



# REPORT ON 21A FACILITY REMEDIATION AND MONITORING

**Marathon Oil Company 697-21A  
Facility #335476  
Garfield County, Colorado**

**Submitted To:** Marathon Oil Company  
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Lakewood, Colorado 80228

**February 6, 2015**

**1520168**

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## 1.0 INTRODUCTION

This report has been prepared for Marathon Oil Company (MOC) by Golder Associates Inc. (Golder) regarding the 697-21A well pad located in Garfield County, Colorado. This facility is shown on Figures 1 and 2 and is referred to herein as the 21A facility or the site. On behalf of MOC, InterTech Environmental and Engineering, L.L.C. (InterTech) provided field inspection services in support of the 21A activities described in this report. Therefore, InterTech provided significant input to this report.

A fluid release at the 21A facility was confirmed on December 2, 2014, and appropriate notification calls were made on December 3. This included notification of the Colorado Oil and Gas Conservation Commission (COGCC), the surface owner (OXY USA), and Garfield County. An initial Form 19 Spill/Release Report regarding the 21A spill was submitted to the COGCC on December 4.

Based on tank gauge and historical data, MOC estimated that 229 barrels of produced water and 4 barrels of condensate were released from the condensate dump line at the site. These estimated spill quantities were discussed with the COGCC during a December 16 visit to the 21A facility. This was followed by submittal of a supplemental Form 19 on December 17 and a Form 4 Sundry Notice on December 18 in connection with the 21A spill.

The December 18 Sundry Notice provided the most recent pressure test records for the site. As part of MOC annual pressure testing of Piceance Operation flow-lines, the 21A condensate dump line had been pressure tested on May 6, 2014. Documentation submitted with the Sundry Notice confirmed that a pressure of 115 pounds per square inch was maintained during the May 2014 pressure testing.

The December 16 site visit with the COGCC included discussions concerning:

- The expected depth to groundwater, distance to surface water, and seeps and springs in the area;
- The plan to evaluate potential impacts of the spill based on area geology/hydrology; and
- Development of a surface water sampling and analysis plan in response to the spill.

This report is intended to expand upon and address these three items. Additionally, this report describes the MOC response to the 21A spill, including site investigations and site remediation activities.



## 2.0 21A SPILL RESPONSE

In addition to the spill notifications and reporting noted above, MOC performed timely site investigations and site remediation in response to the 21A spill. As context for the following discussion of investigations and remediation at the site, the as-built diagram for the 21A facility is provided in Appendix A-1. Site features that are particularly important to the current evaluations include the condensate tank (Figure 2), 2-inch condensate dump line, containment ring, and valve can. The condensate dump line is present at a depth of approximately 4.2 feet below ground surface. Also pertinent to the current evaluations are 21A condensate and produced water analytical results for January 15, 2015 samples, which are presented in Appendix A-2. Representative photos of the 21A investigations and remediation activities are provided in Appendix B-1.

### 2.1 Site Investigations

Based on concerns about a possible fluid leak at the 21A well production pad, field investigations at the site were initiated on December 2. This initial investigation involved hydrovac excavation of five potholes in the vicinity of the condensate tank, condensate dump line, and valve can, as shown on Figure 2. These potholes were excavated by Badger Daylighting (Badger) to confirm the location of pertinent liquid flow-lines and to aid in determining the source and extent of any possible contamination. Four of the potholes are visible in Photo 1 (Appendix B-1), and the fifth pothole was located southwest of the valve can. These potholes partially exposed the underground piping near the containment ring. The spoils and clean-out water collected by Badger were placed in a lined containment that Moody Construction (Moody) constructed in the northeastern corner of the pad.

Site investigations were continued by InterTech on December 3 with photoionization detector (PID) measurements in each of the potholes. As shown on Figure 2, volatile organic compound (VOC) readings of up to 51.85 parts per million (ppm) were measured, with the highest reading along the condensate dump line immediately north of the containment ring.

The PID measurements indicated that a leak was likely present along the condensate dump line between the edge of the tank containment ring and the riser where the dump line emerges from the ground to connect to the tank. Furthermore, the potholes indicated that there was little to no horizontal migration of fluid. The condensate dump line was then pressurized, and the sound of gas escaping from the suspected section of pipe supported the presumption that the leak was likely located between the containment ring and the condensate pipe riser. Now confident that a spill had occurred, MOC notified the COGCC at 14:20 on December 3 and a Form 19 was submitted to the COGCC on December 4.

All of the wells on the 21A well pad were shut-in after a spill had been confirmed. The condensate tank and dump line had been previously isolated, and the condensate dump line had been disconnected from the condensate tank. Produced water was then removed from the produced water tanks present in the



tank containment. The tank containment was then dismantled as necessary to access the condensate dump line from the edge of the tank containment to the pipe riser.

## 2.2 Source Identification and Characterization

On December 9, Moody was dispatched to the site to excavate the soil from the former edge of the tank containment back to the condensate dump line riser. Soil removal efforts included a combination of hand excavation (Photo 2) and machine excavation (Photo 3).

On December 11, two soil samples were collected from the excavation for laboratory analysis (Table 1). At a depth of 4 feet, a laboratory sample was collected directly above the dump line and adjacent to the riser; a duplicate sample was collected and analyzed using a PID (251.6 ppm). At a depth of approximately 6 feet, a laboratory sample was collected from directly below the 90-degree elbow that connected the horizontal run of the condensate dump line to the riser; a duplicate sample was also collected at this location and analyzed using a PID (1,716 ppm). The laboratory analytical results detailed in Appendix B-2 include:

- BTEX (benzene, toluene, ethylbenzene, and total xylenes) concentrations up to 134 ppm;
- Diesel range total petroleum hydrocarbons (TPH-DRO) up to 715 ppm; and
- Gasoline range total petroleum hydrocarbons (TPH-GRO) up to 3,180 ppm.

Once soil excavation was completed, the condensate dump line was pressurized in order to pinpoint the source of the leak. MOC charged the condensate dump line with natural gas, but some residual fluid was also present in the line. As shown by Photo 4, this pressurization confirmed that the leak was from a hole in the 90-degree elbow that connected the condensate dump line horizontal pipe to the riser.

Soil excavated from the site was placed within a lined containment constructed adjacent to the previously constructed containment in the northeastern corner of the pad (Photo 5).

## 2.3 Site Remediation

### 2.3.1 Excavation of Potentially Impacted Soil

Excavation of potentially contaminated soil from the 21A facility continued on December 18 (Photo 6). Moody used a large excavator capable of breaking through the frost and shelf rock. Moody began by removing the soil overlying a portion of the produced water poly line extending from the already exposed section toward the valve can the distance of the planned excavation so that the exact location of the line would be known and the piping would be visible for monitoring. This soil was not contaminated and was set aside to be put back into place during backfilling operations.



Moody then began excavating the portion of soil from the existing excavated area back toward the valve can between the poly line and the tank containment. Out of an abundance of caution, the soil and rock collected from this area was presumed to be contaminated, and was staged in the lined spoil pile area.

During excavation, a PID was used in ambient conditions to assess if VOCs were present in the material being removed. The soil and rock removed were clean to a depth of about 4 feet, where very low levels of VOCs (0.75 ppm or less) began to be detected in the excavation nearest the leak source.

The area was ultimately excavated to a depth of approximately 7 feet, extending from about 2 feet northeast of the leak source to about 4 feet southwest of the leak source in between the produced water dump line and the poly line. At a depth of 7 feet, the highest VOC reading in ambient conditions was 4.25 ppm. A composite soil sample was collected from the newly excavated area, sealed in a bag, and placed in a heated vehicle to bring the sample to approximately 70 degrees Fahrenheit. The PID probe was then inserted into the bag for headspace analysis, which resulted in a reading of 0.70 ppm. Given this result, the excavation operation was deemed complete. A total of approximately 36 cubic yards of soil were excavated at the site in connection with these remediation efforts.

### **2.3.2 Completion of Repairs**

After the excavation operations were completed on December 18, the condensate dump line was purged with inert nitrogen gas in preparation for welding the new segment to the existing pipe. After the line was purged, the team assembled to complete the hot work permit; however, the MX6 area monitor indicated that the area where welding would take place was above 0.00 percent of the lower explosive limit (LEL). As per MOC's policy, which requires a reading of 0.00 percent LEL, the hot work permit was not issued. Welding operations were rescheduled for the following day, and a rig heater was operated overnight to ventilate the excavation area.

On December 19, 0.00 percent LEL was confirmed within the excavation so a welder proceeded to weld together the replacement sections of the condensate dump line, including the horizontal run, the 90 degree elbow, and the riser. When welding was completed, the repaired condensate dump line was pressure tested for 45 minutes and successfully held pressure. The piping was then bedded with ¾-inch road base material, and clean material that had sloughed off of the cut slope on-pad was used to backfill the remaining excavated area. The tank containment was then reassembled on December 19.

On January 8, 2015, H & H Environmental repaired the tank containment liner where it had been cut to provide access to the dump line. H & H Environmental then tested their repair and confirmed a successful "hold." On January 9, MOC field operators returned the 21A wells to production.



The section of pipe removed from the condensate dump line that contained the 90-degree elbow (i.e., the leak source) was inspected by MOC's Fixed Equipment Integrity Specialist in Cody, Wyoming. The Specialist determined that carbon dioxide-related corrosion had caused the holes in the condensate pipe elbow.

### ***2.3.3 Disposition of Excavated Materials***

The spoils resulting from potholing and material excavation at the site were placed within lined containment and will be stored there until Spring 2015. The spoils and containment will be monitored and if free liquid from snowmelt and/or stormwater collects inside of the containment, the fluids will be removed using a vacuum truck and properly disposed of at a third party disposal facility.

Once the spoil pile thaws in the Spring of 2015, composite samples will be collected and laboratory analyzed to identify contaminants and their concentrations. After the laboratory results are known, MOC will determine the best method for treatment or disposal of the materials, as appropriate.



## 3.0 HYDROGEOLOGIC AND TRANSPORT CONSIDERATIONS

### 3.1 Hydrogeologic Conditions

Bedrock in the region near the 21A facility is generally characterized as well-cemented Uinta Formation sandstone, siltstone, and marlstone. While the primary porosity of the Uinta bedrock is typically relatively low, fractures within these strata have been noted to provide zones of enhanced transmissivity (Golder, 2013<sup>1</sup>).

Although hydrogeologic characterization field investigations have not been performed at 21A, detailed investigations at another MOC facility in the area (32C) confirmed that groundwater was present at depths ranging from approximately 100 to 190 feet below the ground surface (Golder, 2013). The hydrogeologic and topographic settings at 21A and 32C are similar. Therefore, it is inferred that the 21A facility is also underlain by a significant thickness of unsaturated strata, similar to 32C.

As shown on Figure 1, the undisturbed ground surface near the site generally slopes west towards Cascade Canyon and southwest towards an unnamed tributary. Groundwater flow in the region is strongly influenced by topography, with flow from topographically high groundwater recharge areas towards drainages in the region. Therefore, it is expected that groundwater flow from the site is primarily towards the west and southwest.

During the 21A spill investigation and remediation operations, there was no indication of significant horizontal migration of contaminants. Instead, it is inferred that the fluid spilled at 21A predominantly infiltrated vertically downward through fractures in the underlying bedrock. Although fluid migration would be influenced by orientation, aperture, and infilling of the fractures present, it is expected that fluid migration would be predominantly downward through the unsaturated zone towards the saturated zone.

The ultimate fate and transport of contaminated fluids from the 21A spill cannot be determined based on existing information. However, if the flux of the contaminated fluid was sufficient to fully penetrate the unsaturated zone beneath the site, it is expected that contaminant migration would then be primarily to the west and southwest towards Cascade Canyon.

### 3.2 Potential Receptors

A search of the Colorado Division of Water Resources (DWR) database confirmed that there are no permitted wells within 2 miles of the site, as shown on the map provided in Appendix C-1. A similar DWR map provided in Appendix C-2 indicates no applications for water wells within 2 miles of the site.

<sup>1</sup> Report on 32C Groundwater Monitoring Program, MOC 596-32C Produced Water Pond, Facility #421284, COGCC REM #7734, Garfield County, Colorado, issued by Golder November 14, 2013.



Springs, seeps, and surface water drainages in the site vicinity may be considered potential receptors and exposure pathways for 21A contamination, as discussed in the sections below. The larger drainages near 21A include Cascade Creek located 2,300 feet northwest and a tributary to Conn Creek located 2,700 feet southeast, as shown on Figure 1.



## 4.0 WATER QUALITY MONITORING

### 4.1 Previous Surface Water Monitoring

MOC has performed surface water monitoring in the vicinity of 21A, as detailed in Appendices D-1 and D-2. The sampling events performed in June 2011 and August 2012 provide baseline data for comparison with results from the 21A surface water monitoring program proposed in Section 4.2. It is noted that some of the 2011 sampling locations were dry in 2012, as shown on Figure 3. For example, two surface water monitoring locations that were sampled in 2011 (Photos 10 and 12 in Appendix B-1) could not be sampled in 2012 (Photos 9 and 11).

### 4.2 Proposed Monitoring Program

To confirm that the 21A spill does not impact waters of the State, MOC proposes the surface water monitoring program described below. Because surface water is only sporadically present near 21A, this monitoring program would of course be dependent on sufficient quantities of surface water from seeps, springs, and natural drainages for technically defensible sampling and analysis.

#### 4.2.1 Seeps and Springs

As the winter 2015 snow melts in the vicinity of the site, the perimeter of the well pad and the surrounding area will be walked to inspect for any seeps or springs. If present, these seeps or springs will be sampled and analyzed as described in Section 4.2.3. It is anticipated that these seep/spring inspections will occur three to four times as conditions warrant. Based on the extremely steep conditions west of 21A, inspection personnel will use heightened caution when working in this area.

#### 4.2.2 Natural Drainages

In connection with each seep and spring sampling event, natural drainages near 21A will be sampled at the six locations shown on Figure 3 and described below, assuming water is present at the time of the sampling event.

- Location 1 – Upstream location in Cascade Creek northwest of 21A. Existing sampling location 69721AMOC34 is suitable for this monitoring.
- Location 2 – Downstream location in Cascade Creek west of 21A where the unnamed tributary located south of 21A enters Cascade Creek.
- Location 3 – Upstream location in the Conn Creek tributary east of 21A. Existing sampling location 69721AMOC42 (Photo 8) is suitable for this monitoring.
- Location 4 – Downstream location in the Conn Creek tributary east of 21A.
- Location 5 – This location would monitor surface water quality from another party located upstream along the unnamed tributary.
- Location 6 – This location would monitor the unnamed tributary located south of 21A.



### **4.2.3 Sampling and Analysis**

It is proposed that the drainages and nearby seeps and springs be monitored by quarterly sampling events beginning in Spring of 2015 and ending in Fall of 2016, dependent on available surface water and surface access conditions. This surface water sampling program will be performed based on Golder Technical Procedure TP 1.2-26 (Surface Water Sampling Methods) provided in Appendix E. Water quality analytical testing will be performed by Accutest Mountain States, a Colorado certified laboratory. Based on the 21A condensate and produced water analyses detailed in Appendix A-2 and the spill area excavation sampling results (Appendix B-2), it is proposed that the analytical testing program include the following parameters:

- BTEX, TPH-DRO, and TPH-GRO;
- Total dissolved solids and total suspended solids; and
- Chloride, sulfate, iron, and pH.

Analytical test methods will be in accordance with COGCC requirements.

### **4.2.4 Monitoring Program Reporting**

For each of the 21A monitoring events, analytical results will be submitted to the COGCC, along with a concise Technical Memorandum. Each Technical Memorandum will describe the sampling and analysis performed and will note any monitoring locations that could not be sampled. The Technical Memorandum issued following the final 2016 monitoring event will include recommendations for possible subsequent water quality monitoring for the site, if appropriate.



## 5.0 SUMMARY AND CONCLUSIONS

Based on concerns about a possible fluid leak at the 21A well production pad, field investigations at the site were initiated on December 2, 2014. It was confirmed on December 2 that a leak was present in the condensate dump line, so appropriate notification calls were made on December 3. Based on tank gauge and historical data, MOC estimated that 229 barrels of produced water and 4 barrels of condensate were released from the condensate dump line at the site.

Subsequent investigations confirmed that: 1) the leak was from a hole in the 90-degree elbow that connected the condensate dump line horizontal pipe to the riser; 2) a PID reading of 1,716 ppm and soil concentrations of 715 ppm TPH-DRO and 3,180 ppm TPH-GRO were present immediately below the leak location; and 3) after soil and rock in the spill area were excavated to an ultimate depth of approximately 7 feet, a residual PID reading of 0.70 ppm was measured. A total of approximately 36 cubic yards of soil and rock were excavated at the site in connection with these remediation efforts.

MOC's Fixed Equipment Integrity Specialist determined that carbon dioxide-related corrosion had caused the holes in the condensate pipe elbow. The affected portion of the condensate dump line was replaced prior to backfilling the 21A remediation excavation area with clean materials. Potentially contaminated materials removed during 21A remediation were staged within lined containment and will be treated or disposed in accordance with applicable requirements in the Spring of 2015.

The site is located in a remote area that is more than 2 miles from any water supply wells, and is likely underlain by at least 100 feet of unsaturated bedrock. However, relatively large surface water drainages are located 2,300 to 2,700 feet from the site. It is proposed that these drainages and nearby seeps and springs be monitored by quarterly sampling events beginning in Spring of 2015 and ending in Fall of 2016, dependent on available surface water and surface access conditions.

Evaluation of site conditions and activities related to the spill at 21A supports the following conclusions.

- MOC was proactive in performing systematic site investigations and site remediation in response to the 21A spill.
- Rock and soil in the spill area were remediated and the corroded portion of the condensate dump line was replaced, thereby minimizing the potential for migration of contamination.
- The proposed water quality monitoring program is a reasonable approach to confirming that the 21A spill does not impact waters of the State.

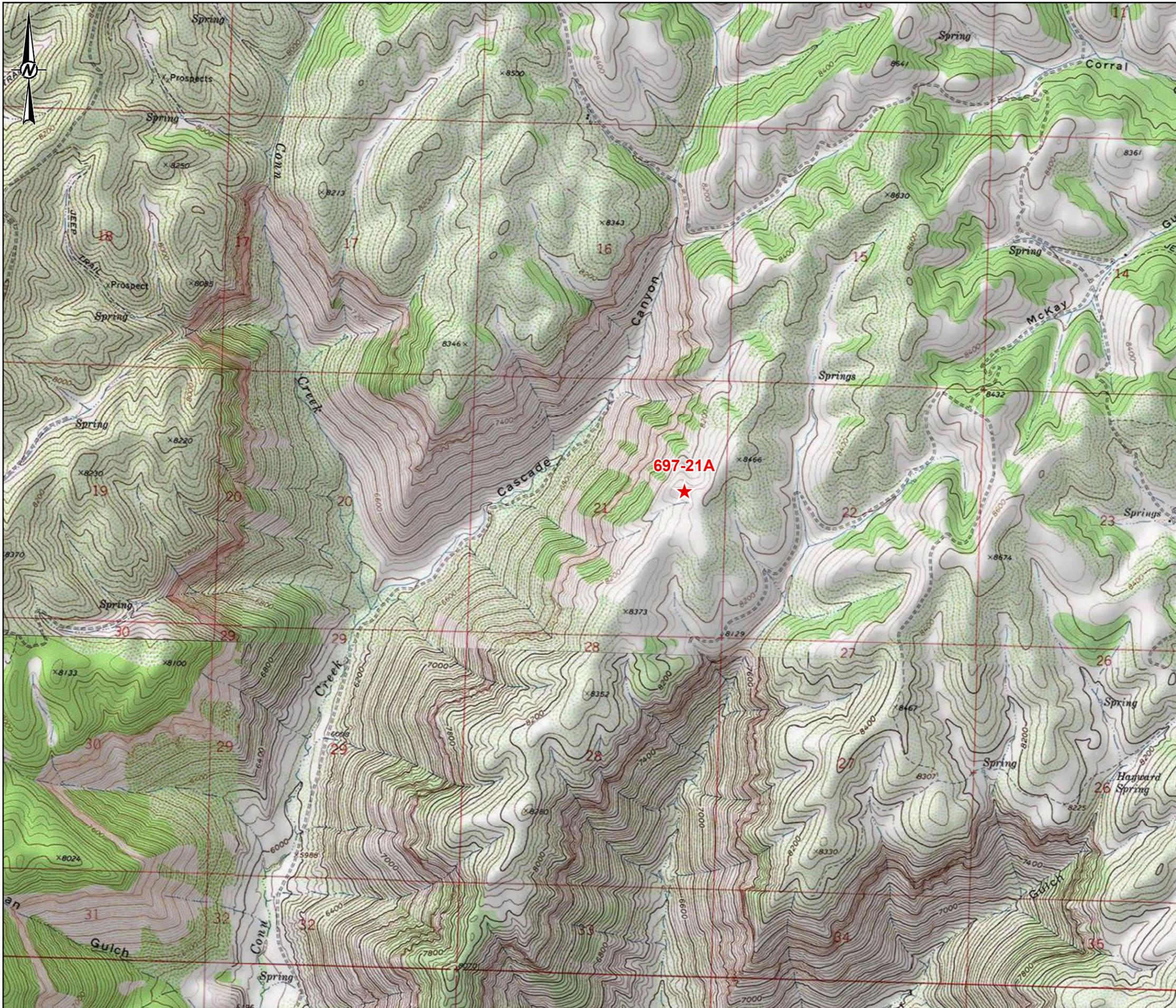
**TABLE**

**Table 1: 21A Flow-line Excavation Sampling**

Sample ID	Depth (ft bgs)	Moisture Observations	Odor Observations	Visual Observations	PID (ppm)
SO_21A_FL_EXC_1	4.0	Nearly saturated; almost at field capacity	Strong hydrocarbon odor	Medium to dark brown in color; very gravelly; much wetter than surrounding, non-impacted soil	251.6
SO_21A_FL_EXC_2	6.0	Saturated; at field capacity	Very strong hydrocarbon odor	Medium to dark brown in color; very gravelly; much, much wetter than surrounding, non-impacted soil	1,716

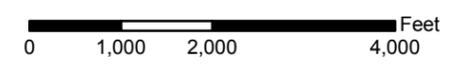
\*Note: Sample SO\_21A\_FL\_EXC\_1 was collected above the 90 degree elbow on the condensate dump line riser; sample SO\_21A\_FL\_EXC\_2 was collected directly below the 90 degree elbow on the condensate dump line riser. Sampling was performed on December 11, 2014.

## FIGURES



**LEGEND**

★ WELL PAD



**REFERENCE**

1. USGS TOPO QUADS ACCESSED VIA ESRI BASEMAP SERVICES, © 2013 NATIONAL GEOGRAPHIC SOCIETY.
2. COORDINATE SYSTEM: NAD83 STATE PLANE COLORADO CENTRAL, FEET.

CLIENT  
MARATHON OIL COMPANY

PROJECT  
21A FACILITY  
GARFIELD COUNTY, COLORADO

TITLE  
**SITE LOCATION MAP**

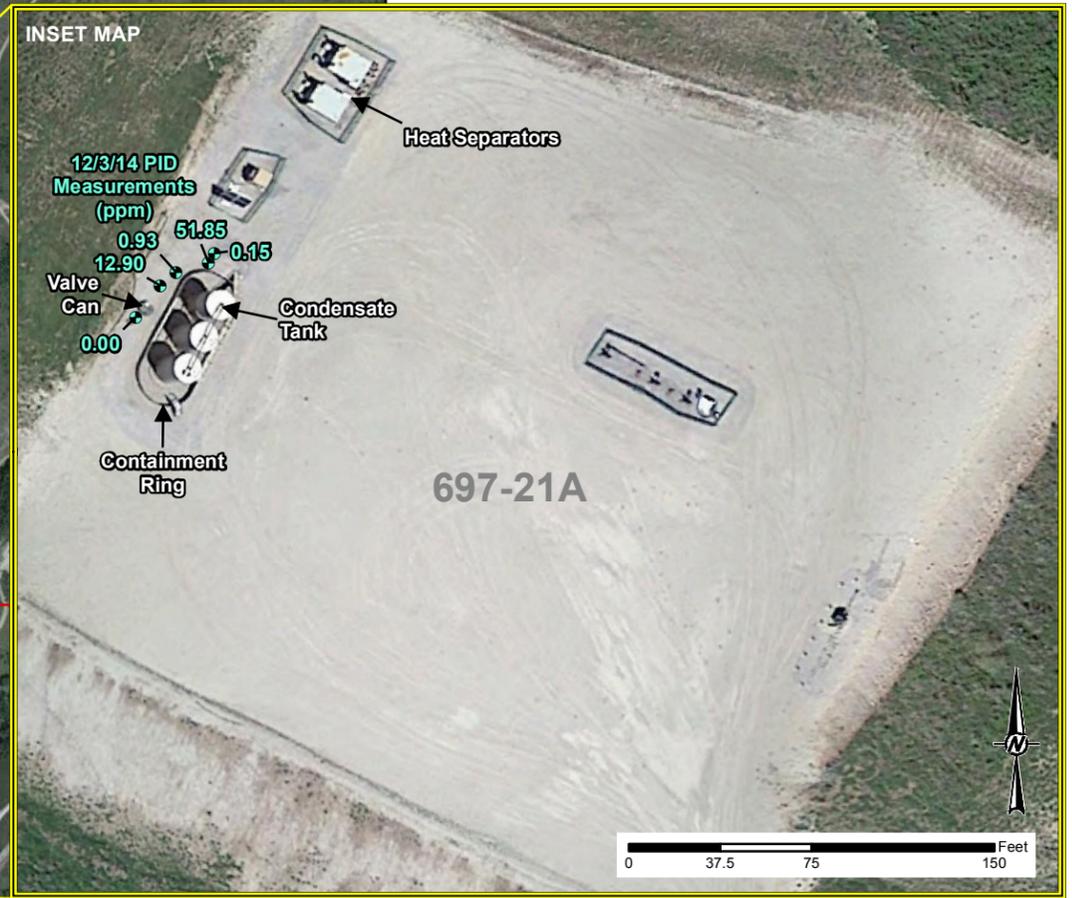
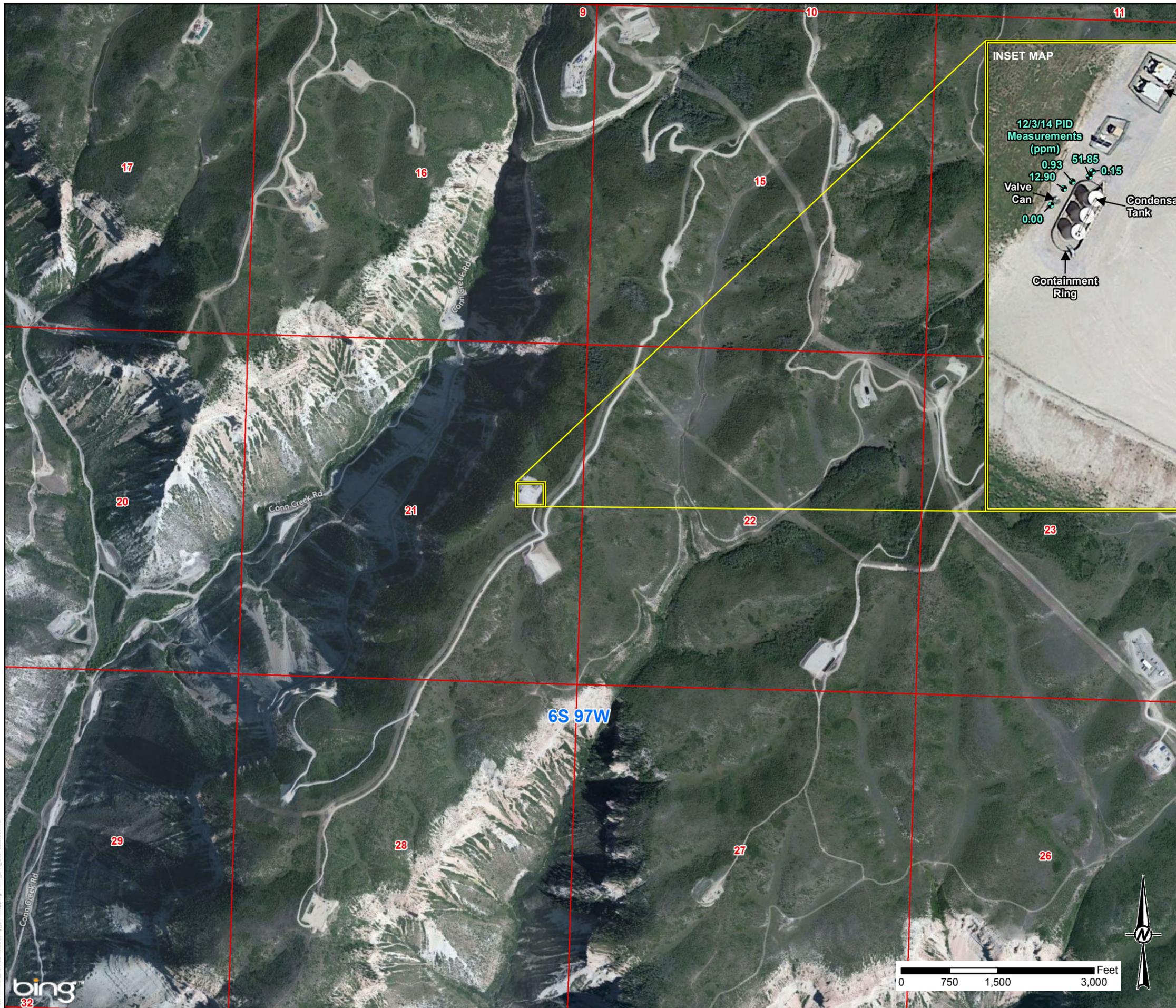
CONSULTANT	YYYY-MM-DD	2015-01-22
	PREPARED	KJC
	DESIGN	KJC
	REVIEW	JM
	APPROVED	RM

PROJECT No.  
1520168

FIGURE  
**1**

Path: \\Marathon\Garfield\County\_21A\MapInfo\1117\_21A\_SiteLocation.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 11in



**REFERENCE**

1. MAIN MAP AERIAL IMAGERY ACCESSED VIA ESRI BASEMAP SERVICES, © 2013 MICROSOFT CORPORATION. IMAGERY CAPTURED 2010.
2. INSET MAP AERIAL IMAGERY EXPORTED FROM GOOGLE EARTH PRO. IMAGERY CAPTURED 6/3/2014.
3. COORDINATE SYSTEM: NAD83 STATE PLANE COLORADO CENTRAL, FEET.

