND	200	100	ug/kg	

CAS No.	Surrogate Recoveries	Limits
2037-26-5	Toluene-D8	101% 64-130%
460-00-4	4-Bromofluorobenzene	95% 62-131%
17060-07-0	1,2-Dichloroethane-D4	104% 70-130%

Blank Spike Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V3V1852-BS	3V31671.D	1	07/25/14	JL	n/a	n/a	V3V1852

The QC reported here applies to the following samples:

Method: SW846 8260B

D60078-1, D60078-2, D60078-3, D60078-4, D60078-5, D60078-6

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
71-43-2	Benzene	2490	2460	99	70-130
100-41-4	Ethylbenzene	2490	2480	100	70-130
108-88-3	Toluene	2490	2420	97	70-130
1330-20-7	Xylene (total)	7470	7350	98	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	100%	64-130%
460-00-4	4-Bromofluorobenzene	94%	62-131%
17060-07-0	1,2-Dichloroethane-D4	103%	70-130%

* = Outside of Control Limits.

Blank Spike Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V3V1853-BS	3V31696.D	1	07/28/14	JL	n/a	n/a	V3V1853

The QC reported here applies to the following samples:

Method: SW846 8260B

D60078-7

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
71-43-2	Benzene	2500	2450	98	70-130
100-41-4	Ethylbenzene	2500	2420	97	70-130
108-88-3	Toluene	2500	2340	94	70-130
1330-20-7	Xylene (total)	7500	7270	97	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	102%	64-130%
460-00-4	4-Bromofluorobenzene	95%	62-131%
17060-07-0	1,2-Dichloroethane-D4	99%	70-130%

* = Outside of Control Limits.

Matrix Spike Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D60162-1MS	3V31697.D	1	07/28/14	JL	n/a	n/a	V3V1853
D60162-1	3V31698.D	1	07/28/14	JL	n/a	n/a	V3V1853

The QC reported here applies to the following samples:

Method: SW846 8260B

D60078-7

CAS No.	Compound	D60162-1 ug/kg	Spike Q	MS ug/kg	MS %	Limits
71-43-2	Benzene	ND		3030	2440	81 64-139
100-41-4	Ethylbenzene	ND		3030	2510	83 68-136
108-88-3	Toluene	ND		3030	2280	75 60-130
1330-20-7	Xylene (total)	ND		9090	7660	84 58-142

CAS No.	Surrogate Recoveries	MS	D60162-1	Limits
2037-26-5	Toluene-D8	90%	88%	64-130%
460-00-4	4-Bromofluorobenzene	97%	97%	62-131%
17060-07-0	1,2-Dichloroethane-D4	99%	100%	70-130%

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D60124-2MS	3V31683.D	1	07/25/14	JL	n/a	n/a	V3V1852
D60124-2MSD	3V31684.D	1	07/25/14	JL	n/a	n/a	V3V1852
D60124-2	3V31682.D	1	07/25/14	JL	n/a	n/a	V3V1852

The QC reported here applies to the following samples:

Method: SW846 8260B

D60078-1, D60078-2, D60078-3, D60078-4, D60078-5, D60078-6

CAS No.	Compound	D60124-2 ug/kg	Spike Q ug/kg	MS ug/kg	MS %	Spike ug/kg	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	ND	2930	2530	86	2930	2710	93	7	64-139/30
100-41-4	Ethylbenzene	ND	2930	2660	91	2930	2870	98	8	68-136/30
108-88-3	Toluene	ND	2930	2400	82	2930	2580	88	7	60-130/30
1330-20-7	Xylene (total)	ND	8780	8100	92	8780	8580	98	6	58-142/30

CAS No.	Surrogate Recoveries	MS	MSD	D60124-2	Limits
2037-26-5	Toluene-D8	91%	92%	90%	64-130%
460-00-4	4-Bromofluorobenzene	98%	97%	95%	62-131%
17060-07-0	1,2-Dichloroethane-D4	100%	110%	104%	70-130%

* = Outside of Control Limits.

Duplicate Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D60162-2DUP	3V31700.D	1	07/28/14	JL	n/a	n/a	V3V1853
D60162-2	3V31699.D	1	07/28/14	JL	n/a	n/a	V3V1853

The QC reported here applies to the following samples:

Method: SW846 8260B

D60078-7

CAS No.	Compound	D60162-2 ug/kg	DUP Q	RPD	Limits
71-43-2	Benzene	ND	ND	nc	30
100-41-4	Ethylbenzene	ND	ND	nc	30
108-88-3	Toluene	ND	ND	nc	30
1330-20-7	Xylene (total)	ND	ND	nc	30

CAS No.	Surrogate Recoveries	DUP	D60162-2	Limits
2037-26-5	Toluene-D8	89%	90%	64-130%
460-00-4	4-Bromofluorobenzene	96%	98%	62-131%
17060-07-0	1,2-Dichloroethane-D4	99%	101%	70-130%

* = Outside of Control Limits.