CLIENT  
MARATHON OIL COMPANY

PROJECT  
21A FACILITY  
GARFIELD COUNTY, COLORADO

TITLE  
**SITE FEATURES**

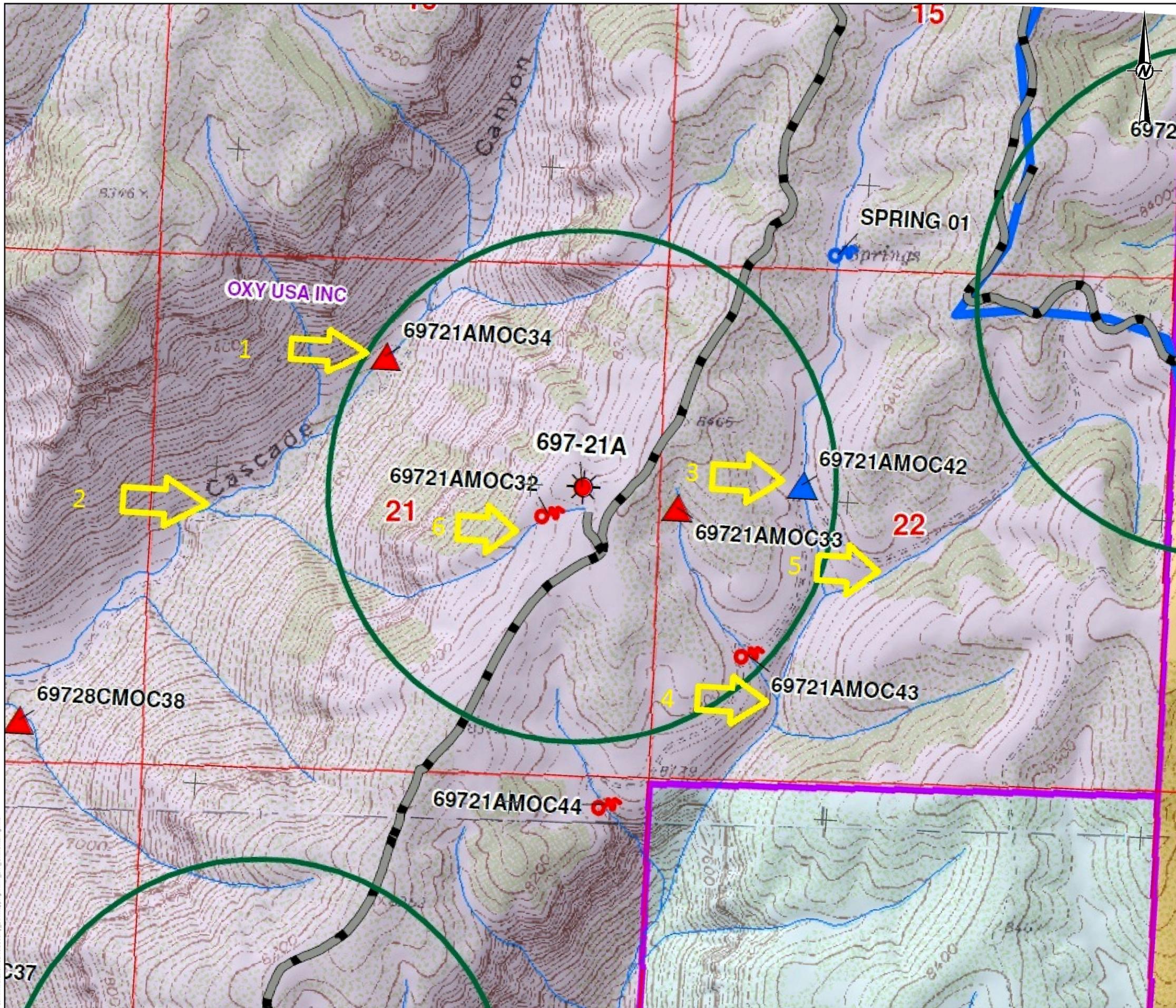
CONSULTANT	YYYY-MM-DD	2015-01-22
	PREPARED	KJC
	DESIGN	KJC
	REVIEW	JM
	APPROVED	RM

PROJECT No.  
1520168

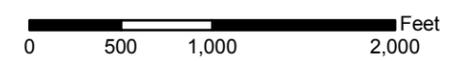
FIGURE  
**2**

Path: \\Marathon\GarfieldCounty\_21A\Map\011117\_21A\_SiteFeatures.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 11in



- LEGEND**
-  WELL PAD 697-21A
  -  POTENTIAL SURFACE WATER MONITORING LOCATION
  -  NO FLOW 8/8/12
  -  SAMPLED 8/8/12
  -  SPRING - NO FLOW 8/8/12
  -  SPRING - SAMPLED 8/8/12



**REFERENCE**

1. USGS TOPO QUADS © 2013 NATIONAL GEOGRAPHIC SOCIETY.
2. COORDINATE SYSTEM: NAD83 STATE PLANE COLORADO CENTRAL, FEET.

CLIENT  
MARATHON OIL COMPANY

PROJECT  
21A FACILITY  
GARFIELD COUNTY, COLORADO

TITLE  
**PROPOSED SURFACE WATER MONITORING**

CONSULTANT	YYYY-MM-DD	2015-01-22
	PREPARED	KJC
	DESIGN	KJC
	REVIEW	JM
	APPROVED	RM

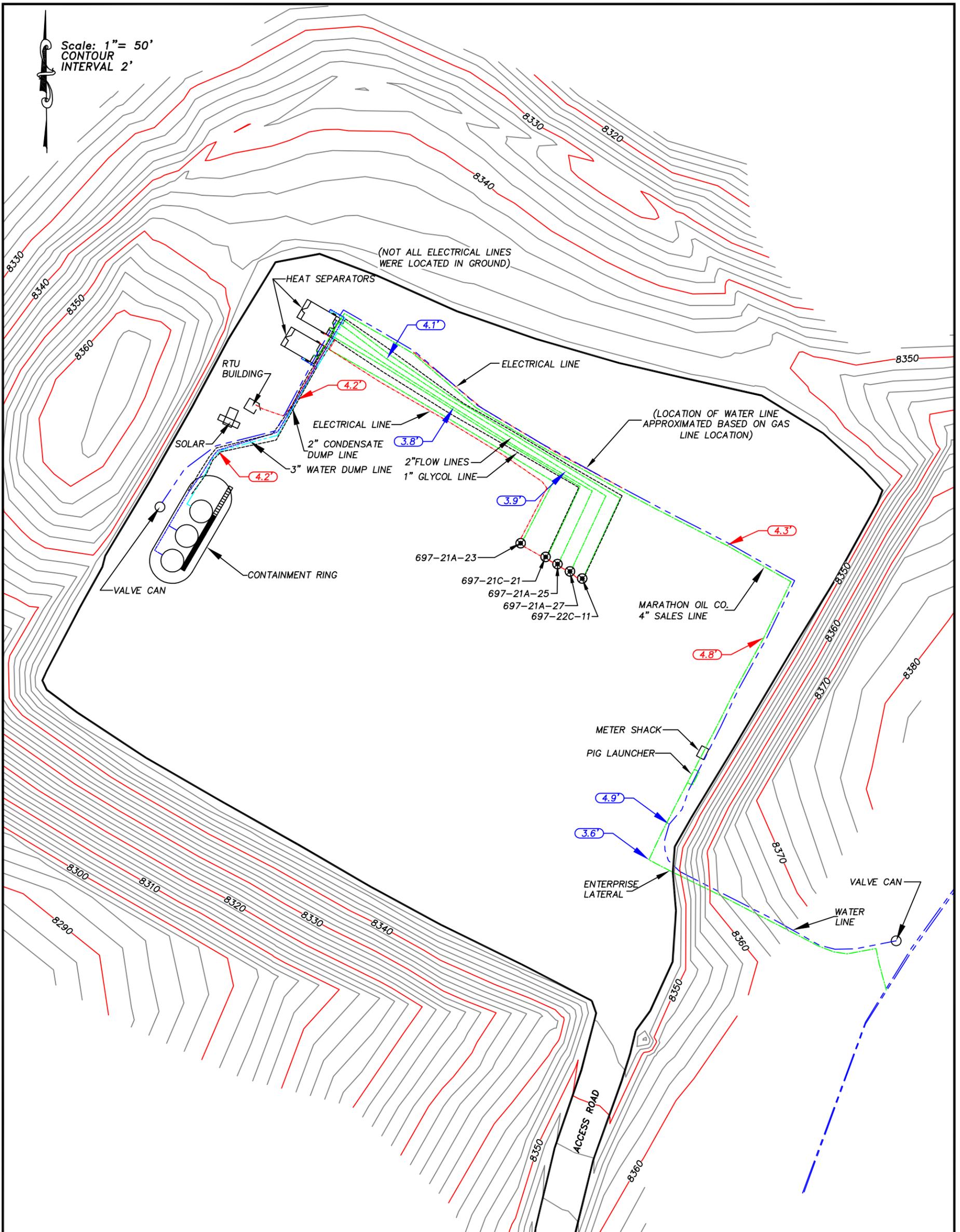
Path: \\Marathon\GarfieldCounty\_21A\MapInfo\1117\_21A\_SWM\Monitoring.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 11x17

**APPENDIX A**  
**21A BACKGROUND DOCUMENTATION**

**APPENDIX A-1**  
**21A AS-BUILT DIAGRAM**

Scale: 1" = 50'  
 CONTOUR  
 INTERVAL 2'



DESCRIPTION	SIZE	SCHEDULE	NOTE
SALES LINE PIPE	4"	40	PIPE COATED SA106 GR B (SEAMLESS)
WATER DUMP LINE	3"	80	PIPE COATED SA106 GR B (SEAMLESS)
CONDENSATE DUMP LINE	2"	40	PIPE COATED SA106 GR B (SEAMLESS)
FLOW LINES	2"	80	PIPE COATED SA106 GR B (SEAMLESS)
GLYCOL LINES	1"	80	PIPE - EXTERNALLY COATED

(4.5') PIPE DEPTH DERIVED FROM DATA COLLECTED FROM PIPE IN THE GROUND  
 (4.5') PIPE DEPTH DERIVED FROM ABOVE GROUND DATA COLLECTED USING METROTECH DEVICE  
 NOTE: PIPE DEPTHS MAY VARY FROM SHOWN DEPTHS BASED ON CONTINUED CONSTRUCTION & EROSION

**WILLIAM H. SMITH & ASSOCIATES P.C.**  
 SURVEYING CONSULTANTS  
 550 EAST SECOND NORTH GREEN RIVER, WY  
 PHONE: 307-875-3638 307-875-3639  
 www.whsmithpc.com

- 2" FLOW LINES
- 4" SALES LINE PIPE
- GAS FLARE STACK
- 3" WATER DUMP LINE
- WATER VALVE CAN
- 1" GLYCOL LINE
- ELECTRICAL LINE
- 2" CONDENSATE D.L.

LOCATION:  
 697-21A  
 WITHIN THE NE/4 SECTION 21,  
 T 6 S, R 97 W,  
 6TH PM.  
 GARFIELD COUNTY,  
 COLORADO

MARATHON OIL COMPANY  
 P.O. Box 3128  
 Houston, TX 77253  
 5555 San Felipe  
 Houston, TX 77056  
**ASBUILT FLOWLINE  
 DIAGRAM**

DRAWN BY: AT/JJ	CHECKED BY: CED	SCALE: 1" = 50'
DATE: 11/16/2011	JOB NO: 26099	SHEET 1 OF 1

**APPENDIX A-2**  
**21A CONDENSATE AND PRODUCED WATER ANALYSES**

**Technical Report for**

**Marathon Oil**

**21A Spill Investigation**

**PO# 4800011767 Line Item 10**

**Accutest Job Number: D66737**

**Sampling Date: 01/15/15**

**Report to:**

**Marathon Oil Company  
251 N. Parachute Ave.  
Parachute, CO 81635  
sdistel@marathonoil.com**

**ATTN: Scott Distel**

**Total number of pages in report: 69**



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

Marathon Oil

Job No: D66737

21A Spill Investigation

Project No: PO# 4800011767 Line Item 10

Sample Number	Collected		Received	Matrix		Client Sample ID
	Date	Time By		Code	Type	
D66737-1	01/15/15	12:40 SD	01/16/15	AQ	Water	PW_21A_PRODUCED_WATER
D66737-2	01/15/15	13:00 SD	01/16/15	LIQ	Liquid, Non-aqueous	LIQ_21A_CONDENSATE

## CASE NARRATIVE / CONFORMANCE SUMMARY

**Client:** Marathon Oil

**Job No** D66737

**Site:** 21A Spill Investigation

**Report Date** 1/23/2015 4:45:16 PM

On 01/16/2015, 2 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 3.2 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D66737 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 8260C

**Matrix:** AQ **Batch ID:** M:MSN3480

- The data for SW846 8260C meets quality control requirements.
- D66737-2: Analysis performed at Accutest Laboratories, Marlborough, MA.

**Matrix:** AQ **Batch ID:** M:MSP2727

- The data for SW846 8260C meets quality control requirements.
- D66737-1: Analysis performed at Accutest Laboratories, Marlborough, MA.

### Volatiles by GC By Method SW846 8015B

**Matrix:** AQ **Batch ID:** GGA1385

- All samples were analyzed within the recommended method holding time.
- Sample(s) D66738-1MS, D66738-1MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

### Extractables by GC By Method SW846-8015B

**Matrix:** AQ **Batch ID:** OP11200

- All samples were extracted and analyzed within the recommended method holding time.
- Sample(s) D66752-3MS, D66752-3MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

**Matrix:** AQ **Batch ID:** OP11205

- All samples were extracted and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D66737-2MS, D66737-2MSD were used as the QC samples indicated.
- The matrix spike (MS) recovery(s) of TPH-DRO (C10-C28) are outside control limits. Outside control limits due to high level in sample relative to spike amount.

## Metals By Method SW846 6010C

**Matrix:** AQ**Batch ID:** MP15034

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D66737-1SDL, D66737-1MS, D66737-1MSD were used as the QC samples for the metals analysis.

**Matrix:** AQ**Batch ID:** MP15067

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D66752-13MS, D66752-13MSD, D66752-13SDL were used as the QC samples for the metals analysis.
- The serial dilution RPD(s) for Iron are outside control limits for sample MP15067-SD1. Percent difference acceptable due to low initial sample concentration (< 50 times IDL).

## Wet Chemistry By Method EPA 300.0/SW846 9056

**Matrix:** AQ**Batch ID:** GP14437

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D66659-2MS, D66659-2MSD were used as the QC samples for the Chloride, Sulfate, Chloride, Nitrogen, Nitrate analysis.
- The matrix spike (MS) recovery(s) and matrix spike duplicate (MSD) recovery(s) of Nitrogen, Nitrate are outside control limits. Probable cause due to matrix interference.
- GP14437-S1 for Nitrogen, Nitrate: NO<sub>2</sub> and NO<sub>3</sub> recoveries are outside QC acceptance limits due to the reduction of NO<sub>3</sub> to NO<sub>2</sub> as a result of a reducing agent in the sample.
- D66737-1 for Nitrogen, Nitrate: Elevated detection limit due to matrix interference.
- D66737-1 for Sulfate: Elevated detection limit due to matrix interference.

## Wet Chemistry By Method SM 2320B-2011

**Matrix:** AQ**Batch ID:** GN28290

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D66559-1DUP, D66559-1MS, D66559-1MSD were used as the QC samples for the Alkalinity, Total as CaCO<sub>3</sub> analysis.

## Wet Chemistry By Method SM 2540C-2011

**Matrix:** AQ**Batch ID:** GN28268

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D66687-1DUP were used as the QC samples for the Solids, Total Dissolved analysis.

## Wet Chemistry By Method SM 2540D-2011

**Matrix:** AQ**Batch ID:** GN28298

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D66687-1DUP were used as the QC samples for the Solids, Total Suspended analysis.

### Wet Chemistry By Method SM 4500S2 F-2011

**Matrix:** AQ

**Batch ID:** GN28322

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D66719-1MS were used as the QC samples for the Sulfide analysis.

### Wet Chemistry By Method SM4500HB+-2011/9040C

**Matrix:** AQ

**Batch ID:** GN28279

- The following samples were run outside of holding time for method SM4500HB+-2011/9040C: D66737-1 Analysis performed past the required 15 minutes from collection time/holding time.

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.



## SAMPLE DELIVERY GROUP CASE NARRATIVE

**Client:** Accutest Mountain States

**Job No** D66737

**Site:** MOILCOGJ: 21A Spill Investigation

**Report Date** 1/23/2015 4:10:26 PM

2 Sample(s) were collected on 01/15/2015 and were received at Accutest on 01/16/2015 properly preserved, at 0.5 Deg. C and intact. These Samples received an Accutest job number of D66737. A listing of the Laboratory Sample ID, Client Sample ID and dates of collection are presented in the Results Summary Section of this report.

Except as noted below, all method specified calibrations and quality control performance criteria were met for this job. For more information, please refer to QC summary pages.

### Volatiles by GCMS By Method SW846 8260C

**Matrix** AQ

**Batch ID:** MSN3480

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) MC36532-1MS, MC36532-1MSD were used as the QC samples indicated.

**Matrix** AQ

**Batch ID:** MSP2727

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) MC36337-1MS, MC36337-1MSD were used as the QC samples indicated.
- MC36337-1MS/MSD Recovery(s) for Benzene are outside control limits. Outside control limits due to high level in sample relative to spike amount.

The Accutest Laboratories of New England certifies that all analysis were performed within method specification. It is further recommended that this report to be used in its entirety. The Accutest Laboratories of NE, Laboratory Director or assignee as verified by the signature on the cover page has authorized the release of this report(D66737).

## Summary of Hits

**Job Number:** D66737  
**Account:** Marathon Oil  
**Project:** 21A Spill Investigation  
**Collected:** 01/15/15



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

**D66737-1 PW\_21A\_PRODUCED\_WATER**

Benzene <sup>a</sup>	11.3	0.050	0.025	mg/l	SW846 8260C
Toluene <sup>a</sup>	19.0	0.10	0.022	mg/l	SW846 8260C
Ethylbenzene <sup>a</sup>	0.539	0.10	0.025	mg/l	SW846 8260C
Xylene (total) <sup>a</sup>	9.32	0.10	0.030	mg/l	SW846 8260C
TPH-GRO (C6-C10)	132	25	25	mg/l	SW846 8015B
TPH-DRO (C10-C28)	272	19	17	mg/l	SW846-8015B
Iron	26400	70		ug/l	SW846 6010C
Manganese	404	5.0		ug/l	SW846 6010C
Alkalinity, Total as CaCO3	309	5.0		mg/l	SM 2320B-2011
Chloride	5910	100		mg/l	EPA 300.0/SW846 9056
Solids, Total Dissolved	12500	10		mg/l	SM 2540C-2011
Solids, Total Suspended	80.0	5.0		mg/l	SM 2540D-2011
pH <sup>b</sup>	6.51			su	SM4500HB+ -2011/9040C

**D66737-2 LIQ\_21A\_CONDENSATE**

Benzene <sup>a</sup>	4110	25	12	mg/l	SW846 8260C
Toluene <sup>a</sup>	19200	50	11	mg/l	SW846 8260C
Ethylbenzene <sup>a</sup>	2220	50	13	mg/l	SW846 8260C
Xylene (total) <sup>a</sup>	26700	50	15	mg/l	SW846 8260C
TPH-GRO (C6-C10)	563000	50000	50000	mg/l	SW846 8015B
TPH-DRO (C10-C28)	178000	3900	3500	mg/l	SW846-8015B
Iron	3760	3500		ug/l	SW846 6010C

(a) Analysis performed at Accutest Laboratories, Marlborough, MA.

(b) Analysis performed past the required 15 minutes from collection time/holding time.

Sample Results

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Report of Analysis

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## Report of Analysis

<b>Client Sample ID:</b> PW_21A_PRODUCED_WATER	<b>Date Sampled:</b> 01/15/15
<b>Lab Sample ID:</b> D66737-1	<b>Date Received:</b> 01/16/15
<b>Matrix:</b> AQ - Water	<b>Percent Solids:</b> n/a
<b>Method:</b> SW846 8260C	
<b>Project:</b> 21A Spill Investigation	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 <sup>a</sup>	P83264.D	100	01/21/15	AMA	n/a	n/a	M:MSP2727
Run #2							

Run #	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	11.3	0.050	0.025	mg/l	
108-88-3	Toluene	19.0	0.10	0.022	mg/l	
100-41-4	Ethylbenzene	0.539	0.10	0.025	mg/l	
1330-20-7	Xylene (total)	9.32	0.10	0.030	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	103%		70-130%
2037-26-5	Toluene-D8	101%		70-130%
460-00-4	4-Bromofluorobenzene	107%		70-130%

(a) Analysis performed at Accutest Laboratories, Marlborough, MA.

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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

## Report of Analysis

<b>Client Sample ID:</b> PW_21A_PRODUCED_WATER	<b>Date Sampled:</b> 01/15/15
<b>Lab Sample ID:</b> D66737-1	<b>Date Received:</b> 01/16/15
<b>Matrix:</b> AQ - Water	<b>Percent Solids:</b> n/a
<b>Method:</b> SW846 8015B	
<b>Project:</b> 21A Spill Investigation	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GA25160.D	500	01/21/15	KN	n/a	n/a	GGA1385
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	132	25	25	mg/l	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	92%		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

<b>Client Sample ID:</b> PW_21A_PRODUCED_WATER	<b>Date Sampled:</b> 01/15/15
<b>Lab Sample ID:</b> D66737-1	<b>Date Received:</b> 01/16/15
<b>Matrix:</b> AQ - Water	<b>Percent Solids:</b> n/a
<b>Method:</b> SW846-8015B SW846 3510C	
<b>Project:</b> 21A Spill Investigation	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FD39924.D	100	01/21/15	JJ	01/19/15	OP11200	GFD1760
Run #2							

Run #	Initial Volume	Final Volume
Run #1	1060 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	272	19	17	mg/l	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	49%		10-130%		

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

<b>Client Sample ID:</b> PW_21A_PRODUCED_WATER	<b>Date Sampled:</b> 01/15/15
<b>Lab Sample ID:</b> D66737-1	<b>Date Received:</b> 01/16/15
<b>Matrix:</b> AQ - Water	<b>Percent Solids:</b> n/a
<b>Project:</b> 21A Spill Investigation	

### Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Iron	26400	70	ug/l	1	01/21/15	01/22/15 JB	SW846 6010C <sup>1</sup>	SW846 3010A <sup>2</sup>
Manganese	404	5.0	ug/l	1	01/21/15	01/22/15 JB	SW846 6010C <sup>1</sup>	SW846 3010A <sup>2</sup>

(1) Instrument QC Batch: MA5698

(2) Prep QC Batch: MP15034

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RL = Reporting Limit

4.1  
4

## Report of Analysis

<b>Client Sample ID:</b> PW_21A_PRODUCED_WATER	<b>Date Sampled:</b> 01/15/15
<b>Lab Sample ID:</b> D66737-1	<b>Date Received:</b> 01/16/15
<b>Matrix:</b> AQ - Water	<b>Percent Solids:</b> n/a
<b>Project:</b> 21A Spill Investigation	

### General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Total as CaCO <sub>3</sub>	309	5.0	mg/l	1	01/19/15	TJ	SM 2320B-2011
Chloride	5910	100	mg/l	200	01/16/15 15:21	BF	EPA 300.0/SW846 9056
Nitrogen, Nitrate <sup>a</sup>	< 2.0	2.0	mg/l	200	01/16/15 15:21	BF	EPA 300.0/SW846 9056
Solids, Total Dissolved	12500	10	mg/l	1	01/19/15	JF	SM 2540C-2011
Solids, Total Suspended	80.0	5.0	mg/l	1	01/20/15	JF	SM 2540D-2011
Sulfate <sup>a</sup>	< 100	100	mg/l	200	01/16/15 15:21	BF	EPA 300.0/SW846 9056
Sulfide	< 0.50	0.50	mg/l	1	01/21/15	JD	SM 4500S2 F-2011
pH <sup>b</sup>	6.51		su	1	01/19/15 08:15	TB	SM4500HB+ -2011/9040C

(a) Elevated detection limit due to matrix interference.

(b) Analysis performed past the required 15 minutes from collection time/holding time.

---

RL = Reporting Limit

## Report of Analysis

<b>Client Sample ID:</b> LIQ_21A_CONDENSATE	<b>Date Sampled:</b> 01/15/15
<b>Lab Sample ID:</b> D66737-2	<b>Date Received:</b> 01/16/15
<b>Matrix:</b> LIQ - Liquid, Non-aqueous	<b>Percent Solids:</b> n/a
<b>Method:</b> SW846 8260C	
<b>Project:</b> 21A Spill Investigation	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 <sup>a</sup>	N94355.D	50000	01/23/15	AMA	n/a	n/a	M:MSN3480
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	4110	25	12	mg/l	
108-88-3	Toluene	19200	50	11	mg/l	
100-41-4	Ethylbenzene	2220	50	13	mg/l	
1330-20-7	Xylene (total)	26700	50	15	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	97%		70-130%
2037-26-5	Toluene-D8	98%		70-130%
460-00-4	4-Bromofluorobenzene	92%		70-130%

(a) Analysis performed at Accutest Laboratories, Marlborough, MA.

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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

<b>Client Sample ID:</b> LIQ_21A_CONDENSATE	<b>Date Sampled:</b> 01/15/15
<b>Lab Sample ID:</b> D66737-2	<b>Date Received:</b> 01/16/15
<b>Matrix:</b> LIQ - Liquid, Non-aqueous	<b>Percent Solids:</b> n/a
<b>Method:</b> SW846 8015B	
<b>Project:</b> 21A Spill Investigation	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GA25161.D	1000000	01/21/15	KN	n/a	n/a	GGA1385
Run #2							

Run #	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	563000	50000	50000	mg/l	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	92%		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

<b>Client Sample ID:</b> LIQ_21A_CONDENSATE	<b>Date Sampled:</b> 01/15/15
<b>Lab Sample ID:</b> D66737-2	<b>Date Received:</b> 01/16/15
<b>Matrix:</b> LIQ - Liquid, Non-aqueous	<b>Percent Solids:</b> n/a
<b>Method:</b> SW846-8015B SW846 3580A	
<b>Project:</b> 21A Spill Investigation	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI20935.D	2	01/21/15	JJ	01/20/15	OP11205	GFI1108
Run #2							

	Initial Volume	Final Volume
Run #1	1.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	178000	3900	3500	mg/l	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	88%		10-130%		

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

4.2  
4

## Report of Analysis

<b>Client Sample ID:</b> LIQ_21A_CONDENSATE	<b>Date Sampled:</b> 01/15/15
<b>Lab Sample ID:</b> D66737-2	<b>Date Received:</b> 01/16/15
<b>Matrix:</b> LIQ - Liquid, Non-aqueous	<b>Percent Solids:</b> n/a
<b>Project:</b> 21A Spill Investigation	

### Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Iron	3760	3500	ug/l	1	01/23/15	01/23/15 JB	SW846 6010C <sup>1</sup>	SW846 3010A <sup>2</sup>
Manganese	< 250	250	ug/l	1	01/23/15	01/23/15 JB	SW846 6010C <sup>1</sup>	SW846 3010A <sup>2</sup>

(1) Instrument QC Batch: MA5702

(2) Prep QC Batch: MP15067

---

RL = Reporting Limit

4.2  
4

## Misc. Forms

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### Custody Documents and Other Forms

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Includes the following where applicable:

- Chain of Custody



**Accutest Job Number:** D66737      **Client:** MARATHON      **Project:** 21A  
**Date / Time Received:** 1/16/2015 1:58:00 PM      **Delivery Method:** \_\_\_\_\_      **Airbill #'s:** CO  
**Cooler Temps (Initial/Adjusted):** #1: (3.2/3.2);

**Cooler Security**

	<u>Y or N</u>			<u>Y or N</u>	
1. Custody Seals Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. COC Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Custody Seals Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. Smp Dates/Time OK	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**Cooler Temperature**

	<u>Y or N</u>	
1. Temp criteria achieved:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Cooler temp verification:	<u>Bar Therm;</u>	
3. Cooler media:	<u>Ice (Bag)</u>	
4. No. Coolers:	<u>1</u>	

**Quality Control Preservation**

	<u>Y</u>	<u>or</u>	<u>N</u>	<u>N/A</u>
1. Trip Blank present / cooler:	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Trip Blank listed on COC:	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. Samples preserved properly:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
4. VOCs headspace free:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

Comments

**Sample Integrity - Documentation**

	<u>Y</u>	<u>or</u>	<u>N</u>
1. Sample labels present on bottles:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
2. Container labeling complete:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
3. Sample container label / COC agree:	<input checked="" type="checkbox"/>		<input type="checkbox"/>

**Sample Integrity - Condition**

	<u>Y</u>	<u>or</u>	<u>N</u>
1. Sample recvd within HT:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
2. All containers accounted for:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
3. Condition of sample:	<u>Intact</u>		

**Sample Integrity - Instructions**

	<u>Y</u>	<u>or</u>	<u>N</u>	<u>N/A</u>
1. Analysis requested is clear:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
2. Bottles received for unspecified tests	<input type="checkbox"/>		<input checked="" type="checkbox"/>	
3. Sufficient volume recvd for analysis:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
4. Compositing instructions clear:	<input type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
5. Filtering instructions clear:	<input type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>

5.1  
5

## 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:** D66737  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GGA1385-MB	GA25139.D	1	01/20/15	KN	n/a	n/a	GGA1385

The QC reported here applies to the following samples:

Method: SW846 8015B

D66737-1, D66737-2

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	0.050	0.050	mg/l	

CAS No.	Surrogate Recoveries	Limits
120-82-1	1,2,4-Trichlorobenzene	92% 60-140%

# Blank Spike Summary

**Job Number:** D66737  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GGA1385-BS	GA25137.D	1	01/20/15	KN	n/a	n/a	GGA1385

The QC reported here applies to the following samples:

Method: SW846 8015B

D66737-1, D66737-2

CAS No.	Compound	Spike mg/l	BSP mg/l	BSP %	Limits
	TPH-GRO (C6-C10)	2.2	2.31	105	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
120-82-1	1,2,4-Trichlorobenzene	93%	60-140%

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D66737  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D66738-1MS	GA25144.D	50	01/20/15	KN	n/a	n/a	GGA1385
D66738-1MSD	GA25145.D	50	01/20/15	KN	n/a	n/a	GGA1385
D66738-1	GA25143.D	50	01/20/15	KN	n/a	n/a	GGA1385

The QC reported here applies to the following samples:

Method: SW846 8015B

D66737-1, D66737-2

CAS No.	Compound	D66738-1 mg/l	Spike Q mg/l	MS mg/l	MS %	Spike mg/l	MSD mg/l	MSD %	RPD	Limits Rec/RPD
	TPH-GRO (C6-C10)	113	110	229	105	110	221	98	4	70-130/30

CAS No.	Surrogate Recoveries	MS	MSD	D66738-1	Limits
120-82-1	1,2,4-Trichlorobenzene	97%	98%	89%	60-140%

\* = 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:** D66737  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP11200-MB	FI20895.D	1	01/20/15	JJ	01/19/15	OP11200	GFI1106

The QC reported here applies to the following samples:

Method: SW846-8015B

D66737-1

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.20	0.18	mg/l	

CAS No.	Surrogate Recoveries	Limits
84-15-1	o-Terphenyl	49% 10-130%

7.1.1  
7

# Method Blank Summary

**Job Number:** D66737  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP11205-MB	FI20929.D	1	01/21/15	JJ	01/20/15	OP11205	GFI1108

The QC reported here applies to the following samples:

Method: SW846-8015B

D66737-2

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	2000	1800	mg/l	

CAS No.	Surrogate Recoveries	Limits
84-15-1	o-Terphenyl	104% 10-130%

# Blank Spike Summary

**Job Number:** D66737  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP11200-BS	FI20896.D	1	01/20/15	JJ	01/19/15	OP11200	GFI1106

The QC reported here applies to the following samples:

Method: SW846-8015B

D66737-1

CAS No.	Compound	Spike mg/l	BSP mg/l	BSP %	Limits
	TPH-DRO (C10-C28)	5	2.18	44	33-130

CAS No.	Surrogate Recoveries	BSP	Limits
84-15-1	o-Terphenyl	53%	10-130%

\* = Outside of Control Limits.

# Blank Spike Summary

**Job Number:** D66737  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP11205-BS	FI20930.D	1	01/21/15	JJ	01/20/15	OP11205	GFI1108

The QC reported here applies to the following samples:

Method: SW846-8015B

D66737-2

CAS No.	Compound	Spike mg/l	BSP mg/l	BSP %	Limits
	TPH-DRO (C10-C28)	5000	3490	70	33-130

CAS No.	Surrogate Recoveries	BSP	Limits
84-15-1	o-Terphenyl	80%	10-130%

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D66737  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP11200-MS	FI20897.D	1	01/20/15	JJ	01/19/15	OP11200	GFI1106
OP11200-MSD	FI20898.D	1	01/20/15	JJ	01/19/15	OP11200	GFI1106
D66752-3	FI20899.D	1	01/20/15	JJ	01/19/15	OP11200	GFI1106

The QC reported here applies to the following samples:

Method: SW846-8015B

D66737-1

CAS No.	Compound	D66752-3 mg/l	Spike Q mg/l	MS mg/l	MS %	Spike mg/l	MSD mg/l	MSD %	RPD	Limits Rec/RPD
	TPH-DRO (C10-C28)	ND	5	2.24	45	5	2.79	56	22	33-130/30

CAS No.	Surrogate Recoveries	MS	MSD	D66752-3	Limits
84-15-1	o-Terphenyl	73%	89%	76%	10-130%

\* = Outside of Control Limits.

7.3.1  
7

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D66737  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP11205-MS	FI20933.D	2	01/21/15	JJ	01/20/15	OP11205	GFI1108
OP11205-MSD	FI20934.D	2	01/21/15	JJ	01/20/15	OP11205	GFI1108
D66737-2	FI20935.D	2	01/21/15	JJ	01/20/15	OP11205	GFI1108

The QC reported here applies to the following samples:

Method: SW846-8015B

D66737-2

CAS No.	Compound	D66737-2 mg/l	Spike Q mg/l	MS mg/l	MS %	Spike mg/l	MSD mg/l	MSD %	RPD	Limits Rec/RPD
	TPH-DRO (C10-C28)	178000	5000	173000	-100* a	5000	165000	-260* a	5	33-130/30

CAS No.	Surrogate Recoveries	MS	MSD	D66737-2	Limits
84-15-1	o-Terphenyl	86%	81%	88%	10-130%

(a) Outside control limits due to high level in sample relative to spike amount.

\* = Outside of Control Limits.

7.3.2  
7

## Metals Analysis

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### QC Data Summaries

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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: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP15034  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/21/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	100	11	41		
Antimony	30	2.1	19		
Arsenic	25	3.8	5.6		
Barium	10	.2	1.4		
Beryllium	10	.9	1.2		
Boron	50	.8	6.6		
Cadmium	10	.2	.36		
Calcium	400	2.4	41		
Chromium	10	.3	.4		
Cobalt	5.0	.5	.57		
Copper	10	.8	1.9		
Iron	70	1.5	9.5	11.4	<70
Lead	50	2.1	21		
Lithium	5.0	.4	2.7		
Magnesium	200	6.8	19		
Manganese	5.0	.5	.46	0.30	<5.0
Molybdenum	10	.4	.84		
Nickel	30	.5	.87		
Phosphorus	100	15	20		
Potassium	1000	99	270		
Selenium	50	7.1	11		
Silicon	50	4.7	5.2		
Silver	30	.3	.6		
Sodium	400	7.3	170		
Strontium	5.0	.01	.12		
Thallium	10	1.8	4		
Tin	50	12	16		
Titanium	10	.1	2.1		
Uranium	50	2.9	5.5		
Vanadium	10	.4	.4		
Zinc	30	.4	3.2		

Associated samples MP15034: D66737-1

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

8.1.1  
8

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

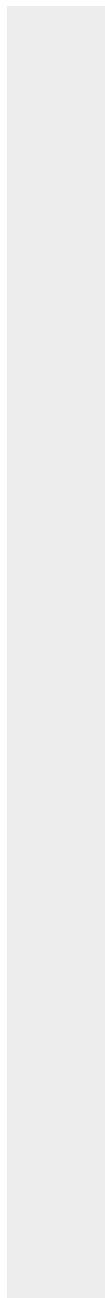
QC Batch ID: MP15034  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/21/15

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



8.1.1  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D66737  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP15034  
 Matrix Type: AQUEOUS

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 01/21/15

Metal	D66737-1 Original MS		SpikeLot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium					
Chromium					
Cobalt					
Copper					
Iron	26400	31400	5000	100.0	75-125
Lead					
Lithium					
Magnesium					
Manganese	404	899	500	99.0	75-125
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium					
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP15034: D66737-1

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

8.12  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

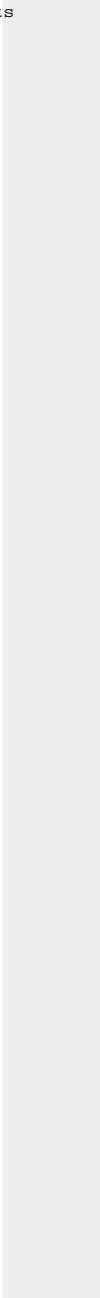
QC Batch ID: MP15034  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/21/15

Metal	D66737-1 Original MS	SpikeLot ICPALL2	% Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested



8.1.2  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D66737  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP15034  
 Matrix Type: AQUEOUS

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 01/21/15

Metal	D66737-1 Original MSD		SpikeLot ICPAL2 % Rec		MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium						
Chromium						
Cobalt						
Copper						
Iron	26400	32000	5000	112.0	1.9	20
Lead						
Lithium						
Magnesium						
Manganese	404	908	500	100.8	1.0	20
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silicon						
Silver						
Sodium						
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP15034: D66737-1

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

8.12  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

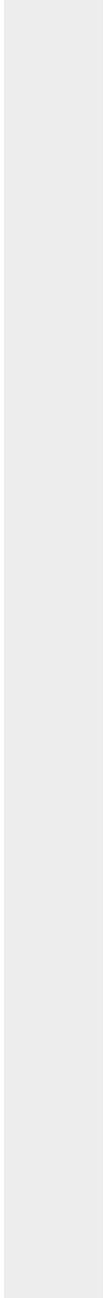
QC Batch ID: MP15034  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/21/15

Metal	D66737-1 Original MSD	Spikelet ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested



8.1.2  
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D66737  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP15034  
 Matrix Type: AQUEOUS

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 01/21/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium				
Cobalt				
Copper				
Iron	5480	5000	109.6	80-120
Lead				
Lithium				
Magnesium				
Manganese	544	500	108.8	80-120
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP15034: D66737-1

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

8.1.3  
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP15034  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/21/15

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



SERIAL DILUTION RESULTS SUMMARY

Login Number: D66737  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP15034  
 Matrix Type: AQUEOUS

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 01/21/15

Metal	D66737-1 Original SDL 1:5		%DIF	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium				
Cobalt				
Copper				
Iron	26400	26100	0.9	0-10
Lead				
Lithium				
Magnesium				
Manganese	404	391	3.3	0-10
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP15034: D66737-1

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

8.1.4  
8

SERIAL DILUTION RESULTS SUMMARY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

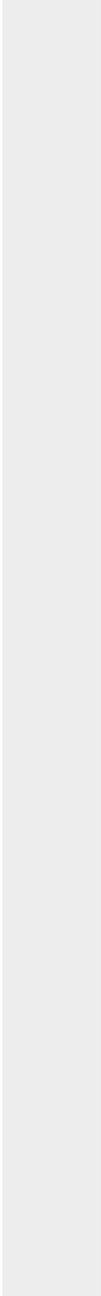
QC Batch ID: MP15034  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/21/15

	D66737-1		QC
Metal	Original SDL 1:5	%DIF	Limits

(anr) Analyte not requested



BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP15067  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/23/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	100	11	41		
Antimony	30	2.1	19		
Arsenic	25	3.8	5.6		
Barium	10	.2	1.4		
Beryllium	10	.9	1.2		
Boron	50	.8	6.6		
Cadmium	10	.2	.36		
Calcium	400	2.4	41		
Chromium	10	.3	.4		
Cobalt	5.0	.5	.57		
Copper	10	.8	1.9		
Iron	70	1.5	9.5	8.2	<70
Lead	50	2.1	21		
Lithium	5.0	.4	2.7		
Magnesium	200	6.8	19		
Manganese	5.0	.5	.46	0.30	<5.0
Molybdenum	10	.4	.84		
Nickel	30	.5	.87		
Phosphorus	100	15	20		
Potassium	1000	99	270		
Selenium	50	7.1	11		
Silicon	50	4.7	5.2		
Silver	30	.3	.6		
Sodium	400	7.3	170		
Strontium	5.0	.01	.12		
Thallium	10	1.8	4		
Tin	50	12	16		
Titanium	10	.1	2.1		
Uranium	50	2.9	5.5		
Vanadium	10	.4	.4		
Zinc	30	.4	3.2		

Associated samples MP15067: D66737-2

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

8.2.1  
8

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

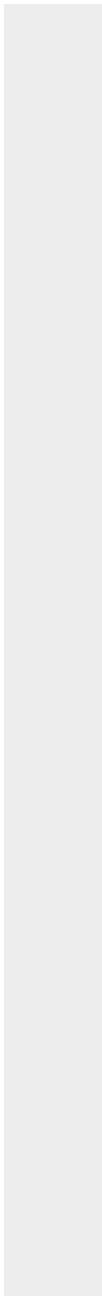
QC Batch ID: MP15067  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/23/15

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



8.2.1  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D66737  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP15067  
 Matrix Type: AQUEOUS

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 01/23/15

Metal	D66752-13 Original MS		SpikeLot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium					
Chromium					
Cobalt					
Copper					
Iron	8.4	5300	5000	105.8	75-125
Lead					
Lithium					
Magnesium					
Manganese	0.0	515	500	103.0	75-125
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium					
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP15067: D66737-2

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

8.2.2  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

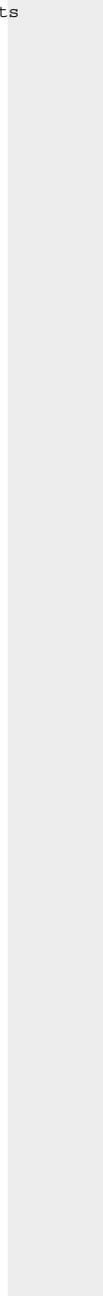
QC Batch ID: MP15067  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/23/15

Metal	D66752-13 Original MS	SpikeLot ICPALL2	% Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested



8.2.2  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D66737  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP15067  
 Matrix Type: AQUEOUS

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 01/23/15

Metal	D66752-13 Original MSD	SpikeLot ICPAL2	% Rec	MSD RPD	QC Limit	
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium						
Chromium						
Cobalt						
Copper						
Iron	8.4	5430	5000	108.4	2.4	20
Lead						
Lithium						
Magnesium						
Manganese	0.0	527	500	105.4	2.3	20
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silicon						
Silver						
Sodium						
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP15067: D66737-2

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

8.2.2  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D66737  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

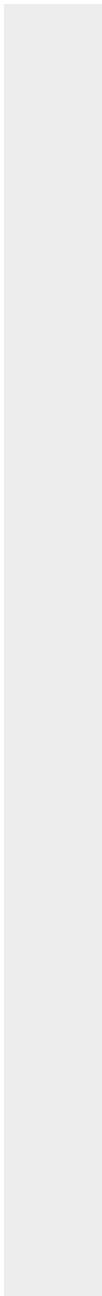
QC Batch ID: MP15067  
 Matrix Type: AQUEOUS

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 01/23/15

Metal	D66752-13 Original MSD	Spikelet ICPALL2 % Rec	MSD RPD	QC Limit
-------	---------------------------	---------------------------	------------	-------------

(N) Matrix Spike Rec. outside of QC limits  
 (anr) Analyte not requested



8.2.2  
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D66737  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP15067  
 Matrix Type: AQUEOUS

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 01/23/15

Metal	BSP Result	Spikelot ICPALL2	QC % Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium				
Cobalt				
Copper				
Iron	5360	5000	107.2	80-120
Lead				
Lithium				
Magnesium				
Manganese	519	500	103.8	80-120
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP15067: D66737-2

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

8.2.3  
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

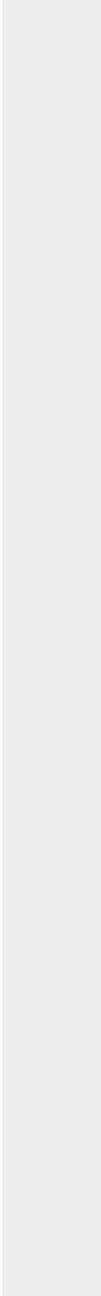
QC Batch ID: MP15067  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/23/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
-------	---------------	---------------------	-------	--------------

(anr) Analyte not requested



SERIAL DILUTION RESULTS SUMMARY

Login Number: D66737  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP15067  
 Matrix Type: AQUEOUS

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 01/23/15

Metal	D66752-13 Original SDL 1:5	%DIF	QC Limits
Aluminum			
Antimony			
Arsenic			
Barium			
Beryllium			
Boron			
Cadmium			
Calcium			
Chromium			
Cobalt			
Copper			
Iron	8.40	0.00	100.0(a) 0-10
Lead			
Lithium			
Magnesium			
Manganese	0.00	0.00	NC 0-10
Molybdenum			
Nickel			
Phosphorus			
Potassium			
Selenium			
Silicon			
Silver			
Sodium			
Strontium			
Thallium			
Tin			
Titanium			
Uranium			
Vanadium			
Zinc			

Associated samples MP15067: D66737-2

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

8.2.4  
8

SERIAL DILUTION RESULTS SUMMARY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP15067  
Matrix Type: AQUEOUS

Methods: SW846 6010C  
Units: ug/l

Prep Date: 01/23/15

Metal	D66752-13	QC
	Original SDL 1:5 %DIF	Limits

(anr) Analyte not requested

(a) Percent difference acceptable due to low initial sample concentration (< 50 times IDL).

## 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: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Alkalinity, Total as CaCO3	GN28290	5.0	0.0	mg/l	100	95.9	95.8	90-110%
Bromide	GP14437/GN28265	0.050	0.0	mg/l	0.5	0.504	100.8	90-110%
Chloride	GP14437/GN28265	0.50	0.0	mg/l	5	5.18	103.6	90-110%
Fluoride	GP14437/GN28265	0.10	0.0	mg/l	1	1.00	100.0	90-110%
Nitrogen, Nitrate	GP14437/GN28265	0.010	0.0	mg/l	0.1	0.100	100.0	90-110%
Nitrogen, Nitrite	GP14437/GN28265	0.0040	0.0	mg/l	0.05	0.0483	96.6	90-110%
Solids, Total Dissolved	GN28268	10	0.0	mg/l	400	396	99.0	90-110%
Solids, Total Suspended	GN28298	5.0	0.0	mg/l	300	297	99.0	90-110%
Sulfate	GP14437/GN28265	0.50	0.0	mg/l	5	4.89	97.8	90-110%
Sulfide	GN28322	0.50	0.0	mg/l	3.51	3.1	88.3	60-120%
pH	GN28279			su	8.00	7.98	99.8	99.1-100.9%

Associated Samples:

Batch GN28268: D66737-1  
Batch GN28279: D66737-1  
Batch GN28290: D66737-1  
Batch GN28298: D66737-1  
Batch GN28322: D66737-1  
Batch GP14437: D66737-1  
(\* ) Outside of QC limits

9.1  
9

DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Alkalinity, Total as CaCO3	GN28290	D66559-1	mg/l	257	261	1.4	0-20%
Solids, Total Dissolved	GN28268	D66687-1	mg/l	192	172	11.0	0-20%
Solids, Total Suspended	GN28298	D66687-1	mg/l	152	150	1.3	0-20%

Associated Samples:

Batch GN28268: D66737-1

Batch GN28290: D66737-1

Batch GN28298: D66737-1

(\* Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Alkalinity, Total as CaCO3	GN28290	D66559-1	mg/l	257	100	345	87.7	80-120%
Bromide	GP14437/GN28265	D66659-2	mg/l	0.16	0.5	0.66	100.0	80-120%
Chloride	GP14437/GN28265	D66659-2	mg/l	35.5	50	84.3	97.6	80-120%
Fluoride	GP14437/GN28265	D66659-2	mg/l	0.24	1	1.2	96.0	80-120%
Nitrogen, Nitrate	GP14437/GN28265	D66659-2	mg/l	2.9	1	3.6	70.0N(a)	80-120%
Nitrogen, Nitrite	GP14437/GN28265	D66659-2	mg/l	0.032	0.05	0.10	136.0N(b)	80-120%
Sulfate	GP14437/GN28265	D66659-2	mg/l	16.9	5	22.0	102.0	80-120%
Sulfide	GN28322	D66719-1	mg/l	0.0	3.51	3.6	101.1	60-120%

Associated Samples:

Batch GN28290: D66737-1

Batch GN28322: D66737-1

Batch GP14437: D66737-1

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

(a) NO2 and NO3 recoveries are outside QC acceptance limits due to the reduction of NO3 to NO2 as a result of a reducing agent in the sample.

(b) NO2 and NO3 recoveries are outside QC acceptance limits due reduction of NO3 to NO2 as a result of a reducing agent in the sample.

9.3

9

MATRIX SPIKE DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: D66737  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Alkalinity, Total as CaCO3	GN28290	D66559-1	mg/l	257	100	346	-0.3	20%
Bromide	GP14437/GN28265	D66659-2	mg/l	0.16	0.5	0.66	0.0	20%
Chloride	GP14437/GN28265	D66659-2	mg/l	35.5	50	83.4	1.1	20%
Fluoride	GP14437/GN28265	D66659-2	mg/l	0.24	1	1.2	0.0	20%
Nitrogen, Nitrate	GP14437/GN28265	D66659-2	mg/l	2.9	1	3.5	2.8	20%
Nitrogen, Nitrite	GP14437/GN28265	D66659-2	mg/l	0.032	0.05	0.099	1.0	20%
Sulfate	GP14437/GN28265	D66659-2	mg/l	16.9	5	21.9	0.5	20%

Associated Samples:

Batch GN28290: D66737-1

Batch GP14437: D66737-1

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

## Misc. Forms

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### Custody Documents and Other Forms

(Accutest Labs of New England, Inc.)

---

Includes the following where applicable:

- Chain of Custody





## GC/MS Volatiles

---

### QC Data Summaries

(Accutest Labs of New England, Inc.)

---

Includes the following where applicable:

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

## Method Blank Summary

**Job Number:** D66737  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MSP2727-MB	P83242.D	1	01/21/15	JM	n/a	n/a	MSP2727

The QC reported here applies to the following samples:

Method: SW846 8260C

D66737-1

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.25	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.25	ug/l	
108-88-3	Toluene	ND	1.0	0.22	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.30	ug/l	

CAS No.	Surrogate Recoveries	Limits	
1868-53-7	Dibromofluoromethane	104%	70-130%
2037-26-5	Toluene-D8	100%	70-130%
460-00-4	4-Bromofluorobenzene	108%	70-130%

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## Method Blank Summary

**Job Number:** D66737  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MSN3480-MB1	N94352.D	1	01/23/15	JB	n/a	n/a	MSN3480

The QC reported here applies to the following samples:

Method: SW846 8260C

D66737-2

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.25	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.25	ug/l	
108-88-3	Toluene	ND	1.0	0.22	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.30	ug/l	

CAS No.	Surrogate Recoveries	Limits
1868-53-7	Dibromofluoromethane	98% 70-130%
2037-26-5	Toluene-D8	99% 70-130%
460-00-4	4-Bromofluorobenzene	97% 70-130%

## Method Blank Summary

**Job Number:** D66737  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MSN3480-MB	N94326.D	1	01/22/15	JB	n/a	n/a	MSN3480

The QC reported here applies to the following samples:

Method: SW846 8260C

MSN3480-BS1, MC36532-1MS, MC36532-1MSD

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.25	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.25	ug/l	
108-88-3	Toluene	ND	1.0	0.22	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.30	ug/l	

CAS No.	Surrogate Recoveries	Limits
1868-53-7	Dibromofluoromethane	97% 70-130%
2037-26-5	Toluene-D8	98% 70-130%
460-00-4	4-Bromofluorobenzene	98% 70-130%

# Blank Spike Summary

**Job Number:** D66737  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MSP2727-BS	P83240.D	1	01/21/15	JM	n/a	n/a	MSP2727

The QC reported here applies to the following samples:

Method: SW846 8260C

D66737-1

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
71-43-2	Benzene	50	46.9	94	70-130
100-41-4	Ethylbenzene	50	46.2	92	70-130
108-88-3	Toluene	50	48.1	96	70-130
1330-20-7	Xylene (total)	150	137	91	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
1868-53-7	Dibromofluoromethane	103%	70-130%
2037-26-5	Toluene-D8	100%	70-130%
460-00-4	4-Bromofluorobenzene	96%	70-130%

\* = Outside of Control Limits.

# Blank Spike Summary

**Job Number:** D66737  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MSN3480-BS1	N94349.D	1	01/23/15	JB	n/a	n/a	MSN3480

The QC reported here applies to the following samples:

Method: SW846 8260C

D66737-2

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
71-43-2	Benzene	50	46.7	93	70-130
100-41-4	Ethylbenzene	50	52.2	104	70-130
108-88-3	Toluene	50	51.6	103	70-130
1330-20-7	Xylene (total)	150	162	108	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
1868-53-7	Dibromofluoromethane	99%	70-130%
2037-26-5	Toluene-D8	99%	70-130%
460-00-4	4-Bromofluorobenzene	89%	70-130%

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D66737  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MC36337-1MS	P83250.D	1	01/21/15	JM	n/a	n/a	MSP2727
MC36337-1MSD	P83251.D	1	01/21/15	JM	n/a	n/a	MSP2727
MC36337-1	P83249.D	1	01/21/15	JM	n/a	n/a	MSP2727
MC36337-1	P83252.D	20	01/21/15	JM	n/a	n/a	MSP2727

The QC reported here applies to the following samples:

Method: SW846 8260C

D66737-1

CAS No.	Compound	MC36337-1 ug/l	Spike Q ug/l	MS ug/l	MS %	Spike ug/l	MSD ug/l	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	839 <sup>b</sup>	50	906	134* <sup>a</sup>	50	866	54* <sup>a</sup>	5	70-130/30
100-41-4	Ethylbenzene	ND	50	46.8	94	50	46.3	93	1	70-130/30
108-88-3	Toluene	0.43	J 50	49.1	97	50	47.8	95	3	70-130/30
1330-20-7	Xylene (total)	0.38	J 150	139	92	150	137	91	1	70-130/30

CAS No.	Surrogate Recoveries	MS	MSD	MC36337-1	MC36337-1	Limits
1868-53-7	Dibromofluoromethane	106%	104%	105%	104%	70-130%
2037-26-5	Toluene-D8	99%	98%	98%	101%	70-130%
460-00-4	4-Bromofluorobenzene	95%	96%	109%	105%	70-130%

- (a) Outside control limits due to high level in sample relative to spike amount.
- (b) Result is from Run #2.

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D66737  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MC36532-1MS	N94345.D	5	01/23/15	JB	n/a	n/a	MSN3480
MC36532-1MSD	N94346.D	5	01/23/15	JB	n/a	n/a	MSN3480
MC36532-1	N94328.D	1	01/23/15	JB	n/a	n/a	MSN3480

The QC reported here applies to the following samples:

Method: SW846 8260C

D66737-2

CAS No.	Compound	MC36532-1 ug/l	Spike Q ug/l	MS ug/l	MS %	Spike ug/l	MSD ug/l	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	0.99	250	255	102	250	243	97	5	70-130/30
100-41-4	Ethylbenzene	0.29	250	272	109	250	259	103	5	70-130/30
108-88-3	Toluene	1.9	250	275	109	250	261	104	5	70-130/30
1330-20-7	Xylene (total)	1.1	750	845	112	750	808	107	4	70-130/30

CAS No.	Surrogate Recoveries	MS	MSD	MC36532-1	Limits
1868-53-7	Dibromofluoromethane	100%	100%	98%	70-130%
2037-26-5	Toluene-D8	99%	99%	97%	70-130%
460-00-4	4-Bromofluorobenzene	90%	89%	95%	70-130%

\* = Outside of Control Limits.

**APPENDIX B**  
**21A INVESTIGATION AND REMEDIATION DOCUMENTATION**

**APPENDIX B-1**  
**REPRESENTATIVE PHOTOGRAPHS**

**MOC 21A Facility Remediation and Monitoring**

**PHOTO 1**

December 3, 2014 investigation near condensate dump line (view southwest).