GC/MS Semi-volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP10310-MB	3G20656.D	1	07/25/14	DC	07/25/14	OP10310	E3G1024

The QC reported here applies to the following samples:

Method: SW846 8270C BY SIM

D60078-1, D60078-2, D60078-3, D60078-4, D60078-5, D60078-6

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	4.3	3.3	ug/kg	
120-12-7	Anthracene	ND	4.3	3.0	ug/kg	
56-55-3	Benzo(a)anthracene	ND	4.3	2.1	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	4.3	2.7	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	4.3	2.1	ug/kg	
50-32-8	Benzo(a)pyrene	ND	4.3	2.1	ug/kg	
218-01-9	Chrysene	ND	4.3	2.1	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	4.3	2.1	ug/kg	
206-44-0	Fluoranthene	ND	4.3	2.4	ug/kg	
86-73-7	Fluorene	ND	4.3	3.1	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	4.3	2.1	ug/kg	
91-20-3	Naphthalene	ND	4.3	2.6	ug/kg	
129-00-0	Pyrene	ND	4.3	2.5	ug/kg	

CAS No.	Surrogate Recoveries	Limits	
4165-60-0	Nitrobenzene-d5	75%	11-164%
321-60-8	2-Fluorobiphenyl	84%	14-138%
1718-51-0	Terphenyl-d14	87%	35-139%

7.1.1
7

Blank Spike Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP10310-BS	3G20657.D	1	07/25/14	DC	07/25/14	OP10310	E3G1024

The QC reported here applies to the following samples:

Method: SW846 8270C BY SIM

D60078-1, D60078-2, D60078-3, D60078-4, D60078-5, D60078-6

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
83-32-9	Acenaphthene	83.3	72.9	87	42-130
120-12-7	Anthracene	83.3	72.9	87	45-130
56-55-3	Benzo(a)anthracene	83.3	74.7	90	49-137
205-99-2	Benzo(b)fluoranthene	83.3	85.6	103	43-146
207-08-9	Benzo(k)fluoranthene	83.3	85.0	102	27-146
50-32-8	Benzo(a)pyrene	83.3	77.8	93	53-130
218-01-9	Chrysene	83.3	76.5	92	61-130
53-70-3	Dibenzo(a,h)anthracene	83.3	80.0	96	59-130
206-44-0	Fluoranthene	83.3	72.9	87	48-130
86-73-7	Fluorene	83.3	75.7	91	44-130
193-39-5	Indeno(1,2,3-cd)pyrene	83.3	79.6	96	58-130
91-20-3	Naphthalene	83.3	75.3	90	56-130
129-00-0	Pyrene	83.3	77.5	93	53-130

CAS No.	Surrogate Recoveries	BSP	Limits
4165-60-0	Nitrobenzene-d5	83%	11-164%
321-60-8	2-Fluorobiphenyl	100%	14-138%
1718-51-0	Terphenyl-d14	98%	35-139%

* = Outside of Control Limits.

7.2.1
 7

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP10310-MS	3G20659.D	1	07/25/14	DC	07/25/14	OP10310	E3G1024
OP10310-MSD	3G20660.D	1	07/25/14	DC	07/25/14	OP10310	E3G1024
D60078-2	3G20658.D	1	07/25/14	DC	07/25/14	OP10310	E3G1024

The QC reported here applies to the following samples:

Method: SW846 8270C BY SIM

D60078-1, D60078-2, D60078-3, D60078-4, D60078-5, D60078-6

CAS No.	Compound	D60078-2 ug/kg	Spike Q ug/kg	MS ug/kg	MS %	Spike ug/kg	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
83-32-9	Acenaphthene	ND	99.1	68.4	69	99.1	63.4	64	8	10-167/30
120-12-7	Anthracene	ND	99.1	72.1	73	99.1	62.7	63	14	10-200/30
56-55-3	Benzo(a)anthracene	ND	99.1	74.7	75	99.1	63.9	64	16	10-161/30
205-99-2	Benzo(b)fluoranthene	ND	99.1	80.9	82	99.1	71.5	72	12	10-166/30
207-08-9	Benzo(k)fluoranthene	ND	99.1	80.1	81	99.1	66.9	68	18	10-152/30
50-32-8	Benzo(a)pyrene	ND	99.1	73.6	74	99.1	63.8	64	14	10-149/30
218-01-9	Chrysene	15.1	99.1	79.3	65	99.1	67.4	53	16	10-156/30
53-70-3	Dibenzo(a,h)anthracene	ND	99.1	75.3	76	99.1	67.2	68	11	11-149/30
206-44-0	Fluoranthene	ND	99.1	75.1	76	99.1	65.1	66	14	10-175/30
86-73-7	Fluorene	ND	99.1	72.2	73	99.1	65.7	66	9	10-280/30
193-39-5	Indeno(1,2,3-cd)pyrene	ND	99.1	76.1	77	99.1	66.4	67	14	10-151/30
91-20-3	Naphthalene	ND	99.1	73.9	75	99.1	65.8	66	12	10-230/30
129-00-0	Pyrene	ND	99.1	77.3	78	99.1	67.0	68	14	10-160/30

CAS No.	Surrogate Recoveries	MS	MSD	D60078-2	Limits
4165-60-0	Nitrobenzene-d5	66%	59%	79%	11-164%
321-60-8	2-Fluorobiphenyl	74%	66%	88%	14-138%
1718-51-0	Terphenyl-d14	71%	63%	84%	35-139%

* = Outside of Control Limits.

7.3.1
7

GC Volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GGA1271-MB	GA22745.D	1	07/28/14	BR	n/a	n/a	GGA1271

The QC reported here applies to the following samples:

Method: SW846 8015B

D60078-1, D60078-2, D60078-3, D60078-4, D60078-5, D60078-6, D60078-7

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	10	5.0	mg/kg	

CAS No.	Surrogate Recoveries	Limits
120-82-1	1,2,4-Trichlorobenzene	94% 60-140%

Blank Spike Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GGA1271-BS	GA22746.D	1	07/28/14	BR	n/a	n/a	GGA1271

The QC reported here applies to the following samples:

Method: SW846 8015B

D60078-1, D60078-2, D60078-3, D60078-4, D60078-5, D60078-6, D60078-7

CAS No.	Compound	Spike mg/kg	BSP mg/kg	BSP %	Limits
	TPH-GRO (C6-C10)	110	111	101	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
120-82-1	1,2,4-Trichlorobenzene	102%	60-140%

8.2.1

8

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D60133-1MS	GA22748.D	1	07/28/14	BR	n/a	n/a	GGA1271
D60133-1MSD	GA22749.D	1	07/28/14	BR	n/a	n/a	GGA1271
D60133-1	GA22747.D	1	07/28/14	BR	n/a	n/a	GGA1271

The QC reported here applies to the following samples:

Method: SW846 8015B

D60078-1, D60078-2, D60078-3, D60078-4, D60078-5, D60078-6, D60078-7

CAS No.	Compound	D60133-1 mg/kg	Spike mg/kg	MS mg/kg	MS %	Spike mg/kg	MSD mg/kg	MSD %	RPD	Limits Rec/RPD
	TPH-GRO (C6-C10)	ND	139	141	101	139	140	100	1	70-130/30

CAS No.	Surrogate Recoveries	MS	MSD	D60133-1	Limits
120-82-1	1,2,4-Trichlorobenzene	102%	102%	95%	60-140%

8.3.1
8

* = Outside of Control Limits.

GC Semi-volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP10309-MB	FI14581.D	1	07/25/14	JS	07/25/14	OP10309	GFI878

The QC reported here applies to the following samples:

Method: SW846-8015B

D60078-1, D60078-2, D60078-3

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	6.7	5.0	mg/kg	

CAS No.	Surrogate Recoveries	Limits
84-15-1	o-Terphenyl	81% 20-130%

Method Blank Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP10318-MB	FI14645.D	1	07/28/14	JS	07/28/14	OP10318	GFI880

The QC reported here applies to the following samples:

Method: SW846-8015B

D60078-4, D60078-5, D60078-6, D60078-7

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	6.7	5.0	mg/kg	

CAS No.	Surrogate Recoveries	Limits
84-15-1	o-Terphenyl	81% 20-130%

Blank Spike Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP10309-BS	FI14583.D	1	07/25/14	JS	07/25/14	OP10309	GFI878

The QC reported here applies to the following samples:

Method: SW846-8015B

D60078-1, D60078-2, D60078-3

CAS No.	Compound	Spike mg/kg	BSP mg/kg	BSP %	Limits
	TPH-DRO (C10-C28)	167	98.3	59	42-130

CAS No.	Surrogate Recoveries	BSP	Limits
84-15-1	o-Terphenyl	80%	20-130%

9.2.1

9

* = Outside of Control Limits.