**PHOTO 2**

December 11 excavation near condensate dump line riser pipe (view southeast).



**PHOTO 3**

December 11 additional excavation near condensate dump line (view southwest).



**PHOTO 4**

December 11 fluid leakage after pressurizing condensate dump line.



**PHOTO 5**

December 11 storage of excavated materials in lined containment area.



**PHOTO 6**

December 18 additional excavation of potentially impacted materials.



**PHOTO 7**

December 18 before sampling of potentially impacted materials.



**PHOTO 8**

Monitoring location 69721AMOC42 in 2012.



**PHOTO 9**

Monitoring location 69721AMOC43 in 2012.



**PHOTO 10**

Monitoring location  
69721AMOC43 in 2011.



**PHOTO 11**

Monitoring location  
69721AMOC44 in 2012.



**PHOTO 12**

Monitoring location  
69721AMOC44 in 2011.



**APPENDIX B-2**  
**SOIL INVESTIGATION TEST RESULTS**



12/22/14

Technical Report for

Marathon Oil

21A Spill Investigation

PO# 4800011767 Line Item 10

Accutest Job Number: D65701

Sampling Date: 12/11/14

Report to:

Marathon Oil Company  
743 Horizon Court Suite 220  
Grand Junction, CO 81056  
sdistel@marathonoil.com

ATTN: Scott Distel

Total number of pages in report: **81**



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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## Sample Summary

Marathon Oil

**Job No:** D65701

21A Spill Investigation

Project No: PO# 4800011767 Line Item 10

Sample Number	Collected		Received	Matrix		Client Sample ID
	Date	Time By		Code	Type	
D65701-1	12/11/14	13:45 SD	12/12/14	SO	Soil	SO_21A_FL_EXC_1
D65701-1A	12/11/14	13:45 SD	12/12/14	SO	Soil	SO_21A_FL_EXC_1
D65701-2	12/11/14	14:40 SD	12/12/14	SO	Soil	SO_21A_FL_EXC_2
D65701-2A	12/11/14	14:40 SD	12/12/14	SO	Soil	SO_21A_FL_EXC_2

---

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

## CASE NARRATIVE / CONFORMANCE SUMMARY

**Client:** Marathon Oil**Job No** D65701**Site:** 21A Spill Investigation**Report Date** 12/22/2014 4:39:09 P

On 12/12/2014, 2 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 3.9 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D65701 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 8260C

**Matrix:** SO**Batch ID:** M:MSK2652

- The data for SW846 8260C meets quality control requirements.
- D65701-1,-2: Analysis performed at Accutest Laboratories, Marlborough, MA.

**Matrix:** SO**Batch ID:** M:MSK2654

- The data for SW846 8260C meets quality control requirements.
- D65701-2: Analysis performed at Accutest Laboratories, Marlborough, MA.

### Extractables by GCMS By Method SW846 8270D BY SIM

**Matrix:** SO**Batch ID:** M:OP41345

- The data for SW846 8270D BY SIM meets quality control requirements.
- Sample(s) D65701-1 have compound(s) reported with a "B" qualifier, indicating analyte is found in the associated method blank.
- D65701-1,-2: Analysis performed at Accutest Laboratories, Marlborough, MA.

### Volatiles by GC By Method SW846 8015B

**Matrix:** SO**Batch ID:** GGB1510

- All samples were analyzed within the recommended method holding time.
- Sample(s) D65711-1MS, D65711-1MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

### Extractables by GC By Method SW846-8015B

**Matrix:** SO**Batch ID:** OP11081

- All samples were extracted and analyzed within the recommended method holding time.
- Sample(s) D65656-3MS, D65656-3MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

## Metals By Method SW846 6010C

<b>Matrix:</b> AQ	<b>Batch ID:</b> MP14800
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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) D65561-1AMS, D65561-1AMSD, D65561-1ASDL were used as the QC samples for the metals analysis.

<b>Matrix:</b> SO	<b>Batch ID:</b> MP14810
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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) D65701-1MS, D65701-1MSD, D65701-1SDL were used as the QC samples for the metals analysis.
- The matrix spike (MS) recovery(s) of Barium, Silver, Zinc are outside control limits. Spike recovery indicates possible matrix interference.
- The matrix spike duplicate (MSD) recovery(s) of Barium, Silver, Sodium, Zinc are outside control limits. Probable cause due to matrix interference.
- The serial dilution RPD(s) for Cadmium, Lead, Selenium, Barium, Chromium, Nickel, Zinc are outside control limits for sample MP14810-SD1. Percent difference acceptable due to low initial sample concentration (< 50 times IDL).
- D65701-2 for Silver: Elevated detection limit due to dilution required for possible matrix interference.
- D65701-1 for Silver: Elevated detection limit due to dilution required for possible matrix interference.
- MP14810-SD1 for Barium, Nickel, Zinc, Chromium: Serial dilution indicates possible matrix interference.

## Metals By Method SW846 6020A

<b>Matrix:</b> SO	<b>Batch ID:</b> MP14811
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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) D65701-1MS, D65701-1MSD, D65701-1SDL were used as the QC samples for the metals analysis.

## Metals By Method SW846 7471B

<b>Matrix:</b> SO	<b>Batch ID:</b> MP14786
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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) D65387-1MS, D65387-1MSD were used as the QC samples for the metals analysis.

## Wet Chemistry By Method ASTM D1498-76M

<b>Matrix:</b> SO	<b>Batch ID:</b> GN27947
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- Sample(s) D65701-1DUP were used as the QC samples for the Redox Potential Vs H2 analysis.

## Wet Chemistry By Method SM2540G-2011 M

<b>Matrix:</b> SO	<b>Batch ID:</b> GN27875
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- The data for SM2540G-2011 M meets quality control requirements.

## Wet Chemistry By Method SW846 3060A/7196A

<b>Matrix:</b> SO	<b>Batch ID:</b> GP14281
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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) D65561-1DUP, D65561-1MS, D65561-1MSD were used as the QC samples for the Chromium, Hexavalent analysis.





## SAMPLE DELIVERY GROUP CASE NARRATIVE

**Client:** Accutest Mountain States

**Job No** D65701

**Site:** MOILCOGJ: 21A Spill Investigation

**Report Date** 12/22/2014 4:25:40 PM

2 Sample(s) were collected on 12/11/2014 and were received at Accutest on 12/12/2014 properly preserved, at 0.4 Deg. C and intact. These Samples received an Accutest job number of D65701. A listing of the Laboratory Sample ID, Client Sample ID and dates of collection are presented in the Results Summary Section of this report.

Except as noted below, all method specified calibrations and quality control performance criteria were met for this job. For more information, please refer to QC summary pages.

### Volatiles by GCMS By Method SW846 8260C

**Matrix:** SO

**Batch ID:** MSK2652

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D65566-4MS, D65566-4MSD were used as the QC samples indicated.

**Matrix:** SO

**Batch ID:** MSK2654

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D65753-1MS, D65753-1MSD were used as the QC samples indicated.
- D65701-2 for Dibromofluoromethane: Outside control limits due to possible matrix interference. Confirmed by reanalysis.
- MSK2654-MB for Dibromofluoromethane: Outside control limits. Associated target analyes are non-detect.

### Extractables by GCMS By Method SW846 8270D BY SIM

**Matrix:** SO

**Batch ID:** OP41345

- All samples were extracted within the recommended method holding time.
- All samples were analyzed within the recommended method holding time.
- Sample(s) MC35641-2MS, MC35641-2MSD were used as the QC samples indicated.
- Sample(s) D65701-1 have compound(s) reported with a "B" qualifier, indicating analyte is found in the associated method blank.

The Accutest Laboratories of New England certifies that all analysis were performed within method specification. It is further recommended that this report to be used in its entirety. The Accutest Laboratories of NE, Laboratory Director or assignee as verified by the signature on the cover page has authorized the release of this report(D65701).

## Summary of Hits

**Job Number:** D65701  
**Account:** Marathon Oil  
**Project:** 21A Spill Investigation  
**Collected:** 12/11/14



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
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**D65701-1**      **SO\_21A\_FL\_EXC\_1**

Benzo(a)anthracene <sup>a</sup>	0.0033 J	0.0059	0.0027	mg/kg	SW846 8270D BY SIM
Benzo(a)pyrene <sup>a</sup>	0.0046 J	0.0059	0.0023	mg/kg	SW846 8270D BY SIM
Benzo(b)fluoranthene <sup>a</sup>	0.0121	0.0059	0.0026	mg/kg	SW846 8270D BY SIM
Benzo(k)fluoranthene <sup>a</sup>	0.0050 J	0.0059	0.0018	mg/kg	SW846 8270D BY SIM
Chrysene <sup>a</sup>	0.0037 J	0.0059	0.0016	mg/kg	SW846 8270D BY SIM
Dibenzo(a,h)anthracene <sup>a</sup>	0.0022 J	0.0059	0.0017	mg/kg	SW846 8270D BY SIM
Fluoranthene <sup>a</sup>	0.0040 J	0.0059	0.0017	mg/kg	SW846 8270D BY SIM
Indeno(1,2,3-cd)pyrene <sup>a</sup>	0.0048 J	0.0059	0.0015	mg/kg	SW846 8270D BY SIM
Naphthalene <sup>a</sup>	0.0044 JB	0.012	0.0013	mg/kg	SW846 8270D BY SIM
Pyrene <sup>a</sup>	0.0044 J	0.0059	0.0018	mg/kg	SW846 8270D BY SIM
TPH-GRO (C6-C10)	8.92 J	14	7.2	mg/kg	SW846 8015B
TPH-DRO (C10-C28)	13.8	8.2	6.1	mg/kg	SW846-8015B
Arsenic	5.8	0.12		mg/kg	SW846 6020A
Barium	474	1.2		mg/kg	SW846 6010C
Chromium	30.0	1.2		mg/kg	SW846 6010C
Copper	21.3	1.2		mg/kg	SW846 6010C
Lead	24.6	12		mg/kg	SW846 6010C
Nickel	21.7	3.7		mg/kg	SW846 6010C
Sodium	5070	99		mg/kg	SW846 6010C
Zinc	62.6	3.7		mg/kg	SW846 6010C
Specific Conductivity	234	1.0		umhos/cm	SM 2510B-2011 MOD
Chromium, Trivalent <sup>b</sup>	29.5	2.2		mg/kg	SW846 3060A/7196A M
Redox Potential Vs H2	255			mv	ASTM D1498-76M
pH	9.42			su	SW846 9045D

**D65701-1A**      **SO\_21A\_FL\_EXC\_1**

Calcium	60.2	2.0		mg/l	SW846 6010C
Magnesium	18.0	1.0		mg/l	SW846 6010C
Sodium	43.4	2.0		mg/l	SW846 6010C
Sodium Adsorption Ratio <sup>c</sup>	1.26			ratio	USDA HANDBOOK 60

**D65701-2**      **SO\_21A\_FL\_EXC\_2**

Benzene <sup>a</sup>	3.18	0.040	0.027	mg/kg	SW846 8260C
Toluene <sup>a</sup>	34.5	4.0	0.16	mg/kg	SW846 8260C
Ethylbenzene <sup>a</sup>	4.68	0.16	0.055	mg/kg	SW846 8260C
Xylene (total) <sup>a</sup>	134	1.6	0.18	mg/kg	SW846 8260C
Acenaphthene <sup>a</sup>	0.0303	0.0062	0.0011	mg/kg	SW846 8270D BY SIM
Anthracene <sup>a</sup>	0.0017 J	0.0062	0.0014	mg/kg	SW846 8270D BY SIM
Benzo(a)anthracene <sup>a</sup>	0.0041 J	0.0062	0.0028	mg/kg	SW846 8270D BY SIM
Benzo(a)pyrene <sup>a</sup>	0.0093	0.0062	0.0025	mg/kg	SW846 8270D BY SIM
Benzo(b)fluoranthene <sup>a</sup>	0.0171	0.0062	0.0027	mg/kg	SW846 8270D BY SIM

## Summary of Hits

**Job Number:** D65701  
**Account:** Marathon Oil  
**Project:** 21A Spill Investigation  
**Collected:** 12/11/14



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
		0.0093	0.0062	0.0019	mg/kg	SW846 8270D BY SIM
		0.0059 J	0.0062	0.0017	mg/kg	SW846 8270D BY SIM
		0.0036 J	0.0062	0.0018	mg/kg	SW846 8270D BY SIM
		0.0050 J	0.0062	0.0018	mg/kg	SW846 8270D BY SIM
		0.0866	0.0062	0.0012	mg/kg	SW846 8270D BY SIM
		0.0089	0.0062	0.0015	mg/kg	SW846 8270D BY SIM
		1.42	0.012	0.0014	mg/kg	SW846 8270D BY SIM
		0.0056 J	0.0062	0.0019	mg/kg	SW846 8270D BY SIM
		3180	300	150	mg/kg	SW846 8015B
		715	8.3	6.3	mg/kg	SW846-8015B
		11.3	0.12		mg/kg	SW846 6020A
		447	1.2		mg/kg	SW846 6010C
		28.4	1.2		mg/kg	SW846 6010C
		26.2	1.2		mg/kg	SW846 6010C
		28.9	12		mg/kg	SW846 6010C
		27.5	3.7		mg/kg	SW846 6010C
		5440	99		mg/kg	SW846 6010C
		65.2	3.7		mg/kg	SW846 6010C
		819	1.0		umhos/cm	SM 2510B-2011 MOD
		28.0	2.2		mg/kg	SW846 3060A/7196A M
		305			mv	ASTM D1498-76M
		9.20			su	SW846 9045D

### D65701-2A SO\_21A\_FL\_EXC\_2

Calcium	34.7	2.0		mg/l	SW846 6010C
Magnesium	5.54	1.0		mg/l	SW846 6010C
Sodium	140	2.0		mg/l	SW846 6010C
Sodium Adsorption Ratio <sup>c</sup>	5.82			ratio	USDA HANDBOOK 60

(a) Analysis performed at Accutest Laboratories, Marlborough, MA.

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

(c) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

Sample Results

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Report of Analysis

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## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_1	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-1	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 81.3
<b>Method:</b> SW846 8260C	
<b>Project:</b> 21A Spill Investigation	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 <sup>a</sup>	K84522.D	1	12/16/14	AMA	n/a	n/a	M:MSK2652
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	9.63 g	10.0 ml	100 ul
Run #2			

**Purgeable Aromatics**

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.038	0.025	mg/kg	
108-88-3	Toluene	ND	0.38	0.015	mg/kg	
100-41-4	Ethylbenzene	ND	0.15	0.052	mg/kg	
1330-20-7	Xylene (total)	ND	0.15	0.017	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	122%		70-130%
2037-26-5	Toluene-D8	107%		70-130%
460-00-4	4-Bromofluorobenzene	109%		70-130%

(a) Analysis performed at Accutest Laboratories, Marlborough, MA.

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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

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## Report of Analysis

<b>Client Sample ID:</b>	SO_21A_FL_EXC_1	<b>Date Sampled:</b>	12/11/14
<b>Lab Sample ID:</b>	D65701-1	<b>Date Received:</b>	12/12/14
<b>Matrix:</b>	SO - Soil	<b>Percent Solids:</b>	81.3
<b>Method:</b>	SW846 8270D BY SIM SW846 3546		
<b>Project:</b>	21A Spill Investigation		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 <sup>a</sup>	I93525.D	1	12/22/14	AMA	12/19/14	M:OP41345	M:MSI3487
Run #2							

Run #	Initial Weight	Final Volume
Run #1	20.9 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	0.0059	0.0010	mg/kg	
120-12-7	Anthracene	ND	0.0059	0.0013	mg/kg	
56-55-3	Benzo(a)anthracene	0.0033	0.0059	0.0027	mg/kg	J
50-32-8	Benzo(a)pyrene	0.0046	0.0059	0.0023	mg/kg	J
205-99-2	Benzo(b)fluoranthene	0.0121	0.0059	0.0026	mg/kg	
207-08-9	Benzo(k)fluoranthene	0.0050	0.0059	0.0018	mg/kg	J
218-01-9	Chrysene	0.0037	0.0059	0.0016	mg/kg	J
53-70-3	Dibenzo(a,h)anthracene	0.0022	0.0059	0.0017	mg/kg	J
206-44-0	Fluoranthene	0.0040	0.0059	0.0017	mg/kg	J
86-73-7	Fluorene	ND	0.0059	0.0012	mg/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	0.0048	0.0059	0.0015	mg/kg	J
91-20-3	Naphthalene	0.0044	0.012	0.0013	mg/kg	JB
129-00-0	Pyrene	0.0044	0.0059	0.0018	mg/kg	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	93%		30-130%
321-60-8	2-Fluorobiphenyl	86%		30-130%
1718-51-0	Terphenyl-d14	115%		30-130%

(a) Analysis performed at Accutest Laboratories, Marlborough, MA.

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

<b>Client Sample ID:</b> SO_21A_FL_EXC_1	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-1	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 81.3
<b>Method:</b> SW846 8015B	
<b>Project:</b> 21A Spill Investigation	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GB28047.D	1	12/17/14	EP	n/a	n/a	GGB1510
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)	8.92	14	7.2	mg/kg	J
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	99%		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

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## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_1	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-1	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 81.3
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> 21A Spill Investigation	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FD38289.D	1	12/17/14	JJ	12/15/14	OP11081	GFD1718
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)	13.8	8.2	6.1	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	94%		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

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## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_1	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-1	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 81.3
<b>Project:</b> 21A Spill Investigation	

## Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	5.8	0.12	mg/kg	5	12/18/14	12/19/14 JB	SW846 6020A <sup>3</sup>	SW846 3050B <sup>7</sup>
Barium	474	1.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Cadmium	< 1.2	1.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Chromium	30.0	1.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Copper	21.3	1.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Lead	24.6	12	mg/kg	2	12/18/14	12/19/14 JB	SW846 6010C <sup>4</sup>	SW846 3050B <sup>6</sup>
Mercury	< 0.068	0.068	mg/kg	1	12/16/14	12/16/14 JB	SW846 7471B <sup>1</sup>	SW846 7471B <sup>5</sup>
Nickel	21.7	3.7	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Selenium	< 6.2	6.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Silver <sup>a</sup>	< 7.5	7.5	mg/kg	2	12/18/14	12/19/14 JB	SW846 6010C <sup>4</sup>	SW846 3050B <sup>6</sup>
Sodium	5070	99	mg/kg	2	12/18/14	12/19/14 JB	SW846 6010C <sup>4</sup>	SW846 3050B <sup>6</sup>
Zinc	62.6	3.7	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>

- (1) Instrument QC Batch: MA5589
- (2) Instrument QC Batch: MA5605
- (3) Instrument QC Batch: MA5606
- (4) Instrument QC Batch: MA5607
- (5) Prep QC Batch: MP14786
- (6) Prep QC Batch: MP14810
- (7) Prep QC Batch: MP14811

(a) Elevated detection limit due to dilution required for possible matrix interference.

RL = Reporting Limit

## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_1	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-1	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 81.3
<b>Project:</b> 21A Spill Investigation	

### General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
<b>%solids</b>							
Solids, Percent	81.3		%	1	12/15/14	SWT	SM2540G-2011 M
<b>prep: DEPT.OF AG, BOOK N9</b>							
Specific Conductivity	234	1.0	umhos/cm	1	12/18/14	AK	SM 2510B-2011 MOD
Chromium, Hexavalent	< 1.0	1.0	mg/kg	1	12/19/14	JF	SW846 3060A/7196A
Chromium, Trivalent <sup>a</sup>	29.5	2.2	mg/kg	1	12/19/14	JF	SW846 3060A/7196A M
Redox Potential Vs H2	255		mv	1	12/18/14	AK	ASTM D1498-76M
pH	9.42		su	1	12/16/14 10:30	TB	SW846 9045D

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

RL = Reporting Limit

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## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_1	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-1A	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 81.3
<b>Project:</b> 21A Spill Investigation	

### SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	60.2	2.0	mg/l	1	12/17/14	12/17/14 KV	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>
Magnesium	18.0	1.0	mg/l	1	12/17/14	12/17/14 KV	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>
Sodium	43.4	2.0	mg/l	1	12/17/14	12/17/14 KV	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>

(1) Instrument QC Batch: MA5593

(2) Prep QC Batch: MP14800

---

RL = Reporting Limit

4.2  
4

## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_1	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-1A	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 81.3
<b>Project:</b> 21A Spill Investigation	

### General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio <sup>a</sup>	1.26		ratio	1	12/17/14 15:07	KV	USDA HANDBOOK 60

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

---

RL = Reporting Limit

4.2  
 4

## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_2	
<b>Lab Sample ID:</b> D65701-2	<b>Date Sampled:</b> 12/11/14
<b>Matrix:</b> SO - Soil	<b>Date Received:</b> 12/12/14
<b>Method:</b> SW846 8260C	<b>Percent Solids:</b> 79.9
<b>Project:</b> 21A Spill Investigation	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 <sup>a</sup>	K84525.D	1	12/16/14	AMA	n/a	n/a	M:MSK2652
Run #2 <sup>a</sup>	K84596.D	1	12/18/14	AMA	n/a	n/a	M:MSK2654

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	9.29 g	10.0 ml	100 ul
Run #2	9.29 g	10.0 ml	10.0 ul

## Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	3.18	0.040	0.027	mg/kg	
108-88-3	Toluene	34.5 <sup>b</sup>	4.0	0.16	mg/kg	
100-41-4	Ethylbenzene	4.68	0.16	0.055	mg/kg	
1330-20-7	Xylene (total)	134 <sup>b</sup>	1.6	0.18	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	124%	141% <sup>c</sup>	70-130%
2037-26-5	Toluene-D8	117%	115%	70-130%
460-00-4	4-Bromofluorobenzene	115%	110%	70-130%

(a) Analysis performed at Accutest Laboratories, Marlborough, MA.

(b) Result is from Run# 2

(c) Outside control limits due to possible matrix interference. Confirmed by reanalysis.

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

<b>Client Sample ID:</b> SO_21A_FL_EXC_2	
<b>Lab Sample ID:</b> D65701-2	<b>Date Sampled:</b> 12/11/14
<b>Matrix:</b> SO - Soil	<b>Date Received:</b> 12/12/14
<b>Method:</b> SW846 8270D BY SIM SW846 3546	<b>Percent Solids:</b> 79.9
<b>Project:</b> 21A Spill Investigation	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 <sup>a</sup>	I93526.D	1	12/22/14	AMA	12/19/14	M:OP41345	M:MSI3487
Run #2							

Run #	Initial Weight	Final Volume
Run #1	20.2 g	1.0 ml
Run #2		

## COGCC Table 910-1 PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	0.0303	0.0062	0.0011	mg/kg	
120-12-7	Anthracene	0.0017	0.0062	0.0014	mg/kg	J
56-55-3	Benzo(a)anthracene	0.0041	0.0062	0.0028	mg/kg	J
50-32-8	Benzo(a)pyrene	0.0093	0.0062	0.0025	mg/kg	
205-99-2	Benzo(b)fluoranthene	0.0171	0.0062	0.0027	mg/kg	
207-08-9	Benzo(k)fluoranthene	0.0093	0.0062	0.0019	mg/kg	
218-01-9	Chrysene	0.0059	0.0062	0.0017	mg/kg	J
53-70-3	Dibenzo(a,h)anthracene	0.0036	0.0062	0.0018	mg/kg	J
206-44-0	Fluoranthene	0.0050	0.0062	0.0018	mg/kg	J
86-73-7	Fluorene	0.0866	0.0062	0.0012	mg/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	0.0089	0.0062	0.0015	mg/kg	
91-20-3	Naphthalene	1.42	0.012	0.0014	mg/kg	
129-00-0	Pyrene	0.0056	0.0062	0.0019	mg/kg	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	116%		30-130%
321-60-8	2-Fluorobiphenyl	84%		30-130%
1718-51-0	Terphenyl-d14	113%		30-130%

(a) Analysis performed at Accutest Laboratories, Marlborough, MA.

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

<b>Client Sample ID:</b> SO_21A_FL_EXC_2	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-2	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 79.9
<b>Method:</b> SW846 8015B	
<b>Project:</b> 21A Spill Investigation	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GB28048.D	1	12/17/14	EP	n/a	n/a	GGB1510
Run #2							

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

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	3180	300	150	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
120-82-1	1,2,4-Trichlorobenzene	102%		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

<b>Client Sample ID:</b> SO_21A_FL_EXC_2	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-2	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 79.9
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> 21A Spill Investigation	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FD38291.D	1	12/17/14	JJ	12/15/14	OP11081	GFD1718
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)	715	8.3	6.3	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	104%		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

4.3  
4

# Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_2	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-2	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 79.9
<b>Project:</b> 21A Spill Investigation	

## Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	11.3	0.12	mg/kg	5	12/18/14	12/19/14 JB	SW846 6020A <sup>3</sup>	SW846 3050B <sup>7</sup>
Barium	447	1.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Cadmium	< 1.2	1.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Chromium	28.4	1.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Copper	26.2	1.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Lead	28.9	12	mg/kg	2	12/18/14	12/19/14 JB	SW846 6010C <sup>4</sup>	SW846 3050B <sup>6</sup>
Mercury	< 0.069	0.069	mg/kg	1	12/16/14	12/16/14 JB	SW846 7471B <sup>1</sup>	SW846 7471B <sup>5</sup>
Nickel	27.5	3.7	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Selenium	< 6.2	6.2	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>
Silver <sup>a</sup>	< 7.4	7.4	mg/kg	2	12/18/14	12/19/14 JB	SW846 6010C <sup>4</sup>	SW846 3050B <sup>6</sup>
Sodium	5440	99	mg/kg	2	12/18/14	12/19/14 JB	SW846 6010C <sup>4</sup>	SW846 3050B <sup>6</sup>
Zinc	65.2	3.7	mg/kg	1	12/18/14	12/18/14 JB	SW846 6010C <sup>2</sup>	SW846 3050B <sup>6</sup>

- (1) Instrument QC Batch: MA5589
- (2) Instrument QC Batch: MA5605
- (3) Instrument QC Batch: MA5606
- (4) Instrument QC Batch: MA5607
- (5) Prep QC Batch: MP14786
- (6) Prep QC Batch: MP14810
- (7) Prep QC Batch: MP14811

(a) Elevated detection limit due to dilution required for possible matrix interference.

RL = Reporting Limit

4.3  
4

## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_2 <b>Lab Sample ID:</b> D65701-2 <b>Matrix:</b> SO - Soil <b>Project:</b> 21A Spill Investigation	<b>Date Sampled:</b> 12/11/14 <b>Date Received:</b> 12/12/14 <b>Percent Solids:</b> 79.9
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### General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
<b>%solids</b>							
Solids, Percent	79.9		%	1	12/15/14	SWT	SM2540G-2011 M
<b>prep: DEPT.OF AG, BOOK N9</b>							
Specific Conductivity	819	1.0	umhos/cm	1	12/18/14	AK	SM 2510B-2011 MOD
Chromium, Hexavalent	< 1.0	1.0	mg/kg	1	12/19/14	JF	SW846 3060A/7196A
Chromium, Trivalent <sup>a</sup>	28.0	2.2	mg/kg	1	12/19/14	JF	SW846 3060A/7196A M
Redox Potential Vs H2	305		mv	1	12/18/14	AK	ASTM D1498-76M
pH	9.20		su	1	12/16/14 10:30	TB	SW846 9045D

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

RL = Reporting Limit

4.3  
4

## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_2	<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-2A	<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 79.9
<b>Project:</b> 21A Spill Investigation	

### SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	34.7	2.0	mg/l	1	12/17/14	12/17/14 KV	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>
Magnesium	5.54	1.0	mg/l	1	12/17/14	12/17/14 KV	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>
Sodium	140	2.0	mg/l	1	12/17/14	12/17/14 KV	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>

(1) Instrument QC Batch: MA5593

(2) Prep QC Batch: MP14800

RL = Reporting Limit

4.4  
4

## Report of Analysis

<b>Client Sample ID:</b> SO_21A_FL_EXC_2		<b>Date Sampled:</b> 12/11/14
<b>Lab Sample ID:</b> D65701-2A		<b>Date Received:</b> 12/12/14
<b>Matrix:</b> SO - Soil		<b>Percent Solids:</b> 79.9
<b>Project:</b> 21A Spill Investigation		

4.4  
4

### General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio <sup>a</sup>	5.82		ratio	1	12/17/14 15:14	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

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5

### Custody Documents and Other Forms

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Includes the following where applicable:

- Chain of Custody



CHAIN OF CUSTODY

4036 Youngfield Street, Wheat Ridge, CO 80033
TEL. 303-425-6021 FAX: 303-425-6854
www.accutest.com

FED-EX Tracking #
Bottle Order Control #
Accutest Quote #
Accutest Job # D65701

Client / Reporting Information
Project Information
Requested Analysis (see TEST CODE sheet)
Matrix Codes
Company Name: Marathon Oil Company
Project Name: 21A Spill Investigation
Street Address: 251 N. Parachute Ave.
City: Parachute, CO 81635
Project Contact: Scott Distel
Phone #: (307) 399-2329
Sampler(s) Name(s): Scott Distel
Project Manager: Vicki Schoeber - vlschoeber@marathonoil.com
Collection table with columns: Accutest Sample #, Field ID / Point of Collection, MECH/ID Vial #, Date, Time, Sampled by, Matrix, # of bottles, HCl, HNO3, H2SO4, NONE, DI WATER, MECH, ENCORE.

See Attached

5.1 5

Turnaround Time (Business days)
Data Deliverable Information
Comments / Special Instructions
PO # 4800011767
Line Item "10"
WBS: TA.14.36942.Exp.001

Sample Custody must be documented below each time samples change possession, including courier delivery.
Relinquished by: Scott Distel
Received By: [Signature]
Date Time: 12/11/14 17:00
Relinquished By: [Signature]
Date Time: 12-12-14 1415
Custody Seal # [ ] Intact [ ] Not Intact
Preserved where applicable [ ]
On Ice [ ] Cooler Temp. 3.9



**Accutest Job Number:** D65701      **Client:** MARATHON      **Project:** \_\_\_\_\_  
**Date / Time Received:** 12/12/2014 2:15:00 PM      **Delivery Method:** \_\_\_\_\_      **Airbill #'s:** CO  
**Cooler Temps (Initial/Adjusted):** #1: (3.9/3.9);

<u>Cooler Security</u>		<u>Y or N</u>			<u>Y or N</u>
1. Custody Seals Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. COC Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Custody Seals Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. Smp Dates/Time OK	<input checked="" type="checkbox"/>	<input type="checkbox"/>

<u>Cooler Temperature</u>		<u>Y or N</u>
1. Temp criteria achieved:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Cooler temp verification:	<u>Bar Therm;</u>	
3. Cooler media:	<u>Ice (Bag)</u>	
4. No. Coolers:	<u>1</u>	

<u>Quality Control Preservation</u>	<u>Y</u>	<u>or</u>	<u>N</u>	<u>N/A</u>
1. Trip Blank present / cooler:	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
2. Trip Blank listed on COC:	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
3. Samples preserved properly:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
4. VOCs headspace free:	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

Comments

<u>Sample Integrity - Documentation</u>		<u>Y</u>	<u>or</u>	<u>N</u>
1. Sample labels present on bottles:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
2. Container labeling complete:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
3. Sample container label / COC agree:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	

<u>Sample Integrity - Condition</u>		<u>Y</u>	<u>or</u>	<u>N</u>
1. Sample recvd within HT:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
2. All containers accounted for:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
3. Condition of sample:	<u>Intact</u>			

<u>Sample Integrity - Instructions</u>	<u>Y</u>	<u>or</u>	<u>N</u>	<u>N/A</u>
1. Analysis requested is clear:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
2. Bottles received for unspecified tests	<input type="checkbox"/>		<input checked="" type="checkbox"/>	
3. Sufficient volume recvd for analysis:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
4. Compositing instructions clear:	<input type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
5. Filtering instructions clear:	<input type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>

5.1  
5

## GC Volatiles

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## QC Data Summaries

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Includes the following where applicable:

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

## Method Blank Summary

**Job Number:** D65701  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GGB1510-MB	GB28040.D	1	12/17/14	EP	n/a	n/a	GGB1510

The QC reported here applies to the following samples:

Method: SW846 8015B

D65701-1, D65701-2

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	9.8	4.9	mg/kg	

CAS No.	Surrogate Recoveries	Limits
120-82-1	1,2,4-Trichlorobenzene	97% 60-140%

# Blank Spike Summary

**Job Number:** D65701  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GGB1510-BS	GB28041.D	1	12/17/14	EP	n/a	n/a	GGB1510

The QC reported here applies to the following samples:

Method: SW846 8015B

D65701-1, D65701-2

CAS No.	Compound	Spike mg/kg	BSP mg/kg	BSP %	Limits
	TPH-GRO (C6-C10)	108	107	99	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
120-82-1	1,2,4-Trichlorobenzene	104%	60-140%

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D65701  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D65711-1MS	GB28043.D	1	12/17/14	EP	n/a	n/a	GGB1510
D65711-1MSD	GB28044.D	1	12/17/14	EP	n/a	n/a	GGB1510
D65711-1	GB28042.D	1	12/17/14	EP	n/a	n/a	GGB1510

The QC reported here applies to the following samples:

Method: SW846 8015B

D65701-1, D65701-2

CAS No.	Compound	D65711-1 mg/kg	Spike Q mg/kg	MS mg/kg	MS %	Spike mg/kg	MSD mg/kg	MSD %	RPD	Limits Rec/RPD
	TPH-GRO (C6-C10)	ND	177	175	99	177	174	98	1	70-130/30

CAS No.	Surrogate Recoveries	MS	MSD	D65711-1	Limits
120-82-1	1,2,4-Trichlorobenzene	104%	103%	99%	60-140%

\* = Outside of Control Limits.

## GC Semi-volatiles

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### QC Data Summaries

---

Includes the following where applicable:

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

# Method Blank Summary

**Job Number:** D65701  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP11081-MB	FI20286.D	1	12/16/14	JJ	12/15/14	OP11081	GFI1081

The QC reported here applies to the following samples:

Method: SW846-8015B

D65701-1, D65701-2

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	89% 20-130%

7.1.1  
7

# Blank Spike Summary

**Job Number:** D65701  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP11081-BS	FI20287.D	1	12/16/14	JJ	12/15/14	OP11081	GFI1081

The QC reported here applies to the following samples:

Method: SW846-8015B

D65701-1, D65701-2

CAS No.	Compound	Spike mg/kg	BSP mg/kg	BSP %	Limits
	TPH-DRO (C10-C28)	167	122	73	42-130

CAS No.	Surrogate Recoveries	BSP	Limits
84-15-1	o-Terphenyl	99%	20-130%

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D65701  
**Account:** MOILCOGJ Marathon Oil  
**Project:** 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP11081-MS	FI20288.D	1	12/16/14	JJ	12/15/14	OP11081	GFI1081
OP11081-MSD	FI20289.D	1	12/16/14	JJ	12/15/14	OP11081	GFI1081
D65656-3	FI20290.D	1	12/16/14	JJ	12/15/14	OP11081	GFI1081

The QC reported here applies to the following samples:

Method: SW846-8015B

D65701-1, D65701-2

CAS No.	Compound	D65656-3 mg/kg	Spike mg/kg	MS mg/kg	MS %	Spike mg/kg	MSD mg/kg	MSD %	RPD	Limits Rec/RPD
	TPH-DRO (C10-C28)	ND	209	134	64	210	123	59	9	20-150/30

CAS No.	Surrogate Recoveries	MS	MSD	D65656-3	Limits
84-15-1	o-Terphenyl	85%	76%	90%	20-130%

\* = Outside of Control Limits.

7.3.1  
7

## Metals Analysis

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### QC Data Summaries

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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: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP14786  
Matrix Type: SOLID

Methods: SW846 7471B  
Units: mg/kg

Prep Date: 12/16/14

Metal	RL	IDL	MDL	MB	
				raw	final
Mercury	0.083	.00088	.0067	0.00011	<0.083

Associated samples MP14786: D65701-1, D65701-2

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

8.1.1

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14786  
 Matrix Type: SOLID

Methods: SW846 7471B  
 Units: mg/kg

Prep Date: 12/16/14

Metal	D65387-1 Original MS	Spikelot HGWSR1	% Rec	QC Limits
Mercury	0.0	0.33	0.338	97.7 75-125

Associated samples MP14786: D65701-1, D65701-2

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

8.1.2  
 8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14786  
 Matrix Type: SOLID

Methods: SW846 7471B  
 Units: mg/kg

Prep Date: 12/16/14

Metal	D65387-1 Original MSD	Spikelot HGWSR1	% Rec	MSD RPD	QC Limit	
Mercury	0.0	0.35	0.355	98.7	5.9	20

Associated samples MP14786: D65701-1, D65701-2

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

8.1.2  
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP14786  
Matrix Type: SOLID

Methods: SW846 7471B  
Units: mg/kg

Prep Date: 12/16/14

Metal	BSP Result	Spikelot HGWSR1	% Rec	QC Limits
Mercury	0.33	0.333	99.0	80-120

Associated samples MP14786: D65701-1, D65701-2

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

8.1.3

8

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP14800  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 12/17/14

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	-49	<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	8.5	<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	193	<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 MP14800: D65701-1A, D65701-2A

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

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

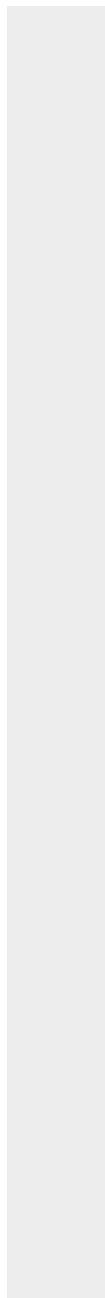
QC Batch ID: MP14800  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 12/17/14

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



8.2.1  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14800  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 12/17/14

Metal	D65561-1A Original MS	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	253000	382000	125000	103.2 75-125
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	40800	163000	125000	97.8 75-125
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	62900	189000	125000	100.9 75-125
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP14800: D65701-1A, D65701-2A

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

8.2.2  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

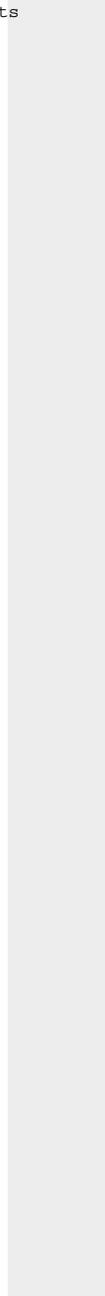
QC Batch ID: MP14800  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 12/17/14

Metal	D65561-1A Original MS	SpikeLot ICPALL2	% Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested



8.2.2  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14800  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 12/17/14

Metal	D65561-1A Original MSD	Spikelot ICPALL2	% Rec	MSD RPD	QC Limit	
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium	253000	376000	125000	98.4	1.6	20
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Lithium						
Magnesium	40800	161000	125000	96.2	1.2	20
Manganese						
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silicon						
Silver						
Sodium	62900	185000	125000	97.7	2.1	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP14800: D65701-1A, D65701-2A

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

8.2.2  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

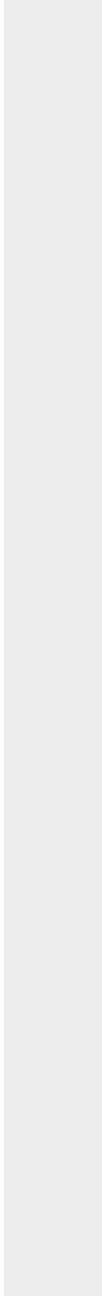
QC Batch ID: MP14800  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 12/17/14

Metal	D65561-1A 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



8.2.2  
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14800  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 12/17/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	119000	125000	95.2	80-120
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	121000	125000	96.8	80-120
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	124000	125000	99.2	80-120
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP14800: D65701-1A, D65701-2A

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

8.2.3  
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP14800  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 12/17/14

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



8.2.3  
8

SERIAL DILUTION RESULTS SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14800  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 12/17/14

Metal	D65561-1A Original SDL 1:5		%DIF	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	50700	49800	1.8	0-10
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	8170	7960	2.6	0-10
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	12600	12200	3.2	0-10
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP14800: D65701-1A, D65701-2A

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

8.2.4  
8

SERIAL DILUTION RESULTS SUMMARY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP14800  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 12/17/14

Metal	D65561-1A	QC
	Original SDL 1:5 %DIF	Limits

(anr) Analyte not requested



8.2.4  
8

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP14810  
Matrix Type: SOLID

Methods: SW846 6010C  
Units: mg/kg

Prep Date: 12/18/14

Metal	RL	IDL	MDL	MB raw	final
Aluminum	10	1.1	1.8		
Antimony	3.0	.21	.5		
Arsenic	2.5	.38	.63		
Barium	1.0	.02	.36	0.040	<1.0
Beryllium	1.0	.09	.06		
Boron	5.0	.08	.16		
Cadmium	1.0	.02	.28	0.020	<1.0
Calcium	40	.24	6.8		
Chromium	1.0	.03	.03	0.12	<1.0
Cobalt	0.50	.05	.039		
Copper	1.0	.08	.13	0.15	<1.0
Iron	7.0	.15	1.8		
Lead	5.0	.21	.25	-0.070	<5.0
Magnesium	20	.68	1.8		
Manganese	0.50	.05	.038		
Molybdenum	1.0	.04	.13		
Nickel	3.0	.05	.07	0.060	<3.0
Phosphorus	10	1.5	1.2		
Potassium	200	9.9	12		
Selenium	5.0	.71	1.1	0.17	<5.0
Silicon	5.0	.47	1.1		
Silver	3.0	.03	.05	0.040	<3.0
Sodium	40	.73	3.7	3.4	<40
Strontium	5.0	.001	.022		
Thallium	1.0	.18	.46		
Tin	5.0	1.2	2.3		
Titanium	1.0	.01	.46		
Vanadium	1.0	.04	.043		
Zinc	3.0	.04	.16	0.36	<3.0

Associated samples MP14810: D65701-1, D65701-2

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

8.3.1  
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14810  
 Matrix Type: SOLID

Methods: SW846 6010C  
 Units: mg/kg

Prep Date: 12/18/14

Metal	D65701-1 Original MS		SpikeLot ICPAL2 % Rec		QC Limits
Aluminum	anr				
Antimony					
Arsenic	anr				
Barium	474	635	244	66.1N(a)	75-125
Beryllium	anr				
Boron	anr				
Cadmium	0.40	53.9	60.9	87.9	75-125
Calcium	anr				
Chromium	30.0	80.3	60.9	82.6	75-125
Cobalt	anr				
Copper	21.3	74.5	60.9	87.4	75-125
Iron	anr				
Lead	24.6	124	122	81.6	75-125
Magnesium	anr				
Manganese	anr				
Molybdenum	anr				
Nickel	21.7	74.0	60.9	85.9	75-125
Phosphorus					
Potassium	anr				
Selenium	3.8	112	122	88.8	75-125
Silicon					
Silver	0.0	17.5	24.4	71.8N(a)	75-125
Sodium	5070	8640	3040	117.3	75-125
Strontium	anr				
Thallium	anr				
Tin					
Titanium					
Vanadium	anr				
Zinc	62.6	102	60.9	64.7N(a)	75-125

Associated samples MP14810: D65701-1, D65701-2

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  
 (a) Spike recovery indicates possible matrix interference.

8.3.2  
 8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14810  
 Matrix Type: SOLID

Methods: SW846 6010C  
 Units: mg/kg

Prep Date: 12/18/14

Metal	D65701-1 Original MSD		SpikeLot ICPAL2 % Rec		MSD RPD	QC Limit
Aluminum	anr					
Antimony						
Arsenic	anr					
Barium	474	593	237	50.3N(a)	6.8	20
Beryllium	anr					
Boron	anr					
Cadmium	0.40	52.1	59.1	87.4	3.4	20
Calcium	anr					
Chromium	30.0	78.2	59.1	81.5	2.6	20
Cobalt	anr					
Copper	21.3	74.4	59.1	89.8	0.1	20
Iron	anr					
Lead	24.6	119	118	79.8	4.1	20
Magnesium	anr					
Manganese	anr					
Molybdenum	anr					
Nickel	21.7	68.8	59.1	79.6	7.3	20
Phosphorus						
Potassium	anr					
Selenium	3.8	107	118	87.3	4.6	20
Silicon						
Silver	0.0	16.2	23.7	68.5N(a)	7.7	20
Sodium	5070	7160	2960	70.7N(a)	18.7	20
Strontium	anr					
Thallium	anr					
Tin						
Titanium						
Vanadium	anr					
Zinc	62.6	105	59.1	71.7N(a)	2.9	20

Associated samples MP14810: D65701-1, D65701-2

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  
 (a) Spike recovery indicates possible matrix interference.

8.3.2  
 8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14810  
 Matrix Type: SOLID

Methods: SW846 6010C  
 Units: mg/kg

Prep Date: 12/18/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum	anr			
Antimony				
Arsenic	anr			
Barium	215	200	107.5	80-120
Beryllium	anr			
Boron	anr			
Cadmium	50.8	50	101.6	80-120
Calcium	anr			
Chromium	53.0	50	106.0	80-120
Cobalt	anr			
Copper	49.3	50	98.6	80-120
Iron	anr			
Lead	108	100	108.0	80-120
Magnesium	anr			
Manganese	anr			
Molybdenum	anr			
Nickel	50.1	50	100.2	80-120
Phosphorus				
Potassium	anr			
Selenium	105	100	105.0	80-120
Silicon				
Silver	19.5	20	97.5	80-120
Sodium	2390	2500	95.6	80-120
Strontium	anr			
Thallium	anr			
Tin				
Titanium				
Vanadium	anr			
Zinc	50.2	50	100.4	80-120

Associated samples MP14810: D65701-1, D65701-2

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

8.3.3  
8

SERIAL DILUTION RESULTS SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14810  
 Matrix Type: SOLID

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 12/18/14

Metal	D65701-1 Original	SDL 1:5	%DIF	QC Limits
Aluminum	anr			
Antimony				
Arsenic	anr			
Barium	3810	4380	14.8*(a)	0-10
Beryllium	anr			
Boron	anr			
Cadmium	3.20	2.50	21.9 (b)	0-10
Calcium	anr			
Chromium	241	273	12.9*(a)	0-10
Cobalt	anr			
Copper	172	177	2.7	0-10
Iron	anr			
Lead	200	240	21.2 (b)	0-10
Magnesium	anr			
Manganese	anr			
Molybdenum	anr			
Nickel	174	209	19.6*(a)	0-10
Phosphorus				
Potassium	anr			
Selenium	30.2	53.5	77.2 (b)	0-10
Silicon				
Silver	0.00	0.00	NC	0-10
Sodium	40800	43800	7.4	0-10
Strontium	anr			
Thallium	anr			
Tin				
Titanium				
Vanadium	anr			
Zinc	504	607	20.6*(a)	0-10

Associated samples MP14810: D65701-1, D65701-2

Results < IDL are shown as zero for calculation purposes

(\*) Outside of QC 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).

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP14811  
Matrix Type: SOLID

Methods: SW846 6020A  
Units: mg/kg

Prep Date: 12/18/14

Metal	RL	IDL	MDL	MB	
				raw	final
Arsenic	0.10	.0085	.024	0.0039	<0.10

Associated samples MP14811: D65701-1, D65701-2

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: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14811  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: mg/kg

Prep Date: 12/18/14

Metal	D65701-1 Original MS	Spikelot ICPALL2	% Rec	QC Limits
Arsenic	5.8	129	122	101.2 75-125

Associated samples MP14811: D65701-1, D65701-2

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

8.4.2  
 8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D65701  
 Account: MOILCOGJ - Marathon Oil  
 Project: 21A Spill Investigation

QC Batch ID: MP14811  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: mg/kg

Prep Date: 12/18/14

Metal	D65701-1 Original MSD	Spikelot ICPALL2	% Rec	MSD RPD	QC Limit	
Arsenic	5.8	114	118	91.5	12.3	20

Associated samples MP14811: D65701-1, D65701-2

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

8.4.2  
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP14811  
Matrix Type: SOLID

Methods: SW846 6020A  
Units: mg/kg

Prep Date: 12/18/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Arsenic	97.8	100	97.8	80-120

Associated samples MP14811: D65701-1, D65701-2

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

8.4.3

8

SERIAL DILUTION RESULTS SUMMARY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

QC Batch ID: MP14811  
Matrix Type: SOLID

Methods: SW846 6020A  
Units: ug/l

Prep Date: 12/18/14

Metal	D65701-1 Original	SDL 5:25	%DIF	QC Limits
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Arsenic 46.4 47.1 1.6 0-10

Associated samples MP14811: D65701-1, D65701-2

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

8.4.4

8

## General Chemistry

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### QC Data Summaries

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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: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Chromium, Hexavalent	GP14281/GN27960	1.0	0.0	mg/kg	205	223	109.0	80-120%
Specific Conductivity	GP14270/GN27934			umhos/cm	999	989	99.0	90-110%
pH	GN27898			su	8.00	8.02	100.2	99.1-100.9%

Associated Samples:

Batch GN27898: D65701-1, D65701-2

Batch GP14270: D65701-1, D65701-2

Batch GP14281: D65701-1, D65701-2

(\* ) Outside of QC limits

DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Chromium, Hexavalent	GP14281/GN27960	D65561-1	mg/kg	1.3	1.3	2.1	0-20%
Redox Potential Vs H2	GN27947	D65701-1	mv	255	247	3.2	0-20%

Associated Samples:

Batch GN27947: D65701-1, D65701-2

Batch GP14281: D65701-1, D65701-2

(\*) Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Chromium, Hexavalent	GP14281/GN27960	D65561-1	mg/kg	1.3	40	41.8	105.0	75-125%

Associated Samples:

Batch GP14281: D65701-1, D65701-2

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

MATRIX SPIKE DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: D65701  
Account: MOILCOGJ - Marathon Oil  
Project: 21A Spill Investigation

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Chromium, Hexavalent	GP14281/GN27960	D65561-1	mg/kg	1.3	40	41.1	1.7	20%

Associated Samples:

Batch GP14281: D65701-1, D65701-2

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

## Misc. Forms

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### Custody Documents and Other Forms

(Accutest Labs of New England, Inc.)

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Includes the following where applicable:

- Chain of Custody



CHAIN OF CUSTODY

4036 Youngfield St. Wheat Ridge, CO 80033  
303-425-6021 FAX: 303-425-6854

Accutest Job #: D65701

Accutest Quote #: 0

AMS P.O. #:

Project No.:

Client Information		Subcontract Laboratory Information						Analytical Information									
Name Accutest Mountain States (AMS)		Name Accutest - New England															
Address 4036 Youngfield St.		Address 495 Technology Center West, BLDG C															
City Wheat Ridge, CO	State CO	Zip 80033	City Marlborough	State MA	Zip 01752												
Send Report to: Any questions contact: Scott Heideman Renea Rooks		Contact: Sample Management															
Phone/Fax #: (303) 425-6021; (303) 425-6854		Phone: (508) 481-6200															
Field ID / Point of Collection	Collection			Matrix	# of bottles	Preservation					B8270SIMP/PAH/10L	V8260BTX				Comments	
	Date	Time				HCL	NaOH	HNO3	H2SO4	None							
D65701 -1	12/11/14	1:45 PM		SDAQ	1	X						X	X				
-2	12/11/14	2:40 PM		SDAQ	1	X						X	X				
																	GE3
Turnaround Information		Data Deliverable Information						Comments / Remarks									
<input checked="" type="checkbox"/> 3 - 5 Business Day Rush <input type="checkbox"/> Other 5 (Days)		Approved By:		<input type="checkbox"/> Commercial "A" <input type="checkbox"/> PDF <input type="checkbox"/> Commercial "B" <input type="checkbox"/> Compact Disk Deliverable <input type="checkbox"/> Commercial "BN" <input type="checkbox"/> Electronic Delivery: <input type="checkbox"/> Reduced Tier 1 <input type="checkbox"/> State Forms <input type="checkbox"/> Full Tier 1 <input type="checkbox"/> Other (Specify)		Please use Colorado regulations and RLS.											
10 Day Turnaround has copy, RUSH is FAX Data unless previously approved.																	
Sample Custody must be documented below each time samples change possession, including courier delivery.																	
Relinquished by:		Date & Time:		Received by:		Date & Time:		Seal #:		Headspace:							
1		12/12/14		1		1		Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>		Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>							
2		12/13/14 10:09		2		2		Preserved where applicable:									
3				3		3		Temperature °C 0.4°		On Ice <input type="checkbox"/>							

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D65701: Chain of Custody  
Page 1 of 2  
Accutest Labs of New England, Inc.

## Accutest Laboratories Sample Receipt Summary

**Accutest Job Number:** D65701      **Client:** AMS      **Project:** ACNE  
**Date / Time Received:** 12/13/2014 10:00:00 AM      **Delivery Method:** \_\_\_\_\_      **Airbill #'s:** \_\_\_\_\_  
**Cooler Temps (Initial/Adjusted):** #1: (0.4/0.4):

**Cooler Security**

	<u>Y</u>	<u>or</u>	<u>N</u>		<u>Y</u>	<u>or</u>	<u>N</u>
1. Custody Seals Present:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	3. COC Present:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
2. Custody Seals Intact:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	4. Smpl Dates/Time OK	<input checked="" type="checkbox"/>		<input type="checkbox"/>

**Cooler Temperature**

	<u>Y</u>	<u>or</u>	<u>N</u>
1. Temp criteria achieved:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
2. Thermometer ID:	<u>G1;</u>		
3. Cooler media:	<u>Ice (Bag)</u>		
4. No. Coolers:	<u>1</u>		

**Quality Control Preservation**

	<u>Y</u>	<u>or</u>	<u>N</u>	<u>N/A</u>
1. Trip Blank present / cooler:	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Trip Blank listed on COC:	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. Samples preserved properly:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
4. VOCs headspace free:	<input type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>

**Sample Integrity - Documentation**

	<u>Y</u>	<u>or</u>	<u>N</u>
1. Sample labels present on bottles:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
2. Container labeling complete:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
3. Sample container label / COC agree:	<input checked="" type="checkbox"/>		<input type="checkbox"/>

**Sample Integrity - Condition**

	<u>Y</u>	<u>or</u>	<u>N</u>
1. Sample recvd within HT:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
2. All containers accounted for:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
3. Condition of sample:	<u>Intact</u>		

**Sample Integrity - Instructions**

	<u>Y</u>	<u>or</u>	<u>N</u>	<u>N/A</u>
1. Analysis requested is clear:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
2. Bottles received for unspecified tests	<input type="checkbox"/>		<input checked="" type="checkbox"/>	
3. Sufficient volume recvd for analysis:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
4. Compositing instructions clear:	<input type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
5. Filtering instructions clear:	<input type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>

Comments

## GC/MS Volatiles

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### QC Data Summaries

(Accutest Labs of New England, Inc.)

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Includes the following where applicable:

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

# Method Blank Summary

**Job Number:** D65701  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MSK2652-MB	K84512.D	1	12/16/14	JM	n/a	n/a	MSK2652

The QC reported here applies to the following samples:

Method: SW846 8260C

D65701-1, D65701-2

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	25	17	ug/kg	
100-41-4	Ethylbenzene	ND	100	34	ug/kg	
108-88-3	Toluene	ND	250	10	ug/kg	
1330-20-7	Xylene (total)	ND	100	11	ug/kg	

CAS No.	Surrogate Recoveries	Limits
1868-53-7	Dibromofluoromethane	114% 70-130%
2037-26-5	Toluene-D8	101% 70-130%
460-00-4	4-Bromofluorobenzene	106% 70-130%

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## Method Blank Summary

**Job Number:** D65701  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MSK2654-MB	K84573.D	1	12/18/14	JM	n/a	n/a	MSK2654

The QC reported here applies to the following samples:

Method: SW846 8260C

D65701-2

CAS No.	Compound	Result	RL	MDL	Units	Q
108-88-3	Toluene	ND	250	10	ug/kg	
1330-20-7	Xylene (total)	ND	100	11	ug/kg	

CAS No.	Surrogate Recoveries	Limits
1868-53-7	Dibromofluoromethane	131%* <sup>a</sup> 70-130%
2037-26-5	Toluene-D8	105% 70-130%
460-00-4	4-Bromofluorobenzene	107% 70-130%

(a) Outside control limits. Associated target analytes are non-detect.

# Blank Spike Summary

**Job Number:** D65701  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MSK2652-BS	K84509.D	1	12/16/14	JM	n/a	n/a	MSK2652

The QC reported here applies to the following samples:

Method: SW846 8260C

D65701-1, D65701-2

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
71-43-2	Benzene	2500	2420	97	70-130
100-41-4	Ethylbenzene	2500	2770	111	70-130
108-88-3	Toluene	2500	2680	107	70-130
1330-20-7	Xylene (total)	7500	8420	112	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
1868-53-7	Dibromofluoromethane	106%	70-130%
2037-26-5	Toluene-D8	117%	70-130%
460-00-4	4-Bromofluorobenzene	106%	70-130%

\* = Outside of Control Limits.