Blank Spike Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP10318-BS	FI14647.D	1	07/28/14	JS	07/28/14	OP10318	GFI880

The QC reported here applies to the following samples:

Method: SW846-8015B

D60078-4, D60078-5, D60078-6, D60078-7

CAS No.	Compound	Spike mg/kg	BSP mg/kg	BSP %	Limits
	TPH-DRO (C10-C28)	167	115	69	42-130

CAS No.	Surrogate Recoveries	BSP	Limits
84-15-1	o-Terphenyl	93%	20-130%

9.2.2
9

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP10309-MS	FI14585.D	1	07/25/14	JS	07/25/14	OP10309	GFI878
OP10309-MSD	FI14587.D	1	07/25/14	JS	07/25/14	OP10309	GFI878
D60078-1	FI14589.D	1	07/25/14	JS	07/25/14	OP10309	GFI878

The QC reported here applies to the following samples:

Method: SW846-8015B

D60078-1, D60078-2, D60078-3

CAS No.	Compound	D60078-1 mg/kg	Spike Q	MS mg/kg	MS %	Spike mg/kg	MSD mg/kg	MSD %	RPD	Limits Rec/RPD
	TPH-DRO (C10-C28)	ND	194	132	68	193	101	52	27	20-150/30

CAS No.	Surrogate Recoveries	MS	MSD	D60078-1	Limits
84-15-1	o-Terphenyl	67%	55%	71%	20-130%

9.3.1
9

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D60078
Account: COCSCOG Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP10318-MS	FI14649.D	1	07/28/14	JS	07/28/14	OP10318	GFI880
OP10318-MSD	FI14651.D	1	07/28/14	JS	07/28/14	OP10318	GFI880
D60162-3	FI14653.D	1	07/28/14	JS	07/28/14	OP10318	GFI880

The QC reported here applies to the following samples:

Method: SW846-8015B

D60078-4, D60078-5, D60078-6, D60078-7

CAS No.	Compound	D60162-3 mg/kg	Spike Q	Spike mg/kg	MS mg/kg	MS %	Spike mg/kg	MSD mg/kg	MSD %	RPD	Limits Rec/RPD
	TPH-DRO (C10-C28)	6.58	J	191	125	62	192	136	68	8	20-150/30

CAS No.	Surrogate Recoveries	MS	MSD	D60162-3	Limits
84-15-1	o-Terphenyl	91%	103%	96%	20-130%

9.3.2
9

* = Outside of Control Limits.

Metals Analysis

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13542
Matrix Type: SOLID

Methods: SW846 6010C
Units: mg/kg

Prep Date: 07/28/14

Metal	RL	IDL	MDL	MB raw	final
Aluminum	10	.86	1.8		
Antimony	3.0	.21	.5		
Arsenic	2.5	.38	.63		
Barium	1.0	.02	.36	0.070	<1.0
Beryllium	1.0	.08	.06		
Boron	5.0	.08	.16		
Cadmium	1.0	.02	.28	-0.010	<1.0
Calcium	40	.22	6.8		
Chromium	1.0	.03	.03	0.010	<1.0
Cobalt	0.50	.04	.039		
Copper	1.0	.12	.13	0.090	<1.0
Iron	7.0	.15	1.8		
Lead	5.0	.21	.25	-0.080	<5.0
Lithium	0.50	.04	.13		
Magnesium	20	.68	1.8		
Manganese	0.50	.001	.038		
Molybdenum	1.0	.04	.13		
Nickel	3.0	.05	.07	0.070	<3.0
Phosphorus	10	1.5	1.2		
Potassium	200	9.9	12		
Selenium	5.0	.71	1.1	0.020	<5.0
Silicon	5.0	.47	1.1		
Silver	3.0	.03	.05	-0.010	<3.0
Sodium	40	.49	3.7		
Strontium	5.0	.001	.022		
Thallium	1.0	.18	.46		
Tin	5.0	1.2	2.3		
Titanium	1.0	.01	.46		
Uranium	5.0	.29	.31		
Vanadium	1.0	.04	.043		
Zinc	3.0	.04	.16	0.46	<3.0