# Blank Spike Summary

**Job Number:** D65701  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
MSK2654-BS	K84571.D	1	12/18/14	JM	n/a	n/a	MSK2654

The QC reported here applies to the following samples:

Method: SW846 8260C

D65701-2

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
108-88-3	Toluene	2500	2610	104	70-130
1330-20-7	Xylene (total)	7500	7560	101	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
1868-53-7	Dibromofluoromethane	123%	70-130%
2037-26-5	Toluene-D8	113%	70-130%
460-00-4	4-Bromofluorobenzene	111%	70-130%

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D65701  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D65566-4MS	K84526.D	1	12/16/14	JM	n/a	n/a	MSK2652
D65566-4MSD	K84527.D	1	12/16/14	JM	n/a	n/a	MSK2652
D65566-4	K84521.D	1	12/16/14	JM	n/a	n/a	MSK2652

The QC reported here applies to the following samples:

Method: SW846 8260C

D65701-1, D65701-2

CAS No.	Compound	D65566-4 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	3530	3210	91	3530	3140	89	2	70-130/30
100-41-4	Ethylbenzene	ND	3530	3630	103	3530	3540	100	3	70-130/30
108-88-3	Toluene	ND	3530	3380	96	3530	3350	95	1	70-130/30
1330-20-7	Xylene (total)	ND	10600	11000	104	10600	10600	100	4	70-130/30

CAS No.	Surrogate Recoveries	MS	MSD	D65566-4	Limits
1868-53-7	Dibromofluoromethane	109%	111%	122%	70-130%
2037-26-5	Toluene-D8	112%	110%	107%	70-130%
460-00-4	4-Bromofluorobenzene	111%	109%	109%	70-130%

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D65701  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D65753-1MS	K84582.D	1	12/18/14	JM	n/a	n/a	MSK2654
D65753-1MSD	K84583.D	1	12/18/14	JM	n/a	n/a	MSK2654
D65753-1	K84574.D	1	12/18/14	JM	n/a	n/a	MSK2654

The QC reported here applies to the following samples:

Method: SW846 8260C

D65701-2

CAS No.	Compound	D65753-1 ug/kg	Spike Q ug/kg	MS ug/kg	MS %	Spike ug/kg	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
108-88-3	Toluene	ND	2890	3090	107	2890	3100	107	0	70-130/30
1330-20-7	Xylene (total)	ND	8660	9030	104	8660	8880	103	2	70-130/30

CAS No.	Surrogate Recoveries	MS	MSD	D65753-1	Limits
1868-53-7	Dibromofluoromethane	127%	124%	123%	70-130%
2037-26-5	Toluene-D8	113%	112%	98%	70-130%
460-00-4	4-Bromofluorobenzene	114%	112%	97%	70-130%

\* = Outside of Control Limits.

## GC/MS Semi-volatiles

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### QC Data Summaries

(Accutest Labs of New England, Inc.)

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Includes the following where applicable:

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

# Method Blank Summary

**Job Number:** D65701  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP41345-MB	I93523.D	1	12/22/14	MR	12/19/14	OP41345	MSI3487

The QC reported here applies to the following samples:

Method: SW846 8270D BY SIM

D65701-1, D65701-2

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	4.9	0.84	ug/kg	
120-12-7	Anthracene	ND	4.9	1.1	ug/kg	
56-55-3	Benzo(a)anthracene	ND	4.9	2.2	ug/kg	
50-32-8	Benzo(a)pyrene	ND	4.9	1.9	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	4.9	2.2	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	4.9	1.5	ug/kg	
218-01-9	Chrysene	ND	4.9	1.3	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	4.9	1.4	ug/kg	
206-44-0	Fluoranthene	ND	4.9	1.4	ug/kg	
86-73-7	Fluorene	ND	4.9	0.96	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	4.9	1.2	ug/kg	
91-20-3	Naphthalene	1.4	9.7	1.1	ug/kg	J
129-00-0	Pyrene	ND	4.9	1.5	ug/kg	

CAS No.	Surrogate Recoveries	Limits
4165-60-0	Nitrobenzene-d5	85% 30-130%
321-60-8	2-Fluorobiphenyl	80% 30-130%
1718-51-0	Terphenyl-d14	104% 30-130%

12.1.1  
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# Blank Spike Summary

**Job Number:** D65701  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP41345-BS	I93524.D	1	12/22/14	MR	12/19/14	OP41345	MSI3487

The QC reported here applies to the following samples:

Method: SW846 8270D BY SIM

D65701-1, D65701-2

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
83-32-9	Acenaphthene	2470	2060	83	40-140
120-12-7	Anthracene	2470	2130	86	40-140
56-55-3	Benzo(a)anthracene	2470	2570	104	40-140
50-32-8	Benzo(a)pyrene	2470	2550	103	40-140
205-99-2	Benzo(b)fluoranthene	2470	2330	94	40-140
207-08-9	Benzo(k)fluoranthene	2470	2510	102	40-140
218-01-9	Chrysene	2470	2340	95	40-140
53-70-3	Dibenzo(a,h)anthracene	2470	2580	104	40-140
206-44-0	Fluoranthene	2470	2400	97	40-140
86-73-7	Fluorene	2470	2130	86	40-140
193-39-5	Indeno(1,2,3-cd)pyrene	2470	2540	103	40-140
91-20-3	Naphthalene	2470	2790	113	40-140
129-00-0	Pyrene	2470	2370	96	40-140

CAS No.	Surrogate Recoveries	BSP	Limits
4165-60-0	Nitrobenzene-d5	88%	30-130%
321-60-8	2-Fluorobiphenyl	82%	30-130%
1718-51-0	Terphenyl-d14	108%	30-130%

\* = Outside of Control Limits.

12.2.1  
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# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D65701  
**Account:** ALMS Accutest Mountain States  
**Project:** MOILCOGJ: 21A Spill Investigation

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP41345-MS	I93527.D	1	12/22/14	MR	12/19/14	OP41345	MSI3487
OP41345-MSD	I93528.D	1	12/22/14	MR	12/19/14	OP41345	MSI3487
MC35641-2	I93529.D	1	12/22/14	MR	12/19/14	OP41345	MSI3487
MC35641-2	I93530.D	5	12/22/14	MR	12/19/14	OP41345	MSI3487

The QC reported here applies to the following samples:

Method: SW846 8270D BY SIM

D65701-1, D65701-2

CAS No.	Compound	MC35641-2 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	202	2720	2300	77	2740	2380	80	3	40-140/30
120-12-7	Anthracene	119	2720	2370	83	2740	2460	86	4	40-140/30
56-55-3	Benzo(a)anthracene	23.6	2720	2750	100	2740	2910	105	6	40-140/30
50-32-8	Benzo(a)pyrene	8.3	2720	2600	95	2740	2750	100	6	40-140/30
205-99-2	Benzo(b)fluoranthene	14.1	2720	2720	99	2740	2760	100	1	40-140/30
207-08-9	Benzo(k)fluoranthene	5.8	2720	2260	83	2740	2520	92	11	40-140/30
218-01-9	Chrysene	44.8	2720	2490	90	2740	2640	95	6	40-140/30
53-70-3	Dibenzo(a,h)anthracene	ND	2720	2630	97	2740	2820	103	7	40-140/30
206-44-0	Fluoranthene	44.7	2720	2540	92	2740	2670	96	5	40-140/30
86-73-7	Fluorene	462	2720	2730	83	2740	2870	88	5	40-140/30
193-39-5	Indeno(1,2,3-cd)pyrene	3.1	J 2720	2610	96	2740	2790	102	7	40-140/30
91-20-3	Naphthalene	5300	2720	6800	55	2740	7430	78	9	40-140/30
129-00-0	Pyrene	115	2720	2570	90	2740	2720	95	6	40-140/30

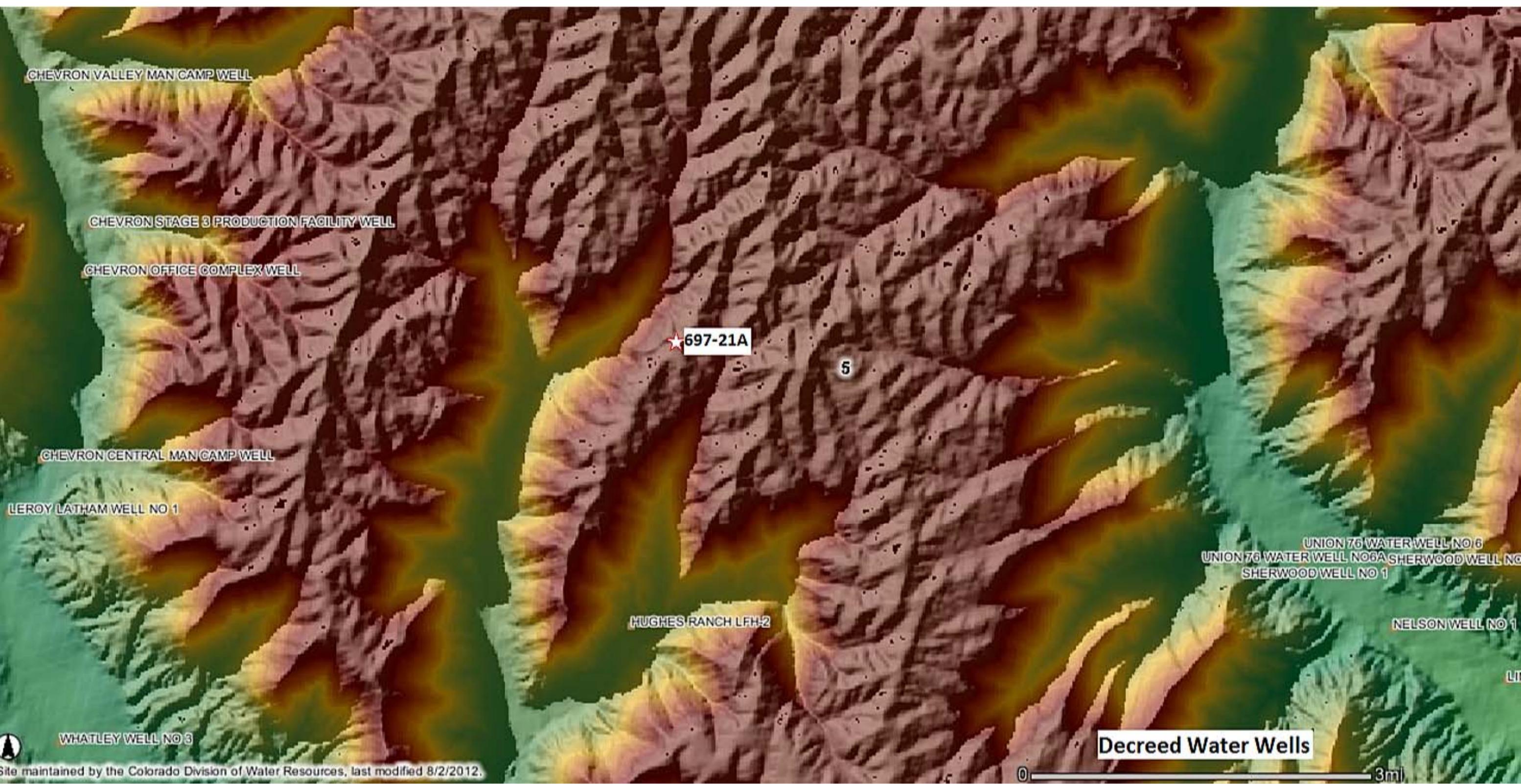
CAS No.	Surrogate Recoveries	MS	MSD	MC35641-2	MC35641-2	Limits
367-12-4	2-Fluorophenol	90%	86%	83%	89%	15-110%
4165-62-2	Phenol-d5	94%	93%	87%	90%	15-110%
118-79-6	2,4,6-Tribromophenol	96%	102%	89%	105%	15-110%
4165-60-0	Nitrobenzene-d5	78%	90%	78%	93%	30-130%
321-60-8	2-Fluorobiphenyl	76%	78%	71%	88%	30-130%
1718-51-0	Terphenyl-d14	106%	114%	105%	107%	30-130%

\* = Outside of Control Limits.

12.3.1  
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**APPENDIX C**  
**21A AREA WATER WELLS**

**APPENDIX C-1**  
**DECREEED WATER WELLS**



CHEVRON VALLEY MAN CAMP WELL

CHEVRON STAGE 3 PRODUCTION FACILITY WELL

CHEVRON OFFICE COMPLEX WELL

★ 697-21A

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CHEVRON CENTRAL MAN CAMP WELL

LEROY LATHAM WELL NO 1

UNION 76 WATER WELL NO 6  
UNION 76 WATER WELL NO 6A SHERWOOD WELL NO 6  
SHERWOOD WELL NO 1

HUGHES RANCH LFH-2

NELSON WELL NO 1

WHATLEY WELL NO 3

Decreed Water Wells

**APPENDIX C-2**  
**WATER WELL APPLICATIONS**



**APPENDIX D**  
**21A AREA SURFACE WATER QUALITY**

**APPENDIX D-1**  
**2011 SURFACE WATER ANALYSES**



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_69721AMOC44  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-001

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 12:45  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190524

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>MAJOR IONS, DISSOLVED</b>								
Bicarbonate as HCO3	310	mg/L	5		5.08	meq/L	A2320 B	06/24/11 10:54 / jap
Carbonate as CO3	ND	mg/L	5		<0.2	meq/L	A2320 B	06/24/11 10:54 / jap
Chloride	3	mg/L	1		0.1	meq/L	E300.0	06/24/11 01:21 / mli
Fluoride	0.2	mg/L	0.1		0.008	meq/L	E300.0	06/24/11 01:21 / mli
Nitrogen, Nitrate as N	0.3	mg/L	0.1	H	0.02	meq/L	E300.0	06/24/11 01:21 / mli
Nitrogen, Nitrite as N	ND	mg/L	0.1	H	<0.007	meq/L	E300.0	06/24/11 01:21 / mli
Sulfate	195	mg/L	1		4.05	meq/L	E300.0	06/24/11 01:21 / mli
Calcium	74	mg/L	1		3.69	meq/L	E200.7	07/12/11 17:09 / eli-b
Magnesium	33	mg/L	1		2.69	meq/L	E200.8	07/15/11 12:01 / eli-b
Potassium	1	mg/L	1		0.03	meq/L	E200.7	07/12/11 17:09 / eli-b
Sodium	54	mg/L	1		2.36	meq/L	E200.8	07/15/11 12:01 / eli-b
<b>METALS, DISSOLVED</b>								
Aluminum	ND	mg/L	0.1				E200.8	07/13/11 13:14 / eli-b
Arsenic	0.007	mg/L	0.005				E200.8	07/13/11 13:14 / eli-b
Barium	ND	mg/L	0.1				E200.8	07/13/11 13:14 / eli-b
Boron	ND	mg/L	0.1				E200.8	07/15/11 12:01 / eli-b
Cadmium	ND	mg/L	0.001				E200.8	07/13/11 13:14 / eli-b
Chromium	0.001	mg/L	0.001				E200.8	07/13/11 13:14 / eli-b
Copper	ND	mg/L	0.01				E200.8	07/13/11 13:14 / eli-b
Iron	ND	mg/L	0.03				E200.7	07/15/11 14:44 / eli-b
Lead	ND	mg/L	0.01				E200.8	07/13/11 13:14 / eli-b
Manganese	ND	mg/L	0.01				E200.8	07/13/11 13:14 / eli-b
Mercury	ND	mg/L	0.001				E200.8	07/15/11 12:01 / eli-b
Molybdenum	0.010	mg/L	0.005				E200.8	07/13/11 13:14 / eli-b
Nickel	ND	mg/L	0.01				E200.8	07/13/11 13:14 / eli-b
Selenium	ND	mg/L	0.005				E200.8	07/13/11 13:14 / eli-b
Silver	ND	mg/L	0.005				E200.8	07/13/11 13:14 / eli-b
Zinc	ND	mg/L	0.01				E200.8	07/13/11 13:14 / eli-b
<b>NUTRIENTS</b>								
Nitrogen, Ammonia as N	ND	mg/L	0.05				E350.1	06/28/11 15:15 / eli-b
<b>DISSOLVED GAS</b>								
Methane	0.002	mg/L	0.001				SW8015M	06/30/11 12:11 / eli-b
Ethane	ND	mg/L	0.001				SW8015M	06/30/11 12:11 / eli-b
Ethene	ND	mg/L	0.001				SW8015M	06/30/11 12:11 / eli-b
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acetone	ND	ug/L	10				SW8260B	06/28/11 17:50 / eli-b

**Report** RL - Analyte reporting limit.

**Definitions:** QCL - Quality control limit.

H - Analysis performed past recommended holding time.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_69721AMOC44  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-001

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 12:45  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190524

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acrolein	ND	ug/L	10				SW8260B	06/29/11 12:43 / eli-b
Acrylonitrile	ND	ug/L	10				SW8260B	06/29/11 12:43 / eli-b
Benzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Bromobenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Bromochloromethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Bromodichloromethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Bromoform	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Bromomethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
n-Butylbenzene	ND	ug/L	0.50				SW8260B	06/28/11 17:50 / eli-b
sec-Butylbenzene	ND	ug/L	20				SW8260B	06/28/11 17:50 / eli-b
tert-Butylbenzene	ND	ug/L	50				SW8260B	06/28/11 17:50 / eli-b
Carbon disulfide	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Carbon tetrachloride	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Chlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Chlorodibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Chloroethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
2-Chloroethyl vinyl ether	ND	ug/L	20				SW8260B	06/28/11 17:50 / eli-b
Chloroform	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Chloromethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
2-Chlorotoluene	ND	ug/L	20				SW8260B	06/28/11 17:50 / eli-b
4-Chlorotoluene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,2-Dibromoethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Dibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,2-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,3-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,4-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Dichlorodifluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,1-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,2-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,1-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
cis-1,2-Dichloroethene	ND	ug/L	20				SW8260B	06/28/11 17:50 / eli-b
trans-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,2-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,3-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
2,2-Dichloropropane	ND	ug/L	20				SW8260B	06/28/11 17:50 / eli-b
1,1-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
cis-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
trans-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Ethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Hexachlorobutadiene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b

**Report** RL - Analyte reporting limit.  
**Definitions:** QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_69721AMOC44  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-001

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 12:45  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190524

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
2-Hexanone	ND	ug/L	20				SW8260B	06/28/11 17:50 / eli-b
Isopropylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Isopropyl ether	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
p-Isopropyltoluene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Methyl tert-butyl ether (MTBE)	ND	ug/L	0.50				SW8260B	06/28/11 17:50 / eli-b
Methyl ethyl ketone	ND	ug/L	10				SW8260B	06/28/11 17:50 / eli-b
Methyl isobutyl ketone	ND	ug/L	10				SW8260B	06/28/11 17:50 / eli-b
Methylene chloride	ND	ug/L	0.50				SW8260B	06/28/11 17:50 / eli-b
Naphthalene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
n-Propylbenzene	ND	ug/L	50				SW8260B	06/28/11 17:50 / eli-b
Styrene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Tetrachloroethene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Toluene	ND	ug/L	20				SW8260B	06/28/11 17:50 / eli-b
1,2,3-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,2,4-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,1,1-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,1,2-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Trichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Trichlorofluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,2,3-Trichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,2,4-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
1,3,5-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
Vinyl acetate	ND	ug/L	20				SW8260B	06/28/11 17:50 / eli-b
Vinyl chloride	ND	ug/L	50				SW8260B	06/28/11 17:50 / eli-b
m+p-Xylenes	ND	ug/L	1.0				SW8260B	06/28/11 17:50 / eli-b
o-Xylene	ND	ug/L	0.50				SW8260B	06/28/11 17:50 / eli-b
Xylenes, Total	ND	ug/L	0.50				SW8260B	06/28/11 17:50 / eli-b
Surr: 1,2-Dichloroethane-d4	96.0	%REC	70-130				SW8260B	06/29/11 12:43 / eli-b
Surr: 1,2-Dichloroethane-d4	99.0	%REC	70-130				SW8260B	06/28/11 17:50 / eli-b
Surr: Dibromofluoromethane	100	%REC	77-126				SW8260B	06/29/11 12:43 / eli-b
Surr: Dibromofluoromethane	104	%REC	77-126				SW8260B	06/28/11 17:50 / eli-b
Surr: p-Bromofluorobenzene	111	%REC	76-127				SW8260B	06/29/11 12:43 / eli-b
Surr: p-Bromofluorobenzene	109	%REC	76-127				SW8260B	06/28/11 17:50 / eli-b
Surr: Toluene-d8	100	%REC	79-122				SW8260B	06/29/11 12:43 / eli-b
Surr: Toluene-d8	100	%REC	79-122				SW8260B	06/28/11 17:50 / eli-b

### GLYCOLS

Ethylene Glycol	ND	mg/L	5.0				SW8015B	06/28/11 09:02 / eli-b
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**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID:** SW\_69721AMOC44  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-001

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 12:45  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190524

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>GLYCOLS</b>								
Surr: 2-Butoxyethanol	92.0	%REC	70-130				SW8015B	06/28/11 09:02 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_69721AMOC43  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-002

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 13:15  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190525

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>MAJOR IONS, DISSOLVED</b>								
Bicarbonate as HCO3	264	mg/L	5		4.33	meq/L	A2320 B	06/24/11 11:10 / jap
Carbonate as CO3	9	mg/L	5		0.30	meq/L	A2320 B	06/24/11 11:10 / jap
Chloride	2	mg/L	1		0.06	meq/L	E300.0	06/24/11 01:36 / mli
Fluoride	0.1	mg/L	0.1		0.007	meq/L	E300.0	06/24/11 01:36 / mli
Nitrogen, Nitrate as N	ND	mg/L	0.1	H	<0.007	meq/L	E300.0	06/24/11 01:36 / mli
Nitrogen, Nitrite as N	ND	mg/L	0.1	H	<0.007	meq/L	E300.0	06/24/11 01:36 / mli
Sulfate	68	mg/L	1		1.41	meq/L	E300.0	06/24/11 01:36 / mli
Calcium	49	mg/L	1		2.46	meq/L	E200.7	06/27/11 16:09 / eli-b
Magnesium	20	mg/L	1		1.62	meq/L	E200.7	06/27/11 16:09 / eli-b
Potassium	ND	mg/L	1		<0.03	meq/L	E200.7	06/27/11 16:09 / eli-b
Sodium	38	mg/L	1		1.65	meq/L	E200.7	06/27/11 16:09 / eli-b
<b>METALS, DISSOLVED</b>								
Aluminum	ND	mg/L	0.1				E200.7	06/27/11 16:09 / eli-b
Arsenic	0.007	mg/L	0.005				E200.8	06/30/11 12:45 / eli-b
Barium	ND	mg/L	0.1				E200.7	06/27/11 16:09 / eli-b
Boron	ND	mg/L	0.1				E200.7	06/27/11 16:09 / eli-b
Cadmium	ND	mg/L	0.001				E200.8	06/30/11 12:45 / eli-b
Chromium	ND	mg/L	0.001				E200.8	06/30/11 12:45 / eli-b
Copper	ND	mg/L	0.01				E200.7	06/27/11 16:09 / eli-b
Iron	ND	mg/L	0.03				E200.7	06/27/11 16:09 / eli-b
Lead	ND	mg/L	0.01				E200.8	06/30/11 12:45 / eli-b
Manganese	ND	mg/L	0.01				E200.7	06/27/11 16:09 / eli-b
Mercury	ND	mg/L	0.001				E200.8	07/05/11 17:56 / eli-b
Molybdenum	ND	mg/L	0.005				E200.7	06/27/11 16:09 / eli-b
Nickel	ND	mg/L	0.01				E200.7	06/27/11 16:09 / eli-b
Selenium	ND	mg/L	0.005				E200.8	06/30/11 12:45 / eli-b
Silver	ND	mg/L	0.005				E200.7	06/27/11 16:09 / eli-b
Zinc	ND	mg/L	0.01				E200.7	06/27/11 16:09 / eli-b
<b>NUTRIENTS</b>								
Nitrogen, Ammonia as N	ND	mg/L	0.05				E350.1	06/28/11 15:16 / eli-b
<b>DISSOLVED GAS</b>								
Methane	ND	mg/L	0.001				SW8015M	06/30/11 12:19 / eli-b
Ethane	ND	mg/L	0.001				SW8015M	06/30/11 12:19 / eli-b
Ethene	ND	mg/L	0.001				SW8015M	06/30/11 12:19 / eli-b
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acetone	ND	ug/L	10				SW8260B	06/28/11 18:29 / eli-b

**Report** RL - Analyte reporting limit.

**Definitions:** QCL - Quality control limit.

H - Analysis performed past recommended holding time.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_69721AMOC43  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-002

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 13:15  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190525

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acrolein	ND	ug/L	10				SW8260B	06/29/11 13:20 / eli-b
Acrylonitrile	ND	ug/L	10				SW8260B	06/29/11 13:20 / eli-b
Benzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Bromobenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Bromochloromethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Bromodichloromethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Bromoform	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Bromomethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
n-Butylbenzene	ND	ug/L	0.50				SW8260B	06/28/11 18:29 / eli-b
sec-Butylbenzene	ND	ug/L	20				SW8260B	06/28/11 18:29 / eli-b
tert-Butylbenzene	ND	ug/L	50				SW8260B	06/28/11 18:29 / eli-b
Carbon disulfide	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Carbon tetrachloride	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Chlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Chlorodibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Chloroethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
2-Chloroethyl vinyl ether	ND	ug/L	20				SW8260B	06/28/11 18:29 / eli-b
Chloroform	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Chloromethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
2-Chlorotoluene	ND	ug/L	20				SW8260B	06/28/11 18:29 / eli-b
4-Chlorotoluene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,2-Dibromoethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Dibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,2-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,3-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,4-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Dichlorodifluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,1-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,2-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,1-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
cis-1,2-Dichloroethene	ND	ug/L	20				SW8260B	06/28/11 18:29 / eli-b
trans-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,2-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,3-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
2,2-Dichloropropane	ND	ug/L	20				SW8260B	06/28/11 18:29 / eli-b
1,1-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
cis-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
trans-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Ethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Hexachlorobutadiene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b

**Report** RL - Analyte reporting limit.  
**Definitions:** QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_69721AMOC43  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-002

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 13:15  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190525

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
2-Hexanone	ND	ug/L	20				SW8260B	06/28/11 18:29 / eli-b
Isopropylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Isopropyl ether	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
p-Isopropyltoluene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Methyl tert-butyl ether (MTBE)	ND	ug/L	0.50				SW8260B	06/28/11 18:29 / eli-b
Methyl ethyl ketone	ND	ug/L	10				SW8260B	06/28/11 18:29 / eli-b
Methyl isobutyl ketone	ND	ug/L	10				SW8260B	06/28/11 18:29 / eli-b
Methylene chloride	ND	ug/L	0.50				SW8260B	06/28/11 18:29 / eli-b
Naphthalene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
n-Propylbenzene	ND	ug/L	50				SW8260B	06/28/11 18:29 / eli-b
Styrene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Tetrachloroethene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Toluene	ND	ug/L	20				SW8260B	06/28/11 18:29 / eli-b
1,2,3-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,2,4-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,1,1-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,1,2-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Trichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Trichlorofluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,2,3-Trichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,2,4-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
1,3,5-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
Vinyl acetate	ND	ug/L	20				SW8260B	06/28/11 18:29 / eli-b
Vinyl chloride	ND	ug/L	50				SW8260B	06/28/11 18:29 / eli-b
m+p-Xylenes	ND	ug/L	1.0				SW8260B	06/28/11 18:29 / eli-b
o-Xylene	ND	ug/L	0.50				SW8260B	06/28/11 18:29 / eli-b
Xylenes, Total	ND	ug/L	0.50				SW8260B	06/28/11 18:29 / eli-b
Surr: 1,2-Dichloroethane-d4	100	%REC	70-130				SW8260B	06/29/11 13:20 / eli-b
Surr: 1,2-Dichloroethane-d4	101	%REC	70-130				SW8260B	06/28/11 18:29 / eli-b
Surr: Dibromofluoromethane	101	%REC	77-126				SW8260B	06/29/11 13:20 / eli-b
Surr: Dibromofluoromethane	104	%REC	77-126				SW8260B	06/28/11 18:29 / eli-b
Surr: p-Bromofluorobenzene	106	%REC	76-127				SW8260B	06/29/11 13:20 / eli-b
Surr: p-Bromofluorobenzene	107	%REC	76-127				SW8260B	06/28/11 18:29 / eli-b
Surr: Toluene-d8	99.0	%REC	79-122				SW8260B	06/29/11 13:20 / eli-b
Surr: Toluene-d8	104	%REC	79-122				SW8260B	06/28/11 18:29 / eli-b

### GLYCOLS

Ethylene Glycol	ND	mg/L	5.0				SW8015B	06/27/11 18:19 / eli-b
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**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID:** SW\_69721AMOC43  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-002

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 13:15  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190525

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>GLYCOLS</b>								
Surr: 2-Butoxyethanol	94.0	%REC	70-130				SW8015B	06/27/11 18:19 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_69721AMOC42  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-003

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 14:00  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190526

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>MAJOR IONS, DISSOLVED</b>								
Bicarbonate as HCO3	258	mg/L	5		4.22	meq/L	A2320 B	06/24/11 11:17 / jap
Carbonate as CO3	13	mg/L	5		0.45	meq/L	A2320 B	06/24/11 11:17 / jap
Chloride	7	mg/L	1		0.20	meq/L	E300.0	06/24/11 01:51 / mli
Fluoride	0.1	mg/L	0.1		0.006	meq/L	E300.0	06/24/11 01:51 / mli
Nitrogen, Nitrate as N	0.7	mg/L	0.1	H	0.05	meq/L	E300.0	06/24/11 01:51 / mli
Nitrogen, Nitrite as N	ND	mg/L	0.1	H	<0.007	meq/L	E300.0	06/24/11 01:51 / mli
Sulfate	50	mg/L	1		1.05	meq/L	E300.0	06/24/11 01:51 / mli
Calcium	45	mg/L	1		2.24	meq/L	E200.7	07/15/11 14:48 / eli-b
Magnesium	19	mg/L	1		1.55	meq/L	E200.8	07/15/11 12:05 / eli-b
Potassium	ND	mg/L	1		<0.03	meq/L	E200.7	07/12/11 17:13 / eli-b
Sodium	40	mg/L	1		1.72	meq/L	E200.8	07/15/11 12:05 / eli-b
<b>METALS, DISSOLVED</b>								
Aluminum	ND	mg/L	0.1				E200.8	07/13/11 13:18 / eli-b
Arsenic	0.007	mg/L	0.005				E200.8	07/13/11 13:18 / eli-b
Barium	ND	mg/L	0.1				E200.8	07/13/11 13:18 / eli-b
Boron	ND	mg/L	0.1				E200.8	07/15/11 12:05 / eli-b
Cadmium	ND	mg/L	0.001				E200.8	07/13/11 13:18 / eli-b
Chromium	0.001	mg/L	0.001				E200.8	07/13/11 13:18 / eli-b
Copper	ND	mg/L	0.01				E200.8	07/13/11 13:18 / eli-b
Iron	ND	mg/L	0.03				E200.7	07/15/11 14:48 / eli-b
Lead	ND	mg/L	0.01				E200.8	07/13/11 13:18 / eli-b
Manganese	ND	mg/L	0.01				E200.8	07/13/11 13:18 / eli-b
Mercury	ND	mg/L	0.001				E200.8	07/15/11 12:05 / eli-b
Molybdenum	0.006	mg/L	0.005				E200.8	07/13/11 13:18 / eli-b
Nickel	ND	mg/L	0.01				E200.8	07/13/11 13:18 / eli-b
Selenium	ND	mg/L	0.005				E200.8	07/13/11 13:18 / eli-b
Silver	ND	mg/L	0.005				E200.8	07/15/11 12:05 / eli-b
Zinc	ND	mg/L	0.01				E200.8	07/13/11 13:18 / eli-b
<b>NUTRIENTS</b>								
Nitrogen, Ammonia as N	ND	mg/L	0.05				E350.1	06/28/11 15:17 / eli-b
<b>DISSOLVED GAS</b>								
Methane	0.001	mg/L	0.001				SW8015M	06/30/11 12:26 / eli-b
Ethane	ND	mg/L	0.001				SW8015M	06/30/11 12:26 / eli-b
Ethene	ND	mg/L	0.001				SW8015M	06/30/11 12:26 / eli-b
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acetone	ND	ug/L	10				SW8260B	06/28/11 19:14 / eli-b

**Report** RL - Analyte reporting limit.

**Definitions:** QCL - Quality control limit.

H - Analysis performed past recommended holding time.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_69721AMOC42  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-003

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 14:00  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190526

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acrolein	ND	ug/L	10				SW8260B	06/29/11 13:57 / eli-b
Acrylonitrile	ND	ug/L	10				SW8260B	06/29/11 13:57 / eli-b
Benzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Bromobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Bromochloromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Bromodichloromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Bromoform	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Bromomethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
n-Butylbenzene	ND	ug/L	0.50				SW8260B	06/28/11 19:14 / eli-b
sec-Butylbenzene	ND	ug/L	20				SW8260B	06/28/11 19:14 / eli-b
tert-Butylbenzene	ND	ug/L	50				SW8260B	06/28/11 19:14 / eli-b
Carbon disulfide	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Carbon tetrachloride	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Chlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Chlorodibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Chloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
2-Chloroethyl vinyl ether	ND	ug/L	20				SW8260B	06/28/11 19:14 / eli-b
Chloroform	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Chloromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
2-Chlorotoluene	ND	ug/L	20				SW8260B	06/28/11 19:14 / eli-b
4-Chlorotoluene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,2-Dibromoethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Dibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,2-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,3-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,4-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Dichlorodifluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,1-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,2-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,1-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
cis-1,2-Dichloroethene	ND	ug/L	20				SW8260B	06/28/11 19:14 / eli-b
trans-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,2-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,3-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
2,2-Dichloropropane	ND	ug/L	20				SW8260B	06/28/11 19:14 / eli-b
1,1-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
cis-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
trans-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Ethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Hexachlorobutadiene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b

**Report** RL - Analyte reporting limit.  
**Definitions:** QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



**LABORATORY ANALYTICAL REPORT**

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_69721AMOC42  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-003

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 14:00  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190526

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
2-Hexanone	ND	ug/L	20				SW8260B	06/28/11 19:14 / eli-b
Isopropylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Isopropyl ether	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
p-Isopropyltoluene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Methyl tert-butyl ether (MTBE)	ND	ug/L	0.50				SW8260B	06/28/11 19:14 / eli-b
Methyl ethyl ketone	ND	ug/L	10				SW8260B	06/28/11 19:14 / eli-b
Methyl isobutyl ketone	ND	ug/L	10				SW8260B	06/28/11 19:14 / eli-b
Methylene chloride	ND	ug/L	0.50				SW8260B	06/28/11 19:14 / eli-b
Naphthalene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
n-Propylbenzene	ND	ug/L	50				SW8260B	06/28/11 19:14 / eli-b
Styrene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Tetrachloroethene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Toluene	ND	ug/L	20				SW8260B	06/28/11 19:14 / eli-b
1,2,3-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,2,4-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,1,1-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,1,2-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Trichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Trichlorofluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,2,3-Trichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,2,4-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
1,3,5-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
Vinyl acetate	ND	ug/L	20				SW8260B	06/28/11 19:14 / eli-b
Vinyl chloride	ND	ug/L	50				SW8260B	06/28/11 19:14 / eli-b
m+p-Xylenes	ND	ug/L	1.0				SW8260B	06/28/11 19:14 / eli-b
o-Xylene	ND	ug/L	0.50				SW8260B	06/28/11 19:14 / eli-b
Xylenes, Total	ND	ug/L	0.50				SW8260B	06/28/11 19:14 / eli-b
Surr: 1,2-Dichloroethane-d4	97.0	%REC	70-130				SW8260B	06/29/11 13:57 / eli-b
Surr: 1,2-Dichloroethane-d4	101	%REC	70-130				SW8260B	06/28/11 19:14 / eli-b
Surr: Dibromofluoromethane	99.0	%REC	77-126				SW8260B	06/29/11 13:57 / eli-b
Surr: Dibromofluoromethane	104	%REC	77-126				SW8260B	06/28/11 19:14 / eli-b
Surr: p-Bromofluorobenzene	109	%REC	76-127				SW8260B	06/29/11 13:57 / eli-b
Surr: p-Bromofluorobenzene	105	%REC	76-127				SW8260B	06/28/11 19:14 / eli-b
Surr: Toluene-d8	104	%REC	79-122				SW8260B	06/29/11 13:57 / eli-b
Surr: Toluene-d8	102	%REC	79-122				SW8260B	06/28/11 19:14 / eli-b

**GLYCOLS**

Ethylene Glycol	ND	mg/L	5.0				SW8015B	06/27/11 18:38 / eli-b
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**Report** RL - Analyte reporting limit.  
**Definitions:** QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID:** SW\_69721AMOC42  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-003

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 14:00  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190526

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>GLYCOLS</b>								
Surr: 2-Butoxyethanol	93.0	%REC	70-130				SW8015B	06/27/11 18:38 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID:** SW\_Spring\_01  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-004

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 15:45  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190527

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>MAJOR IONS, DISSOLVED</b>								
Bicarbonate as HCO3	270	mg/L	5		4.43	meq/L	A2320 B	06/24/11 11:24 / jap
Carbonate as CO3	8	mg/L	5		0.26	meq/L	A2320 B	06/24/11 11:24 / jap
Chloride	10	mg/L	1		0.29	meq/L	E300.0	06/24/11 02:06 / mli
Fluoride	0.1	mg/L	0.1		0.006	meq/L	E300.0	06/24/11 02:06 / mli
Nitrogen, Nitrate as N	1.2	mg/L	0.1	H	0.08	meq/L	E300.0	06/24/11 02:06 / mli
Nitrogen, Nitrite as N	ND	mg/L	0.1	H	<0.007	meq/L	E300.0	06/24/11 02:06 / mli
Sulfate	45	mg/L	1		0.93	meq/L	E300.0	06/24/11 02:06 / mli
Calcium	47	mg/L	1		2.37	meq/L	E200.7	06/27/11 16:25 / eli-b
Magnesium	19	mg/L	1		1.53	meq/L	E200.7	06/27/11 16:25 / eli-b
Potassium	ND	mg/L	1		<0.03	meq/L	E200.7	06/27/11 16:25 / eli-b
Sodium	43	mg/L	1		1.89	meq/L	E200.7	06/27/11 16:25 / eli-b
<b>METALS, DISSOLVED</b>								
Aluminum	ND	mg/L	0.1				E200.7	06/27/11 16:25 / eli-b
Arsenic	0.006	mg/L	0.005				E200.8	06/30/11 12:54 / eli-b
Barium	ND	mg/L	0.1				E200.7	06/27/11 16:25 / eli-b
Boron	ND	mg/L	0.1				E200.7	06/27/11 16:25 / eli-b
Cadmium	ND	mg/L	0.001				E200.8	06/30/11 12:54 / eli-b
Chromium	ND	mg/L	0.001				E200.8	06/30/11 12:54 / eli-b
Copper	ND	mg/L	0.01				E200.7	06/27/11 16:25 / eli-b
Iron	ND	mg/L	0.03				E200.7	06/27/11 16:25 / eli-b
Lead	ND	mg/L	0.01				E200.8	06/30/11 12:54 / eli-b
Manganese	ND	mg/L	0.01				E200.7	06/27/11 16:25 / eli-b
Mercury	ND	mg/L	0.001				E200.8	07/05/11 18:06 / eli-b
Molybdenum	ND	mg/L	0.005				E200.7	06/27/11 16:25 / eli-b
Nickel	ND	mg/L	0.01				E200.7	06/27/11 16:25 / eli-b
Selenium	ND	mg/L	0.005				E200.8	06/30/11 12:54 / eli-b
Silver	ND	mg/L	0.005				E200.7	06/27/11 16:25 / eli-b
Zinc	ND	mg/L	0.01				E200.7	06/27/11 16:25 / eli-b
<b>NUTRIENTS</b>								
Nitrogen, Ammonia as N	ND	mg/L	0.05				E350.1	06/28/11 15:18 / eli-b
<b>DISSOLVED GAS</b>								
Methane	0.002	mg/L	0.001				SW8015M	06/30/11 12:34 / eli-b
Ethane	ND	mg/L	0.001				SW8015M	06/30/11 12:34 / eli-b
Ethene	ND	mg/L	0.001				SW8015M	06/30/11 12:34 / eli-b
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acetone	ND	ug/L	10				SW8260B	06/28/11 19:53 / eli-b

**Report** RL - Analyte reporting limit.

**Definitions:** QCL - Quality control limit.

H - Analysis performed past recommended holding time.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_Spring\_01  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-004

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 15:45  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190527

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acrolein	ND	ug/L	10				SW8260B	06/29/11 07:23 / eli-b
Acrylonitrile	ND	ug/L	10				SW8260B	06/29/11 07:23 / eli-b
Benzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Bromobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Bromochloromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Bromodichloromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Bromoform	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Bromomethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
n-Butylbenzene	ND	ug/L	0.50				SW8260B	06/28/11 19:53 / eli-b
sec-Butylbenzene	ND	ug/L	20				SW8260B	06/28/11 19:53 / eli-b
tert-Butylbenzene	ND	ug/L	50				SW8260B	06/28/11 19:53 / eli-b
Carbon disulfide	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Carbon tetrachloride	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Chlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Chlorodibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Chloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
2-Chloroethyl vinyl ether	ND	ug/L	20				SW8260B	06/28/11 19:53 / eli-b
Chloroform	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Chloromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
2-Chlorotoluene	ND	ug/L	20				SW8260B	06/28/11 19:53 / eli-b
4-Chlorotoluene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,2-Dibromoethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Dibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,2-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,3-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,4-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Dichlorodifluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,1-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,2-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,1-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
cis-1,2-Dichloroethene	ND	ug/L	20				SW8260B	06/28/11 19:53 / eli-b
trans-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,2-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,3-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
2,2-Dichloropropane	ND	ug/L	20				SW8260B	06/28/11 19:53 / eli-b
1,1-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
cis-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
trans-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Ethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Hexachlorobutadiene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b

**Report** RL - Analyte reporting limit.  
**Definitions:** QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** SW\_Spring\_01  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-004

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 15:45  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190527

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
2-Hexanone	ND	ug/L	20				SW8260B	06/28/11 19:53 / eli-b
Isopropylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Isopropyl ether	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
p-Isopropyltoluene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Methyl tert-butyl ether (MTBE)	ND	ug/L	0.50				SW8260B	06/28/11 19:53 / eli-b
Methyl ethyl ketone	ND	ug/L	10				SW8260B	06/28/11 19:53 / eli-b
Methyl isobutyl ketone	ND	ug/L	10				SW8260B	06/28/11 19:53 / eli-b
Methylene chloride	ND	ug/L	0.50				SW8260B	06/28/11 19:53 / eli-b
Naphthalene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
n-Propylbenzene	ND	ug/L	50				SW8260B	06/28/11 19:53 / eli-b
Styrene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Tetrachloroethene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Toluene	ND	ug/L	20				SW8260B	06/28/11 19:53 / eli-b
1,2,3-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,2,4-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,1,1-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,1,2-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Trichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Trichlorofluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,2,3-Trichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,2,4-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
1,3,5-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
Vinyl acetate	ND	ug/L	20				SW8260B	06/28/11 19:53 / eli-b
Vinyl chloride	ND	ug/L	50				SW8260B	06/28/11 19:53 / eli-b
m+p-Xylenes	ND	ug/L	1.0				SW8260B	06/28/11 19:53 / eli-b
o-Xylene	ND	ug/L	0.50				SW8260B	06/28/11 19:53 / eli-b
Xylenes, Total	ND	ug/L	0.50				SW8260B	06/28/11 19:53 / eli-b
Surr: 1,2-Dichloroethane-d4	98.0	%REC	70-130				SW8260B	06/28/11 19:53 / eli-b
Surr: 1,2-Dichloroethane-d4	97.0	%REC	70-130				SW8260B	06/29/11 07:23 / eli-b
Surr: Dibromofluoromethane	103	%REC	77-126				SW8260B	06/28/11 19:53 / eli-b
Surr: Dibromofluoromethane	97.0	%REC	77-126				SW8260B	06/29/11 07:23 / eli-b
Surr: p-Bromofluorobenzene	108	%REC	76-127				SW8260B	06/28/11 19:53 / eli-b
Surr: p-Bromofluorobenzene	113	%REC	76-127				SW8260B	06/29/11 07:23 / eli-b
Surr: Toluene-d8	102	%REC	79-122				SW8260B	06/28/11 19:53 / eli-b
Surr: Toluene-d8	102	%REC	79-122				SW8260B	06/29/11 07:23 / eli-b

### GLYCOLS

Ethylene Glycol ND mg/L 5.0 SW8015B 06/27/11 18:57 / eli-b

**Report** RL - Analyte reporting limit.  
**Definitions:** QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID:** SW\_Spring\_01  
**Location:**  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-004

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 15:45  
**Date Received:** 06/23/11  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 190527

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>GLYCOLS</b>								
Surr: 2-Butoxyethanol	95.0	%REC	70-130				SW8015B	06/27/11 18:57 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** Trip\_Blank  
**Location:** Trip Blank-LOTg2klr1106161200  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-005

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 12:45  
**Date Received:** 06/23/11  
**Sampled By:** Kasey Ruff  
**Matrix:** Trip Blank  
**Tracking Number:** 191018

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acetone	ND	ug/L	10				SW8260B	06/28/11 11:34 / eli-b
Acrolein	ND	ug/L	10				SW8260B	06/28/11 11:34 / eli-b
Acrylonitrile	ND	ug/L	10				SW8260B	06/28/11 11:34 / eli-b
Benzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Bromobenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Bromochloromethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Bromodichloromethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Bromoform	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Bromomethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
n-Butylbenzene	ND	ug/L	0.50				SW8260B	06/28/11 11:34 / eli-b
sec-Butylbenzene	ND	ug/L	20				SW8260B	06/28/11 11:34 / eli-b
tert-Butylbenzene	ND	ug/L	50				SW8260B	06/28/11 11:34 / eli-b
Carbon disulfide	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Carbon tetrachloride	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Chlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Chlorodibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Chloroethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
2-Chloroethyl vinyl ether	ND	ug/L	20				SW8260B	06/28/11 11:34 / eli-b
Chloroform	0.37	ug/L	1.0	J			SW8260B	06/28/11 11:34 / eli-b
Chloromethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
2-Chlorotoluene	ND	ug/L	20				SW8260B	06/28/11 11:34 / eli-b
4-Chlorotoluene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,2-Dibromoethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Dibromomethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,2-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,3-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,4-Dichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Dichlorodifluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,1-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,2-Dichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,1-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
cis-1,2-Dichloroethene	ND	ug/L	20				SW8260B	06/28/11 11:34 / eli-b
trans-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,2-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,3-Dichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
2,2-Dichloropropane	ND	ug/L	20				SW8260B	06/28/11 11:34 / eli-b
1,1-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
cis-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
trans-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Ethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b

**Report** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

**Definitions:** QCL - Quality control limit.

ND - Not detected at the reporting limit.

J - Estimated value. The analyte was present but less than the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Baseline\_Water\_Quality  
**Client Sample ID** Trip\_Blank  
**Location:** Trip Blank-LOTg2Klr1106161200  
**Samp FRQ/Type:** SP  
**Lab ID:** G11060745-005

**Report Date:** 07/18/11  
**Collection Date:** 06/21/11 12:45  
**Date Received:** 06/23/11  
**Sampled By:** Kasey Ruff  
**Matrix:** Trip Blank  
**Tracking Number:** 191018

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Hexachlorobutadiene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
2-Hexanone	ND	ug/L	20				SW8260B	06/28/11 11:34 / eli-b
Isopropylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Isopropyl ether	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
p-Isopropyltoluene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Methyl tert-butyl ether (MTBE)	ND	ug/L	0.50				SW8260B	06/28/11 11:34 / eli-b
Methyl ethyl ketone	ND	ug/L	10				SW8260B	06/28/11 11:34 / eli-b
Methyl isobutyl ketone	ND	ug/L	10				SW8260B	06/28/11 11:34 / eli-b
Methylene chloride	ND	ug/L	0.50				SW8260B	06/28/11 11:34 / eli-b
Naphthalene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
n-Propylbenzene	ND	ug/L	50				SW8260B	06/28/11 11:34 / eli-b
Styrene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Tetrachloroethene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Toluene	ND	ug/L	20				SW8260B	06/28/11 11:34 / eli-b
1,2,3-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,2,4-Trichlorobenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,1,1-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,1,2-Trichloroethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Trichloroethene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Trichlorofluoromethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,2,3-Trichloropropane	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,2,4-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
1,3,5-Trimethylbenzene	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
Vinyl acetate	ND	ug/L	20				SW8260B	06/28/11 11:34 / eli-b
Vinyl chloride	ND	ug/L	50				SW8260B	06/28/11 11:34 / eli-b
m+p-Xylenes	ND	ug/L	1.0				SW8260B	06/28/11 11:34 / eli-b
o-Xylene	ND	ug/L	0.50				SW8260B	06/28/11 11:34 / eli-b
Xylenes, Total	ND	ug/L	0.50				SW8260B	06/28/11 11:34 / eli-b
Surr: 1,2-Dichloroethane-d4	97.0	%REC	70-130				SW8260B	06/28/11 11:34 / eli-b
Surr: Dibromofluoromethane	100	%REC	77-126				SW8260B	06/28/11 11:34 / eli-b
Surr: p-Bromofluorobenzene	111	%REC	76-127				SW8260B	06/28/11 11:34 / eli-b
Surr: Toluene-d8	105	%REC	79-122				SW8260B	06/28/11 11:34 / eli-b

Due to an inadvertent omission, 1,1,2-Trichloro-1,2,2-trifluoroethane and Isopropyl ether were not included in the Continuing Calibration Verification sample associated with this sample. There was not additional sample available for re-analysis.

### GLYCOLS

Ethylene Glycol	ND	mg/L	5.0				SW8015B	06/27/11 16:25 / eli-b
Surr: 2-Butoxyethanol	98.0	%REC	70-130				SW8015B	06/27/11 16:25 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.

**APPENDIX D-2**  
**2012 SURFACE WATER ANALYSES**



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID** SW\_69721AMOC42  
**Location:**  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-001

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 10:30  
**Date Received:** 08/08/12  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 212436

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>MAJOR IONS, DISSOLVED</b>								
Bicarbonate as HCO <sub>3</sub>	299	mg/L	5		4.90	meq/L	A2320 B	08/09/12 12:39 / blb
Carbonate as CO <sub>3</sub>	9	mg/L	5		0.31	meq/L	A2320 B	08/09/12 12:39 / blb
Chloride	21	mg/L	1		0.60	meq/L	E300.0	08/08/12 17:25 / jab
Fluoride	0.1	mg/L	0.1		0.005	meq/L	E300.0	08/08/12 17:25 / jab
Nitrogen, Nitrate as N	ND	mg/L	0.1	H	<0.007	meq/L	E300.0	08/08/12 17:25 / jab
Nitrogen, Nitrite as N	ND	mg/L	0.1	H	<0.007	meq/L	E300.0	08/08/12 17:25 / jab
Sulfate	61	mg/L	1		1.28	meq/L	E300.0	08/08/12 17:25 / jab
Calcium	60	mg/L	1		2.98	meq/L	E200.7	08/10/12 13:58 / eli-b
Magnesium	24	mg/L	1		1.93	meq/L	E200.7	08/10/12 13:58 / eli-b
Potassium	2	mg/L	1		0.04	meq/L	E200.7	08/10/12 13:58 / eli-b
Sodium	49	mg/L	1		2.13	meq/L	E200.7	08/10/12 13:58 / eli-b
<b>METALS, DISSOLVED</b>								
Aluminum	ND	mg/L	0.1				E200.7	08/10/12 13:58 / eli-b
Arsenic	0.008	mg/L	0.005				E200.8	08/10/12 22:30 / eli-b
Barium	ND	mg/L	0.1				E200.7	08/10/12 13:58 / eli-b
Boron	ND	mg/L	0.1				E200.7	08/10/12 13:58 / eli-b
Cadmium	ND	mg/L	0.001				E200.7	08/10/12 13:58 / eli-b
Chromium	0.001	mg/L	0.001				E200.8	08/10/12 22:30 / eli-b
Copper	ND	mg/L	0.01				E200.7	08/10/12 13:58 / eli-b
Iron	ND	mg/L	0.03				E200.7	08/10/12 13:58 / eli-b
Lead	ND	mg/L	0.01				E200.8	08/10/12 22:30 / eli-b
Manganese	0.03	mg/L	0.01				E200.7	08/10/12 13:58 / eli-b
Mercury	ND	mg/L	0.001				E200.8	08/10/12 22:30 / eli-b
Molybdenum	ND	mg/L	0.005				E200.8	08/10/12 22:30 / eli-b
Nickel	ND	mg/L	0.01				E200.7	08/10/12 13:58 / eli-b
Selenium	ND	mg/L	0.005				E200.8	08/10/12 22:30 / eli-b
Silver	ND	mg/L	0.005				E200.7	08/10/12 13:58 / eli-b
Zinc	ND	mg/L	0.01				E200.7	08/10/12 13:58 / eli-b
<b>NON-METALS</b>								
Alkalinity, Total as CaCO <sub>3</sub>	261	mg/L	5				A2320 B	08/09/12 12:39 / blb
Organic Carbon, Total (TOC)	3.8	mg/L	0.5				A5310 C	08/10/12 11:40 / eli-c
Solids, Total Dissolved TDS @ 180 C	395	mg/L	20				A2540 C	08/09/12 08:45 / blb
Solids, Total Suspended TSS @ 105 C	11	mg/L	10				A2540 D	08/10/12 13:29 / blb
Sulfide	ND	mg/L	0.04				A4500-S D	08/10/12 11:00 / eli-b
<b>NUTRIENTS</b>								
Nitrogen, Ammonia as N	ND	mg/L	0.05				E350.1	08/13/12 12:04 / eli-b

**Report** RL - Analyte reporting limit.

**Definitions:** QCL - Quality control limit.

H - Analysis performed past recommended holding time.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID** SW\_69721AMOC42  
**Location:**  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-001

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 10:30  
**Date Received:** 08/08/12  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 212436

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>DISSOLVED GAS</b>								
Methane	0.002	mg/L	0.001				SW8015M	08/13/12 07:51 / eli-b
Ethane	ND	mg/L	0.001				SW8015M	08/13/12 07:51 / eli-b
Ethene	ND	mg/L	0.001				SW8015M	08/13/12 07:51 / eli-b
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acetone	ND	ug/L	20				SW8260B	08/15/12 14:20 / eli-b
Acrolein	ND	ug/L	20				SW8260B	08/15/12 19:02 / eli-b
Acrylonitrile	ND	ug/L	20				SW8260B	08/15/12 19:02 / eli-b
Benzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Bromobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Bromochloromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Bromodichloromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Bromoform	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Bromomethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
n-Butylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
sec-Butylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
tert-Butylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Carbon disulfide	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Carbon tetrachloride	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Chlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Chlorodibromomethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Chloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
2-Chloroethyl vinyl ether	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Chloroform	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Chloromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
2-Chlorotoluene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
4-Chlorotoluene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,2-Dibromoethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Dibromomethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,2-Dichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,3-Dichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,4-Dichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Dichlorodifluoromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,1-Dichloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,2-Dichloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,1-Dichloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
cis-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
trans-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,2-Dichloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,3-Dichloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b

**Report** RL - Analyte reporting limit.  
**Definitions:** QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID** SW\_69721AMOC42  
**Location:**  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-001

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 10:30  
**Date Received:** 08/08/12  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 212436

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
2,2-Dichloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,1-Dichloropropene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
cis-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
trans-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Ethylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Hexachlorobutadiene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
2-Hexanone	ND	ug/L	20				SW8260B	08/15/12 14:20 / eli-b
Isopropylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Isopropyl ether	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
p-Isopropyltoluene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Methyl tert-butyl ether (MTBE)	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Methyl ethyl ketone	ND	ug/L	20				SW8260B	08/15/12 14:20 / eli-b
Methyl isobutyl ketone	ND	ug/L	20				SW8260B	08/15/12 14:20 / eli-b
Methylene chloride	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Naphthalene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
n-Propylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Styrene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Tetrachloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Toluene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,2,3-Trichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,2,4-Trichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,1,1-Trichloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,1,2-Trichloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Trichloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Trichlorofluoromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,2,3-Trichloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,2,4-Trimethylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
1,3,5-Trimethylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Vinyl acetate	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Vinyl chloride	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
m+p-Xylenes	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
o-Xylene	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Xylenes, T total	ND	ug/L	1.0				SW8260B	08/15/12 14:20 / eli-b
Surr: 1,2-Dichloroethane-d4	124	%REC	70-130				SW8260B	08/15/12 14:20 / eli-b
Surr: 1,2-Dichloroethane-d4	126	%REC	70-130				SW8260B	08/15/12 19:02 / eli-b
Surr: Dibromofluoromethane	126	%REC	77-126				SW8260B	08/15/12 14:20 / eli-b
Surr: Dibromofluoromethane	126	%REC	77-126				SW8260B	08/15/12 19:02 / eli-b
Surr: p-Bromofluorobenzene	107	%REC	76-127				SW8260B	08/15/12 14:20 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID** SW\_69721AMOC42  
**Location:**  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-001

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 10:30  
**Date Received:** 08/08/12  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 212436

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Surr: p-Bromofluorobenzene	110	%REC	76-127				SW8260B	08/15/12 19:02 / eli-b
Surr: Toluene-d8	99.0	%REC	79-122				SW8260B	08/15/12 14:20 / eli-b
Surr: Toluene-d8	99.0	%REC	79-122				SW8260B	08/15/12 19:02 / eli-b
<b>GLYCOLS</b>								
Ethylene Glycol	ND	mg/L	5.0				SW8015B	08/16/12 09:47 / eli-b
Surr: 2-Butoxyethanol	99.0	%REC	83-121				SW8015B	08/16/12 09:47 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID** SW\_Spring\_01  
**Location:**  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-002

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 11:05  
**Date Received:** 08/08/12  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 212437