Associated samples MP13542: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

10.1.1
10

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

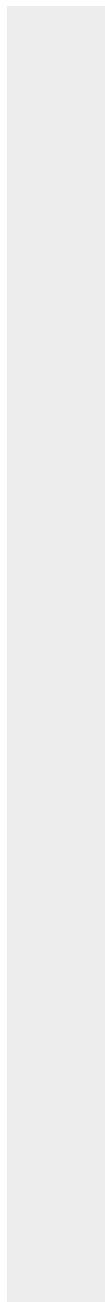
QC Batch ID: MP13542
Matrix Type: SOLID

Methods: SW846 6010C
Units: mg/kg

Prep Date: 07/28/14

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested



10.1.1
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13542
 Matrix Type: SOLID

Methods: SW846 6010C
 Units: mg/kg

Prep Date: 07/28/14

Metal	D60044-1 Original MS		SpikeLot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic	anr				
Barium	409	735	215	151.4N(a)	75-125
Beryllium					
Boron					
Cadmium	0.21	46.6	53.8	86.2	75-125
Calcium	anr				
Chromium	8.2	56.2	53.8	89.2	75-125
Cobalt					
Copper	9.3	61.8	53.8	97.5	75-125
Iron					
Lead	1.8	95.0	108	86.6	75-125
Lithium					
Magnesium	anr				
Manganese					
Molybdenum	anr				
Nickel	7.6	54.5	53.8	87.1	75-125
Phosphorus	anr				
Potassium	anr				
Selenium	0.0	94.5	108	87.8	75-125
Silicon					
Silver	0.0	16.1	21.5	74.8N(a)	75-125
Sodium	anr				
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc	28.4	75.0	53.8	86.6	75-125

Associated samples MP13542: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

10.1.2
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13542
Matrix Type: SOLID

Methods: SW846 6010C
Units: mg/kg

Prep Date: 07/28/14

Metal	D60044-1 Original MS	Spike/lot ICPALL2 % Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) Spike recovery indicates possible matrix interference.

10.1.2
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13542
 Matrix Type: SOLID

Methods: SW846 6010C
 Units: mg/kg

Prep Date: 07/28/14

Metal	D60044-1 Original	MSD	SpikeLot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic	anr					
Barium	409	619	215	97.5	17.1	20
Beryllium						
Boron						
Cadmium	0.21	45.9	53.8	84.9	1.5	20
Calcium	anr					
Chromium	8.2	55.0	53.8	87.0	2.2	20
Cobalt						
Copper	9.3	59.3	53.8	92.9	4.1	20
Iron						
Lead	1.8	92.9	108	84.6	2.2	20
Lithium						
Magnesium	anr					
Manganese						
Molybdenum	anr					
Nickel	7.6	53.5	53.8	85.3	1.9	20
Phosphorus	anr					
Potassium	anr					
Selenium	0.0	93.6	108	87.0	1.0	20
Silicon						
Silver	0.0	15.8	21.5	73.4N(a)	1.9	20
Sodium	anr					
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc	28.4	75.5	53.8	87.5	0.7	20

Associated samples MP13542: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

10.1.2
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13542
 Matrix Type: SOLID

Methods: SW846 6010C
 Units: mg/kg

Prep Date: 07/28/14

Metal	D60044-1 Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested
 (a) Spike recovery indicates possible matrix interference.

10.1.2
 10

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13542
 Matrix Type: SOLID

Methods: SW846 6010C
 Units: mg/kg

Prep Date: 07/28/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium	193	200	96.5	80-120
Beryllium				
Boron				
Cadmium	47.1	50	94.2	80-120
Calcium	anr			
Chromium	47.7	50	95.4	80-120
Cobalt				
Copper	49.8	50	99.6	80-120
Iron				
Lead	95.9	100	95.9	80-120
Lithium				
Magnesium	anr			
Manganese				
Molybdenum	anr			
Nickel	45.4	50	90.8	80-120
Phosphorus	anr			
Potassium	anr			
Selenium	98.3	100	98.3	80-120
Silicon				
Silver	17.0	20	85.0	80-120
Sodium	anr			
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	46.1	50	92.2	80-120

Associated samples MP13542: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

10.1.3
10

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13542
Matrix Type: SOLID

Methods: SW846 6010C
Units: mg/kg

Prep Date: 07/28/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested



10.1.3
10

SERIAL DILUTION RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13542
 Matrix Type: SOLID

Methods: SW846 6010C
 Units: ug/l

Prep Date: 07/28/14

Metal	D60044-1 Original	SDL 1:5	%DIF	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium	3830	4530	18.3*(a)	0-10
Beryllium				
Boron				
Cadmium	2.00	0.00	100.0(b)	0-10
Calcium	anr			
Chromium	76.6	84.0	9.7	0-10
Cobalt				
Copper	87.3	92.5	6.0	0-10
Iron				
Lead	17.2	21.0	22.1 (b)	0-10
Lithium				
Magnesium	anr			
Manganese				
Molybdenum	anr			
Nickel	71.5	84.0	17.5*(a)	0-10
Phosphorus	anr			
Potassium	anr			
Selenium	0.00	0.00	NC	0-10
Silicon				
Silver	0.00	0.00	NC	0-10
Sodium	anr			
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	266	315	18.2*(a)	0-10

Associated samples MP13542: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

10.1.4
10

SERIAL DILUTION RESULTS SUMMARY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13542
Matrix Type: SOLID

Methods: SW846 6010C
Units: ug/l

Prep Date: 07/28/14

Metal	D60044-1	QC
	Original SDL 1:5 %DIF	Limits

- (anr) Analyte not requested
- (a) Serial dilution indicates possible matrix interference.
- (b) Percent difference acceptable due to low initial sample concentration (< 50 times IDL).

10.1.4
10

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13546
Matrix Type: SOLID

Methods: SW846 6020A
Units: mg/kg

Prep Date: 07/28/14

Metal	RL	IDL	MDL	MB raw	final
Aluminum	25	.55	.75		
Antimony	0.20	.0011	.029		
Arsenic	0.10	.0085	.024	0.013	<0.10
Barium	1.0	.008	.16		
Beryllium	0.10	.008	.049		
Boron	20	.25	.07		
Cadmium	0.050	.018	.038		
Calcium	200	2.8	13		
Chromium	1.0	.027	.11		
Cobalt	0.10	.0025	.0085		
Copper	1.0	.03	.1		
Iron	5.0	1.8	1.8		
Lead	0.25	.004	.0075		
Magnesium	50	.65	.65		
Manganese	0.50	.06	.07		
Molybdenum	0.50	.025	.046		
Nickel	1.0	.0044	.17		
Phosphorus	30	1.3	4.9		
Potassium	100	1.5	2.5		
Selenium	0.20	.03	.13		
Silver	0.050	.00095	.01		
Sodium	250	2.5	5.5		
Strontium	10	.005	.027		
Thallium	0.10	.0012	.0075		
Tin	5.0	.032	2.3		
Titanium	1.0	.03	.085		
Uranium	0.25	.00085	.0015		
Vanadium	2.0	.019	.11		
Zinc	5.0	.11	1.4		

Associated samples MP13546: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

10.2.1
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13546
 Matrix Type: SOLID

Methods: SW846 6020A
 Units: mg/kg

Prep Date: 07/28/14

Metal	D60044-1 Original MS	Spikelot ICPALL2	% Rec	QC Limits	
Aluminum					
Antimony					
Arsenic	2.1	106	108	96.5	75-125
Barium					
Beryllium					
Boron					
Cadmium					
Calcium					
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silver					
Sodium					
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP13546: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

10.2.2
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13546
 Matrix Type: SOLID

Methods: SW846 6020A
 Units: mg/kg

Prep Date: 07/28/14

Metal	D60044-1 Original MSD	Spikelot ICPAL2	% Rec	MSD RPD	QC Limit	
Aluminum						
Antimony						
Arsenic	2.1	104	108	94.7	1.9	20
Barium						
Beryllium						
Boron						
Cadmium						
Calcium						
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Magnesium						
Manganese						
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silver						
Sodium						
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP13546: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

10.2.2
10

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13546
 Matrix Type: SOLID

Methods: SW846 6020A
 Units: mg/kg

Prep Date: 07/28/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	95.2	100	95.2	80-120
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP13546: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (anr) Analyte not requested

10.2.3
10

SERIAL DILUTION RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13546
 Matrix Type: SOLID

Methods: SW846 6020A
 Units: ug/l

Prep Date: 07/28/14

Metal	D60044-1	QC
	Original	Limits

Metal	Original	SDL	5:25 %DIF	QC Limits
Aluminum				
Antimony				
Arsenic	19.8	17.4	12.2*(a)	0-10
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP13546: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (anr) Analyte not requested
 (a) Serial dilution indicates possible matrix interference.