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>MAJOR IONS, DISSOLVED</b>								
Bicarbonate as HCO3	303	mg/L	5		4.97	meq/L	A2320 B	08/09/12 12:47 / blb
Carbonate as CO3	ND	mg/L	5		<0.2	meq/L	A2320 B	08/09/12 12:47 / blb
Chloride	37	mg/L	1		1.05	meq/L	E300.0	08/08/12 17:39 / jab
Fluoride	ND	mg/L	0.1		<0.005	meq/L	E300.0	08/08/12 17:39 / jab
Nitrogen, Nitrate as N	1.0	mg/L	0.1	H	0.07	meq/L	E300.0	08/08/12 17:39 / jab
Nitrogen, Nitrite as N	ND	mg/L	0.1	H	<0.007	meq/L	E300.0	08/08/12 17:39 / jab
Sulfate	68	mg/L	1		1.41	meq/L	E300.0	08/08/12 17:39 / jab
Calcium	62	mg/L	1		3.07	meq/L	E200.7	08/10/12 14:01 / eli-b
Magnesium	23	mg/L	1		1.93	meq/L	E200.7	08/10/12 14:01 / eli-b
Potassium	2	mg/L	1		0.05	meq/L	E200.7	08/10/12 14:01 / eli-b
Sodium	56	mg/L	1		2.45	meq/L	E200.7	08/10/12 14:01 / eli-b
<b>METALS, DISSOLVED</b>								
Aluminum	ND	mg/L	0.1				E200.7	08/10/12 14:01 / eli-b
Arsenic	ND	mg/L	0.005				E200.8	08/10/12 22:33 / eli-b
Barium	ND	mg/L	0.1				E200.7	08/10/12 14:01 / eli-b
Boron	ND	mg/L	0.1				E200.7	08/10/12 14:01 / eli-b
Cadmium	ND	mg/L	0.001				E200.7	08/10/12 14:01 / eli-b
Chromium	0.002	mg/L	0.001				E200.8	08/10/12 22:33 / eli-b
Copper	ND	mg/L	0.01				E200.7	08/10/12 14:01 / eli-b
Iron	ND	mg/L	0.03				E200.7	08/10/12 14:01 / eli-b
Lead	ND	mg/L	0.01				E200.8	08/10/12 22:33 / eli-b
Manganese	0.08	mg/L	0.01				E200.7	08/10/12 14:01 / eli-b
Mercury	ND	mg/L	0.001				E200.8	08/10/12 22:33 / eli-b
Molybdenum	0.005	mg/L	0.005				E200.8	08/10/12 22:33 / eli-b
Nickel	ND	mg/L	0.01				E200.7	08/10/12 14:01 / eli-b
Selenium	ND	mg/L	0.005				E200.8	08/10/12 22:33 / eli-b
Silver	ND	mg/L	0.005				E200.7	08/10/12 14:01 / eli-b
Zinc	ND	mg/L	0.01				E200.7	08/10/12 14:01 / eli-b
<b>NON-METALS</b>								
Alkalinity, Total as CaCO3	249	mg/L	5				A2320 B	08/09/12 12:47 / blb
Organic Carbon, Total (TOC)	2.9	mg/L	0.5				A5310 C	08/10/12 11:51 / eli-c
Solids, Total Dissolved TDS @ 180 C	424	mg/L	20				A2540 C	08/09/12 08:45 / blb
Solids, Total Suspended TSS @ 105 C	49	mg/L	10				A2540 D	08/10/12 13:30 / blb
Sulfide	ND	mg/L	0.04				A4500-S D	08/10/12 11:00 / eli-b
<b>NUTRIENTS</b>								
Nitrogen, Ammonia as N	0.09	mg/L	0.05				E350.1	08/13/12 12:12 / eli-b

**Report** RL - Analyte reporting limit.

**Definitions:** QCL - Quality control limit.

H - Analysis performed past recommended holding time.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID:** SW\_Spring\_01  
**Location:**  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-002

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 11:05  
**Date Received:** 08/08/12  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 212437

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>DISSOLVED GAS</b>								
Methane	0.002	mg/L	0.001				SW8015M	08/13/12 07:59 / eli-b
Ethane	ND	mg/L	0.001				SW8015M	08/13/12 07:59 / eli-b
Ethene	ND	mg/L	0.001				SW8015M	08/13/12 07:59 / eli-b
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acetone	ND	ug/L	20				SW8260B	08/15/12 14:49 / eli-b
Acrolein	ND	ug/L	20				SW8260B	08/15/12 19:30 / eli-b
Acrylonitrile	ND	ug/L	20				SW8260B	08/15/12 19:30 / eli-b
Benzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Bromobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Bromochloromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Bromodichloromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Bromoform	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Bromomethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
n-Butylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
sec-Butylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
tert-Butylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Carbon disulfide	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Carbon tetrachloride	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Chlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Chlorodibromomethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Chloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
2-Chloroethyl vinyl ether	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Chloroform	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Chloromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
2-Chlorotoluene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
4-Chlorotoluene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,2-Dibromoethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Dibromomethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,2-Dichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,3-Dichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,4-Dichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Dichlorodifluoromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,1-Dichloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,2-Dichloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,1-Dichloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
cis-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
trans-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,2-Dichloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,3-Dichloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID** SW\_Spring\_01  
**Location:**  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-002

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 11:05  
**Date Received:** 08/08/12  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 212437

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
2,2-Dichloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,1-Dichloropropene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
cis-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
trans-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Ethylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Hexachlorobutadiene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
2-Hexanone	ND	ug/L	20				SW8260B	08/15/12 14:49 / eli-b
Isopropylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Isopropyl ether	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
p-Isopropyltoluene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Methyl tert-butyl ether (MTBE)	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Methyl ethyl ketone	ND	ug/L	20				SW8260B	08/15/12 14:49 / eli-b
Methyl isobutyl ketone	ND	ug/L	20				SW8260B	08/15/12 14:49 / eli-b
Methylene chloride	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Naphthalene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
n-Propylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Styrene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Tetrachloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Toluene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,2,3-Trichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,2,4-Trichlorobenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,1,1-Trichloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,1,2-Trichloroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Trichloroethene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Trichlorofluoromethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,2,3-Trichloropropane	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,2,4-Trimethylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
1,3,5-Trimethylbenzene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Vinyl acetate	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Vinyl chloride	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
m+p-Xylenes	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
o-Xylene	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Xylenes, T total	ND	ug/L	1.0				SW8260B	08/15/12 14:49 / eli-b
Surr: 1,2-Dichloroethane-d4	121	%REC	70-130				SW8260B	08/15/12 14:49 / eli-b
Surr: 1,2-Dichloroethane-d4	126	%REC	70-130				SW8260B	08/15/12 19:30 / eli-b
Surr: Dibromofluoromethane	126	%REC	77-126				SW8260B	08/15/12 14:49 / eli-b
Surr: Dibromofluoromethane	126	%REC	77-126				SW8260B	08/15/12 19:30 / eli-b
Surr: p-Bromofluorobenzene	108	%REC	76-127				SW8260B	08/15/12 14:49 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID:** SW\_Spring\_01  
**Location:**  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-002

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 11:05  
**Date Received:** 08/08/12  
**Sampled By:** Beau Bergstrom  
**Matrix:** Aqueous  
**Tracking Number:** 212437

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Surr: p-Bromofluorobenzene	111	%REC	76-127				SW8260B	08/15/12 19:30 / eli-b
Surr: Toluene-d8	101	%REC	79-122				SW8260B	08/15/12 14:49 / eli-b
Surr: Toluene-d8	98.0	%REC	79-122				SW8260B	08/15/12 19:30 / eli-b
<b>GLYCOLS</b>								
Ethylene Glycol	ND	mg/L	5.0				SW8015B	08/16/12 10:06 / eli-b
Surr: 2-Butoxyethanol	101	%REC	83-121				SW8015B	08/16/12 10:06 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID:** SW\_69721AMOC42\_Trip\_Blank  
**Location:** TRIP BLANK-LOTg2pks1206291400  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-003

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 10:30  
**Date Received:** 08/08/12  
**Sampled By:** Perry Smith  
**Matrix:** Trip Blank  
**Tracking Number:** 212438

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Acetone	ND	ug/L	20				SW8260B	08/14/12 11:15 / eli-b
Acrolein	ND	ug/L	20				SW8260B	08/14/12 11:15 / eli-b
Acrylonitrile	ND	ug/L	20				SW8260B	08/14/12 11:15 / eli-b
Benzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Bromobenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Bromochloromethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Bromodichloromethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Bromoform	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Bromomethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
n-Butylbenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
sec-Butylbenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
tert-Butylbenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Carbon disulfide	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Carbon tetrachloride	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Chlorobenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Chlorodibromomethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Chloroethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
2-Chloroethyl vinyl ether	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Chloroform	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Chloromethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
2-Chlorotoluene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
4-Chlorotoluene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,2-Dibromoethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Dibromomethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,2-Dichlorobenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,3-Dichlorobenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,4-Dichlorobenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Dichlorodifluoromethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,1-Dichloroethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,2-Dichloroethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,1-Dichloroethene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
cis-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
trans-1,2-Dichloroethene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,2-Dichloropropane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,3-Dichloropropane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
2,2-Dichloropropane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,1-Dichloropropene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
cis-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
trans-1,3-Dichloropropene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Ethylbenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

**Client:** Marathon Oil Company  
**Site Name:** Conn\_Creek  
**Project:** Surface\_Water  
**Client Sample ID** SW\_69721AMOC42\_Trip\_Blank  
**Location:** TRIP BLANK-LOTg2pks1206291400  
**Samp FRQ/Type:**  
**Lab ID:** G12080201-003

**Report Date:** 08/20/12  
**Collection Date:** 08/06/12 10:30  
**Date Received:** 08/08/12  
**Sampled By:** Perry Smith  
**Matrix:** Trip Blank  
**Tracking Number:** 212438

Analyses	Result	Units	RL	Qualifier	Result	Units	Method	Analysis Date / By
<b>VOLATILE ORGANIC COMPOUNDS</b>								
Hexachlorobutadiene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
2-Hexanone	ND	ug/L	20				SW8260B	08/14/12 11:15 / eli-b
Isopropylbenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Isopropyl ether	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
p-Isopropyltoluene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Methyl tert-butyl ether (MTBE)	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Methyl ethyl ketone	ND	ug/L	20				SW8260B	08/14/12 11:15 / eli-b
Methyl isobutyl ketone	ND	ug/L	20				SW8260B	08/14/12 11:15 / eli-b
Methylene chloride	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Naphthalene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
n-Propylbenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Styrene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,1,1,2,2-Tetrachloroethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Tetrachloroethene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Toluene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,2,3-Trichlorobenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,2,4-Trichlorobenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,1,1-Trichloroethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,1,2-Trichloroethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Trichloroethene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Trichlorofluoromethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,2,3-Trichloropropane	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,2,4-Trimethylbenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
1,3,5-Trimethylbenzene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Vinyl acetate	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Vinyl chloride	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
m+p-Xylenes	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
o-Xylene	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Xylenes, Total	ND	ug/L	1.0				SW8260B	08/14/12 11:15 / eli-b
Surr: 1,2-Dichloroethane-d4	108	%REC	70-130				SW8260B	08/14/12 11:15 / eli-b
Surr: Dibromofluoromethane	114	%REC	77-126				SW8260B	08/14/12 11:15 / eli-b
Surr: p-Bromofluorobenzene	112	%REC	76-127				SW8260B	08/14/12 11:15 / eli-b
Surr: Toluene-d8	105	%REC	79-122				SW8260B	08/14/12 11:15 / eli-b

**Report Definitions:** RL - Analyte reporting limit.  
QCL - Quality control limit.

MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.

**APPENDIX E**  
**GOLDER TP 1.2-26 (SURFACE WATER SAMPLING METHODS)**



## 1. PURPOSE

This document describes the sampling protocols used by Golder Associates to collect surface water samples. It contains sampling instructions and information concerning appropriate containers, preservation, and handling of water quality samples.

## 2. APPLICABILITY

This technical procedure is applicable to any persons involved in the collection of surface water samples. It is applicable to all geographic areas.

## 3. DEFINITIONS

### 3.1 Analytical Request Form

Standard form provided by analytical laboratories. This form is filled out by the person collecting samples and is used to indicate how each sample is to be analyzed. This form is often combined with the Chain-of-Custody Form in a single document.

### 3.2 Chain-of-Custody Form

Standard form used to track the movement of sample containers from the time they leave the field until they arrive at the specified laboratory. The Chain-of-Custody form provides a clear record of sample transport and handling, thereby reducing the risk of sample loss during transport. This form may be combined with the Analytical Request Form in a single document.

### 3.3 Chemical Analysis

Analytical procedure used to measure the *amount* of a certain compound, or group of compounds, present in a sample.

### 3.4 Preservatives

Preservatives are used to maintain sample integrity from the time a sample is collected until it is analyzed. Sample preservation may involve adding acid or other fixatives to collected waters or simply keeping them refrigerated. Sample-specific requirements are outlined in this document (Table 1); preservatives, when required, are provided by the analytical laboratory.

### 3.5 Sample Bottles

Sample bottles are containers specifically designed and prepared for storing liquid samples. Sample bottle type, material, size, and type of lid are specific for particular groups of analytes. Sample bottles must be properly cleaned and prepared by a laboratory or the manufacturer. Table 1 summarizes bottle type and preparation requirements.

### **3.6 Surface Water Sample**

A surface water sample is defined as water acquired from a surface water body for chemical analyses that is representative of surface water within the cross-section of a lake, stream, or river being sampled.

### **3.7 Quality Assurance/Quality Control (QA/QC)**

Quality Assurance refers to a detailed protocol used to produce high quality products, while Quality Control refers to the process by which this protocol is tested to ensure that final products are of the specified quality. With reference to water sampling, QA protocol includes the use trained personnel, proper sampling methods, clean containers and equipment, proper sample preservation and transportation and detailed documentation of the entire process; field, travel and other assorted test blanks are used for Quality Control testing.

### **3.8 Sample Types**

#### **3.8.1 Grab Samples**

Sample containing water collected during a single sampling event (i.e., water taken from a given place at a given time).

#### **3.8.2 Composite Samples**

Sample containing a mixture of water collected from multiple locations or from different times at the same location.

#### **3.8.3 Equipment Blanks**

Equipment blanks are used to detect contamination from sampling equipment. They are prepared by rinsing precleaned equipment with deionized water and collecting the rinsate into an appropriate container.

#### **3.8.4 Field Blanks**

Field blanks are used to detect contamination during sample collection and transport. They are prepared during a sampling event by filling the appropriate container with deionized water. Field blanks are usually used in situations where there is reason to suspect that contamination will occur during sample collection and transport.

#### **3.8.5 Travel Blanks**

Travel blanks detect sample contamination during transport. Travel blanks consist of pre-filled bottles provided by the analytical lab. They accompany empty sample bottles to the field site,

where they are left intact and unopened inside the shipping cooler. The unopened travel blanks are then returned to the analytical lab to be analyzed along with collected samples.

### 3.8.6 Field Spikes

Field spikes are used to measure the performance of the complete analytical system, including sample handling, preservation and storage, as well as interference from the sample matrix. To generate a field spike, field personnel fill the usual sampling container with sample, leaving a small amount of space at the top. They then add a specified amount of the chemical or compound of interest to the bottle and submit it with the rest of the samples. In general, field spikes are not recommended due to the logistical difficulties of transporting concentrated solutions in the field. If there is reason to doubt the performance of the sampling system, then a separate study involving field spikes should be carried out.

### 3.8.7 Standard Reference Samples

Standard reference samples, or blind QA samples, are samples of known concentration that are submitted to the analytical lab as a normal sample. The lab is not informed about the identity of the sample until after all analyses are complete.

### 3.8.8 Replicate Samples

Replicate samples are used to evaluate within-site variation. Replicate samples are collected by filling multiple containers at a single site. They are labeled and preserved individually and are submitted separately to the analytical laboratory. Check the field sampling plan (FSP) for the number of replicate samples required per sampling site.

### 3.8.9 Split Samples

Split samples are used to check analytical variation. A single sample (e.g. grab) is collected and is split into two sample containers. These are labeled and preserved individually and are submitted separately to the analytical laboratory.

## 4. REFERENCES AND SUGGESTED READING

ASTM, 1994, *Annual Book of Standards, Volume 04.08, 1994*, American Society of Testing and Materials, Philadelphia, PA.

Clesceri, L.S., A.E. Greenberg and R.R. Trussell. 1989. *Standard Methods for the Examination of Water and Wastewater*. American Public Health Association, Washington, D.C.

Feldt, L., Editor, 1987, *A Compendium of Superfund Field Operations Methods*, U.S. Environmental Protection Agency Report No. 9355.0-14, Washington, D.C.

Golder Associates Inc. Quality Procedure QP-11.1, "Calibration and Maintenance of Measuring and Test Equipment."

Golder Associates Inc. Technical Procedure TP-1.2-23, "Chain of Custody."

U.S. Department of the Interior, 1977, National Handbook of recommended methods for water-data acquisition, Reston, VA.

U.S. EPA, 1994, *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganics Data Review*, EPA 540/R-94/013, U.S. EPA Office of Emergency and Remedial Response, Washington, D.C.

U.S. Geological Survey, 1982, *Measurement and Computation of Streamflow: Volume 1 and 2*, Washington, D.C.

U.S. EPA, 1986, *Test Methods for Evaluating Solid Waste - (SW-846)*, 3<sup>rd</sup> Edition (Final Update III, December 1996), U.S. EPA/Office of Solid Waste, Washington, D.C.

40 CFR 136, U.S. EPA, *Guidelines Establishing Test Procedures for the Analysis of Pollutants*. Title 40 Part 136 of the Code of Federal Regulations.

## 5. DISCUSSION

### 5.1 Sampling Procedures

Samples are collected as representative pieces of a larger puzzle. Ideally, they should describe all of the characteristics of the larger body from which they originate, which, by its very definition, is too large to analyze directly. As a result, it is very important to follow a well-organized sampling plan and to preserve sample integrity throughout the collection and transportation process.

#### 5.1.1 General Practices

Usually, analytical laboratories will provide pre-cleaned sample containers, shipping containers, required forms for sample submission and specific sample shipping instructions. It is important to check with the lab that these arrangements have been made. Similarly, field crews should familiarize themselves with the FSP before initiating a sampling program. By reviewing the instructions, personnel can ensure that they have all of the equipment they require to fulfill the objectives of the sampling program. Field crews will also then be aware of the types of samples they are being asked to collect, be they grab samples, composite samples or QA/QC test blanks. Finally, sample crews should organize themselves such that samples will be collected and shipped during the early part of the work week to avoid delays caused by weekend shipping or make specific arrangements with laboratories to receive samples on the weekend.

**Sampling Locations.** General sampling locations are described in FSP. However, field crews will have a certain degree of freedom in choosing the exact locations from which to take the samples. When selecting these sites, personnel should consider the layout of the local

environment, project objectives and personal safety. They should then choose areas that are both easily accessible and representative of the target waterbody or waterbodies.

Once sampling sites have been identified, they must be described relative to permanent landmarks, such as groundwater wells, outfalls or distinctive landscape features; measuring the distance from permanent landmarks to each site with an appropriate compass heading is recommended. Ideally, one should try to use the Global Positioning System (GPS), but locations can also be recorded as the perpendicular distance from the shoreline and the distance upstream or downstream of a permanent landmark.

**Sample Collection.** Where possible, start sampling at the least contaminated site (i.e., the reference site) and move from there to the more contaminated areas.

If sampling equipment must be used, then it must be cleaned before and after use. This may involve rinsing with ambient water, cleaning with soap and water, acid washing, rinsing with organic solvents or pure water, or a combination of these. Refer to the FSP for details.

Each sample bottle must be labeled at the time of collection with either waterproof, permanent marker or using pre-printed waterproof labels. See section 5.3.2 for details of label format.

When sampling, it is important to rinse sample containers 3 times before taking a sample. Rinse each bottle by partially filling it with ambient water, loosely attaching the cap and shaking the bottle; drain the water and repeat the process. As a general rule, rinse plastic bottles unless instructed otherwise by the analytical laboratory. Bottles that already contain the appropriate preservatives and containers for the following analyses should *not* be rinsed prior to taking the sample:

- volatile organic compounds (VOCs), including total volatile hydrocarbons (TVH),
- total extractable hydrocarbons (TEH),
- BTEX (benzene, toluene, ethylbenzene and xylene)
- total petroleum hydrocarbons (TPH; includes TVH, TEH and BTEX); and
- bacteriological testing (e.g., fecal coliforms).

Carefully fill sample containers, without splashing, leaving only enough space for preservatives (if required - see Table 1 ). Be sure to keep hands and fingers downstream of bottle opening and sample upstream of bridges, boats and yourself to prevent sample contamination. The samples will be collected in flowing water, unless otherwise specified in the FSP, from areas where the flow is well mixed. If no preservatives need to be added, completely fill the bottles and cap tightly. There should be as little air in the containers as possible, as it can affect sample integrity.

Whenever possible, fill sample containers directly from the source, without using an intermediate container to transfer the sample. This avoids potential sample contamination due to carry-over from one sample to the next. Also, take care to avoid contaminating sample

waters through contact with rubber, oil, gasoline and other machinery fluids, metal-based paints, cigarette ash, paper tissues and other such material.

Sample bottles should then be stored appropriately (Table 1). In most cases, this will involve keeping the sample cool (4°C) and dark. Samples should never be allowed to freeze and should be shipped as soon as possible to the appropriate analytical lab, in coolers with reusable ice packs. Avoid using bags of ice purchased from convenience stores; the water that leaks out of these bags as the ice melts may ruin sample labels.

Chain-of-Custody and Analytical Request forms must accompany all samples (one set of forms per sample shipment). Prior to shipping, the person submitting the sample should inform the analytical lab by telephone, e-mail, or fax that the samples will be arriving. As well, he or she should check back later to confirm arrival of the samples and to explain analysis requests if needed.

### 5.1.2 Sampling for Metals

When collecting samples for a metals analysis, it is important that sample waters do not come into contact with any metal products. Samples for metals analysis also have other stringent collection and preservation requirements (Table 1). For example, waters collected for dissolved metal analysis have to be field-filtered using a 0.45  $\mu\text{m}$  polycarbonate or cellulose acetate filter and then preserved with acid. Field-filtering should be conducted as soon as possible after sampling. If field-filtering is not possible, then acid preservatives should not be added and the laboratory should be notified to filter the sample as soon as possible after sample receipt.

Field crews need to be aware of these restrictions to ensure that samples are taken correctly and that they maintain their integrity until they can be analyzed. Special sampling and preservation instructions should be included in the FSP.

### 5.1.3 Sampling for Organic Chemicals

In addition to the general principles outlined above, there are specific protocols associated with sampling for organic measurements. As described above, sample bottles should *not* be rinsed prior to taking samples for certain organics analyses. It is also very important to completely fill each bottle, as certain organics will volatilize into the overlying air space and will be lost after opening the bottle. Finally, proper containers must be used when sampling for organics, since some bottles will release or absorb organic compounds when filled with water. Generally, glass containers are used, but certain tests may require other materials; be sure to obtain the appropriate sample bottles from the analytical laboratory and refer to the FSP.

## 5.2 Sample Documentation

Proper sample documentation is important because lack of careful documentation can lead to misunderstandings and questionable test results. Components of proper documentation of field activities are described below.

### 5.2.1 Field Notebooks

Field notebooks must be kept, describing all field activities. Format of field notes and information to be recorded should follow Golder Associates' specific guidelines. During the field survey, field notes must be maintained in a permanent, safe location at the field site where samples are collected. If possible, new entries in the field note book should be photocopied at the end of each field day and copies should be stored in a safe place.

### 5.2.2 Sample Labels

Sample labels must contain the following information:

- Sample identifier (name of site or sample code);
- Date (written as day/month/year; month abbreviated as three letters) and time (24 hour clock) of collection;
- Initials of collector; and
- Analysis requested (this is usually done by the analytical laboratory in the form of a code on the sample bottle).

Fill out labels at the time of collection using waterproof ink and affix a label to each sample container. Plastic bottles may be labeled by writing directly on the bottle using a waterproof marker; however, this approach is not recommended if samples are transported over long distances (friction may rub label off) or if bags of ice are used to keep the samples cool (water may damage label information).

### 5.2.3 Custody Seals

Numbered seals should be used (when required by the FSP) to detect tampering with samples in transit. Attach the seal in a way that it is necessary to break it to open the cooler containing the samples. The number on the custody seal should be recorded in the field note book and on the Chain-of-Custody and Analytical Request forms

### 5.2.4 Chain-of-Custody Forms and Analytical Request Forms

Chain-of-Custody and Analytical Request forms must accompany all samples submitted for analysis in accordance with procedure TP1.2-23, "Chain of Custody". These forms are usually combined as a single document. An example of Golder Associates' combined Chain-of-Custody and Analytical Request Form is provided in Exhibit 1.

The combined form must be filled out completely and the white and yellow copies should be sent along with the samples being submitted. Field personnel should retain the pink copy after it is signed by the shipper. Depending on the shipping container, these forms can either be enclosed inside the sealed container or attached firmly to the outside of the container. In either

case, it is advisable to enclose the forms within a waterproof plastic bag to guard against damage. It is important that each person having custody or control of the samples identify themselves on this form. This means the person collecting the sample; intermediate persons involved in packaging, storing or transporting the sample; and the person accepting the sample on behalf of the analytical lab must all be identified.

### **5.3 Sample QA/QC**

The main goal of sample QA/QC is to monitor for various sources of contamination during sample collection, transport and analysis. This process will involve the use of field, travel and other test blanks. QA/QC programs are designed on a project-specific basis. Details of individual QA/QC programs are described in the FSP.

## **6. EQUIPMENT AND MATERIALS**

### **6.1 Sampling**

The following is a list of sampling equipment generally recommended for surface water sampling:

- Pre-cleaned sample bottles and required preservatives (usually supplied by the analytical laboratory)
- Coolers and reusable ice packs
- Waterproof labels and permanent markers
- Sampling equipment (e.g. Kemmerer or Van Dorn bottles)

### **6.2 Site Location and Sample Documentation**

For proper sample site identification and sample documentation, field crews may need:

- Bound, water-proof field logbooks
- Maps
- Air photos
- Indelible ink pens and pencils
- Long tape measure
- Survey flagging tape
- Compass
- GPS unit
- Combined Analytical Request and Chain-of-Custody forms

### 6.3 Health and Safety

The following health and safety equipment is recommended for surface water sampling:

- Waders and waterproof gloves
- Heavy socks, warm pants, rain gear and other articles of clothing suitable for prolonged water work
- Extra set of clothes
- First aid kit
- Approved personal floatation device for deep water or boat work

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TABLE 1

SAMPLE CONTAINER CODES, TYPES, VOLUMES, PREPARATION,  
SPECIAL HANDLING, PRESERVATION, HOLDING TIMES

Page 1 of 2

Analysis	Cont. Code	Containers, Water	Handling and Preservation	Holding Time
Volatile Organics	V	2, 40ml glass vial teflon lined septum	Store 4±2°C; handle upwind from equip. Fumes, no headspace permitted; Pres with HCl to pH <2 for volatile aromatics	7 days 14 days (HCl pres.)
Base/Neutral and Acid Extractable Organics	SV	2, 1 liter amber glass, teflon lined cap	Store 4±2°C; handle upwind from equip. fumes; no contact with plastics, gloves	7 days until extraction 40 days thereafter
Organochlorine Pesticides and PCBs	P	2, 1 liter amber glass, teflon lined cap	Store 4±2°C; handle upwind from equip. fumes; no contact with plastics, gloves	7 days until extraction 40 days thereafter
Herbicides	H	2, 1 liter amber glass, teflon lined cap	Store 4±2°C; handle upwind from equip. fumes; no contact with plastic, gloves	7 days until extraction 40 days thereafter
Total Fuel Hydrocarbons (Fuel Fingerprint)	TH	1, 125 ml amber glass, teflon lined septum	Store 4±2°C; handle upwind from equip. fumes, no headspace permitted; pres with HCl to pH <2	14 days
Total Petroleum Hydrocarbons or Oil and Grease	OG	1, 1 liter glass, teflon lined cap	Store 4±2°C; handle upwind from equip. fumes, no contact with gloves or plastics; pres with HCl to pH <2	28 days
Cyanide (total)	CN	1, 1 liter plastic	Store 4±2°C; pres with NaOH to pH >12	14 days
Sulfide (total)	S	1, 1 liter plastic	Store 4±2°C; pres with ZnOAC/NaOH to pH >12	7 days
Chloride, Sulfate, pH Conductivity and Total Dissolved Solids	MA	1, 1 liter plastic	Store 4±2°C.	28 days (Chloride, sulfate and conductivity) Analyze on-site (pH) 7 days (TDS)

TABLE 1

SAMPLE CONTAINER CODES, TYPES, VOLUMES, PREPARATION,  
SPECIAL HANDLING, PRESERVATION, HOLDING TIMES,  
Page 2 of 2

Analysis	Cont. Code	Containers, Water	Handling and Preservation	Holding Time
Major Cations and Metals	TM	1,1 liter plastic	0.45 um filter, pres with HNO <sub>3</sub> to pH <2	6 months (28 days for mercury)
Gamma Emitting Radionuclides	GR	2, 1 liter plastic	0.45 um filter, pres with HNO <sub>3</sub> to pH <2	6 months (record exact date/time of sampling for calculation of half-life decay)
Alpha Emitting Radionuclides	AR	2, 1 liter plastic	0.45 um filter, pres with HNO <sub>3</sub> to pH <2	6 months (record exact date/time of sampling for calculation of half-life decay)
Beta Emitting Radionuclides	BR	2, 1 liter plastic	0.45 um filter, pres with HNO <sub>3</sub> to pH <2	6 months (record exact date/time of sampling for calculation of half-life decay)
Total Phosphorus, Ammonia-N, Nitrate/nitrite-N, COD and TOC	TP	1, 1 liter plastic	Store 4±2°C; pres with H <sub>2</sub> SO <sub>4</sub> to pH <2, store in dark	28 days
Orthophosphate	OP	1, 1 liter plastic	0.45 um filter, store 4±2°C	48 hours