10.2.4
 10

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13579
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 07/31/14

Metal	RL	IDL	MDL	MB raw	final
Aluminum	500	55	210		
Antimony	150	11	95		
Arsenic	130	19	28		
Barium	50	1	7		
Beryllium	50	4.5	6		
Boron	250	4	33		
Cadmium	50	1	1.8		
Calcium	2000	12	210	-6.0	<2000
Chromium	50	1.5	2		
Cobalt	25	2.5	2.9		
Copper	50	4	9.5		
Iron	350	7.5	48		
Lead	250	11	110		
Lithium	25	2	14		
Magnesium	1000	34	95	14.0	<1000
Manganese	25	2.5	2.3		
Molybdenum	50	2	4.2		
Nickel	150	2.5	4.4		
Phosphorus	500	75	100		
Potassium	5000	500	1400		
Selenium	250	36	55		
Silicon	250	24	26		
Silver	150	1.5	3		
Sodium	2000	37	850	-390	<2000
Strontium	25	.05	.6		
Thallium	50	9	20		
Tin	250	60	80		
Titanium	50	.5	11		
Uranium	250	15	28		
Vanadium	50	2	2		
Zinc	150	2	16		

Associated samples MP13579: D60078-10A, D60078-11A, D60078-12A, D60078-13A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

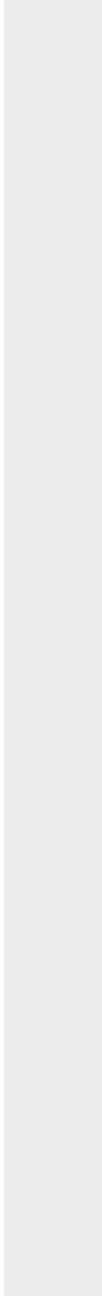
QC Batch ID: MP13579
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 07/31/14

Metal	RL	IDL	MDL	MB	raw	final
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(anr) Analyte not requested



10.3.1
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13579
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 07/31/14

Metal	D60227-3 Original MS	Spikelot ICPAL2	% Rec	QC Limits	
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	56700	194000	125000	109.8	75-125
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Lithium					
Magnesium	250000	402000	125000	121.6	75-125
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium	743000	934000	125000	152.8(a)	75-125
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP13579: D60078-10A, D60078-11A, D60078-12A, D60078-13A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

10.3.2
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13579
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 07/31/14

Metal	D60227-3 Original MS	Spike/lot ICPAL2 % Rec	QC Limits
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- (N) Matrix Spike Rec. outside of QC limits
- (anr) Analyte not requested
- (a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

10.3.2
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MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13579
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 07/31/14

Metal	D60227-3 Original MSD	Spikelot ICPALL2	% Rec	MSD RPD	QC Limit	
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium	56700	187000	125000	104.2	3.7	20
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Lithium						
Magnesium	250000	381000	125000	104.8	5.4	20
Manganese						
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silicon						
Silver						
Sodium	743000	874000	125000	104.8	6.6	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP13579: D60078-10A, D60078-11A, D60078-12A, D60078-13A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

10.3.2
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

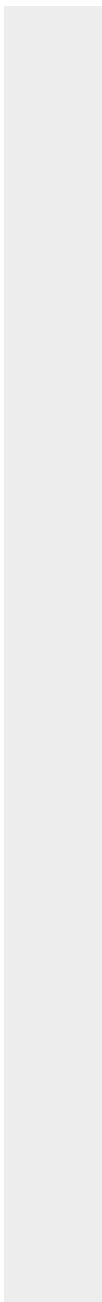
QC Batch ID: MP13579
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 07/31/14

Metal	D60227-3 Original MSD	SpikeLot ICPAL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested



10.3.2
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SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13579
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 07/31/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	130000	125000	104.0	80-120
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	128000	125000	102.4	80-120
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	129000	125000	103.2	80-120
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP13579: D60078-10A, D60078-11A, D60078-12A, D60078-13A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

10.3.3
10

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

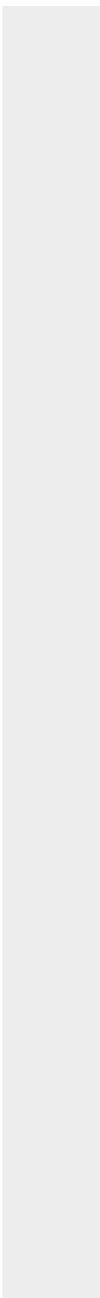
QC Batch ID: MP13579
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 07/31/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested



10.3.3
10

SERIAL DILUTION RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13579
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 07/31/14

Metal	D60227-3 Original	SDL 1:5	%DIF	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	11300	12000	5.7	0-10
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	50000	51700	3.4	0-10
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	149000	154000	3.5	0-10
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP13579: D60078-10A, D60078-11A, D60078-12A, D60078-13A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

10.3.4
10

SERIAL DILUTION RESULTS SUMMARY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

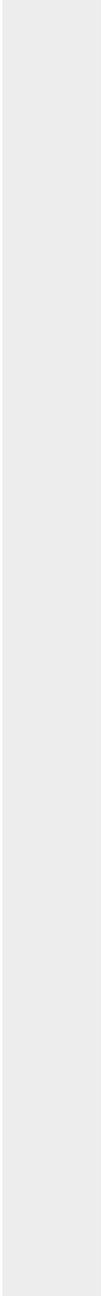
QC Batch ID: MP13579
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 07/31/14

Metal	D60227-3	QC
	Original SDL 1:5 %DIF	Limits

(anr) Analyte not requested



10.3.4
10

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13583
Matrix Type: SOLID

Methods: SW846 7471B
Units: mg/kg

Prep Date: 08/01/14

Metal	RL	IDL	MDL	MB	
				raw	final
Mercury	0.083	.00088	.0067	-0.0023	<0.083

Associated samples MP13583: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13583
 Matrix Type: SOLID

Methods: SW846 7471B
 Units: mg/kg

Prep Date: 08/01/14

Metal	D60078-1 Original MS	Spikelot HGWSR1	% Rec	QC Limits
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Mercury	0.0	0.35	0.369	94.8	75-125
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Associated samples MP13583: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

10.4.2
10

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D60078
 Account: COCSCOG - Olsson Associates - Denver
 Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13583
 Matrix Type: SOLID

Methods: SW846 7471B
 Units: mg/kg

Prep Date: 08/01/14

Metal	D60078-1 Original	MSD	Spike lot HGWSR1	% Rec	MSD RPD	QC Limit
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Mercury	0.0	0.35	0.388	90.3	0.0	20
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Associated samples MP13583: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

QC Batch ID: MP13583
Matrix Type: SOLID

Methods: SW846 7471B
Units: mg/kg

Prep Date: 08/01/14

Metal	BSP Result	Spikelot HGWSR1	% Rec	QC Limits
Mercury	0.32	0.333	96.0	80-120

Associated samples MP13583: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

10.4.3
10

General Chemistry

QC Data Summaries

Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries



METHOD BLANK AND SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Chloride	GP13145/GN25744	0.50	0.0	mg/l	5	4.88	97.6	90-110%
Chromium, Hexavalent	GP13184/GN25818	1.0	0.0	mg/kg	205	195	95.1	80-120%
Solids, Total Dissolved	GN25761	10	0.0	mg/l	400	399	99.8	90-110%
Sulfate	GP13145/GN25744	0.50	0.0	mg/l	5	4.94	98.8	90-110%
pH	GN25735			su	8.00	8.00	100.0	99.1-100.9%

Associated Samples:

Batch GN25735: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Batch GN25761: D60078-8, D60078-9

Batch GP13145: D60078-8, D60078-9

Batch GP13184: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

(*) Outside of QC limits

11.1
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DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Chromium, Hexavalent	GP13184/GN25818	D60078-4	mg/kg	0.0	0.0	0.0	0-20%
Redox Potential Vs H2	GN25749	D60078-1	mv	482	475	1.5	0-20%
Solids, Total Dissolved	GN25761	D60078-9	mg/l	11900	11900	0.0	0-20%

Associated Samples:

Batch GN25749: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

Batch GN25761: D60078-8, D60078-9

Batch GP13184: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

(*) Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Chloride	GP13145/GN25744	D60119-5	mg/l	1.1	5	5.9	96.0	80-120%
Chromium, Hexavalent	GP13184/GN25818	D60078-4	mg/kg	0.0	40	40.3	100.7	75-125%
Sulfate	GP13145/GN25744	D60119-5	mg/l	3.2	5	8.0	96.0	80-120%

Associated Samples:

Batch GP13145: D60078-8, D60078-9

Batch GP13184: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

MATRIX SPIKE DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D60078
Account: COCSCOG - Olsson Associates - Denver
Project: CM Production LLC, Rice Lease Logan County Co

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Chloride	GP13145/GN25744	D60119-5	mg/l	1.1	5	5.9	0.0	20%
Chromium, Hexavalent	GP13184/GN25818	D60078-4	mg/kg	0.0	40	39.4	2.2	20%
Sulfate	GP13145/GN25744	D60119-5	mg/l	3.2	5	8.1	1.2	20%

Associated Samples:

Batch GP13145: D60078-8, D60078-9

Batch GP13184: D60078-1, D60078-2, D60078-3, D60078-4, D60078-5

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits