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1.0 Introduction

1.1 Project Background

This work plan was prepared at the request of Williams Production RMT Company (Williams), Petroleum Development Corporation (PDC), Marathon Oil Company (Marathon), and Nonsuch Natural Gas (Nonsuch) (collectively, "the Companies"), to outline the approach for delineating the contamination source or sources that have impacted a private drinking water supply in the form of a spring located in the vicinity of active natural gas development. The contaminated water is present at the Prather spring, which is, in fact, a manmade, permitted well identified as SEO Permit 233234, located in Section 14 (SE quarter of the SW quarter) of Township 6 south, Range 97 west and is referred to herein as the "Prather Spring." From its origin, water from Prather Spring is piped approximately 0.25-miles down-slope to a hunting cabin (the Prather Cabin), where it is used seasonally as the main potable water supply. The overflow from this water delivery system flows down-gradient through additional piping and is eventually discharged into a perennial stream known as McKay Gulch. Figure 1 shows the locations of pertinent surface features, natural gas wells and well pads, sample locations, and proposed Phase 1 soil boring locations.

Contaminated water was discovered in Prather Spring on or around May 31, 2008, when one of the cabin owners (Mr. Ned Prather) turned on the cabin tap while opening up the hunting cabin for the summer season. Since that time, Williams and its consultant (HRL Resources) have collected at least four samples of the cabin tap and the spring. Marathon, PDC, and COGCC have also collected samples of this springs and other nearby springs and surface water samples from a stock pond and from McKay Gulch for analysis. Available water quality data from these recent sampling events have been considered in the development of this work plan. Benzene, toluene, and xylenes have been reported in samples from the spring and cabin tap, with benzene concentrations above the drinking water standard at both the spring and cabin tap. Subsequent water samples from springs in adjacent drainages are nondetect for these constituents, suggesting a localized source or sources of contaminants.

In addition to Williams, three other companies have drilling and production operations near the Prather cabin: Petroleum Development Corporation (PDC), Marathon Oil Company (Marathon), and Nonsuch Natural Gas (Nonsuch). It is our understanding that PDC drilled two nearby wells, which have now been transferred to Marathon for operation. These three companies and Williams are collectively referred to as "the Companies" throughout the remainder of this work plan. In response to the contaminant release, the Colorado Oil and Gas Conservation Commission (COGCC) issued each of the Companies a Notice of Alleged Violation (NOAV), and directed the Companies to provide an alternate

drinking water supply for the cabin. The NOAV also included a requirement to provide a suitable alternate water supply for livestock consumption. The Companies have since complied with these directives, and have initiated a hydrogeologic investigation to delineate the contamination source(s). Williams retained URS Corporation (URS) to lead, conduct and oversee the joint investigation in the vicinity of the spring on behalf of the Companies. In addition to this proposed study, other operators are also responding to the NOAV, performing internal investigations, and collecting water samples for analysis.

URS personnel, accompanied by a Williams representative, made an initial visit to the site on June 26, 2008. The purpose of this visit was to observe the geologic and hydrogeologic conditions in order to formulate a strategy for the investigation. During the site visit, six borehole locations were staked in the field along three drainages that may contribute groundwater to the contaminated spring and associated drainage feature (Figure 1).

1.2 Project Scope and Objectives

The project scope will involve a phased investigation approach. The objective of this initial scope, Phase 1, is to identify the probable contamination source(s). Potential contaminant sources could include spills or leaks from reserve/production pits; condensate or produced water tanks or flow lines; or completed natural gas wellbores. More than the one round of drilling, monitoring well installation, and sampling described in this work plan may be required in Phase 1. Additionally, the number and locations of boreholes and temporary monitoring well installations may be increased or decreased from what is described in this work plan based on field observations during drilling and well installation activities.

Phase 2 activities would be designed to delineate the extent of any source(s) found during Phase 1 activities, including verification of the source(s) located on the well pads. Phase 3 activities would be designed to remediate the source(s) of the groundwater contamination identified from Phase 2 results.

The Companies are working under the assumption, that based on field evidence, if any operator can be ruled out as contributing to the source of contamination, that operator is no longer required to participate in the subsequent phases of investigation. Ideally, only the operator responsible for the contamination will actually be required to follow through with source area delineation and remediation activities, as necessary.

2.0 Phase 1 Site Investigation Activities

The first phase of the site investigation will include the installation of six to twelve temporary borings at locations staked by URS. The initial locations for the proposed soil boring and monitoring well are shown on Figure 1. Completion of the initial phase is designed to be flexible while in the field. The location of the source of contamination is unknown at this time and therefore the locations of boreholes must be flexible. Drilling and sampling activities will start at location PC-5 and proceed in an upstream direction. However, subsequent locations may be modified by conditions encountered at each borehole location. For example, an additional boring will likely be located further south up the drainage past PC-1.

Escorted access to the sampling sites will be provided by a Company representative. The Companies will arrange for site access for the site investigation activities with the two landowners in the area (Prather and Puckett).

2.1 Drilling Methods and Monitoring Well Completions

Williams has contracted Geotechnical Engineering Group (GEG), in Grand Junction, Colorado, to provide drilling services. URS personnel will direct the drilling and sampling activities while in the field. A Notice of Intent to construct the monitoring wells was completed and submitted by URS to the State Engineers Office (SEO) on July 1, 2008.

The soil borings will be advanced through the colluvium using hollow stem augers, and continuous core sampling will be performed at the first borehole location. Depending upon the geologic and hydrologic conditions, and contaminant observations, observed at the first location, subsequent boreholes may not need to be continuously cored. Solid flight augers will be available on the drill rig and may be required if large boulders are encountered in the colluvium, or the bedrock is sufficiently resistant.

Groundwater is anticipated to be encountered at shallow depths (5 to 15 feet below ground surface) at the contact between the colluvium and underlying Uinta Formation or Green River Formation bedrock. Based on the rate of discharge from the Prather Spring discharge pipe, it is anticipated that there will be sufficient groundwater present beneath the gulch/valley, which can be identified while drilling a borehole, and subsequently supply the necessary groundwater to obtain a sample from a monitoring well. This may not be the case at potential drilling sites located up-valley or along the margins of the valley.

At each boring location, URS personnel will screen the soil cores with a photo-ionization detector (PID) to identify potentially impacted soils, and identify appropriate intervals for soil sample collection. If

impacted soils are encountered during drilling, a soil sample will be collected for possible laboratory analysis.

Assuming that groundwater is encountered at the bedrock interface, the borings will be drilled to a depth of 2 to 5 feet into the underlying bedrock, or until auger refusal. Temporary monitoring wells will be installed at each borehole for groundwater sample collection. Monitoring wells will consist of 2-inch diameter schedule 40 PVC material. A 5-foot long slotted screen section will be placed at the bottom of the borehole. A sandpack filter will be placed around the well screen, and extend approximately one foot above the top of the screen interval. A one to two feet thick bentonite seal will be placed above the sandpack. The remainder of the borehole will remain open until the laboratory analytical results are reviewed and the next phase of the investigation is initiated. The well casing will be cut-off above the ground surface to a height of approximately one foot, to minimize disturbance by wildlife and/or cattle. A locking cap will be placed and labeled with the designated identification on each well, and brightly-colored flagging will be attached to the casing.

Drilling equipment will be decontaminated following completion of each soil boring. Due to the remote location of the drill site, we anticipate decontaminating only the lead auger flight and drill-head. Decontamination procedures will consist of pressure-washing the equipment at a temporary decontamination pad. The temporary decontamination pad will be constructed on a Williams well pad. For soil coring/sampling equipment, decontamination procedures will consist of manually scrubbing the sample core barrel and rinsing with potable water between each use.

2.2 Well Sampling

Prior to collection of groundwater samples, the depth to water inside the well casing will be measured from the top of the PVC well casing and recorded for each well. Assuming that sufficient groundwater will flow into the monitoring wells, each monitoring well will be bailed using a disposable polyethylene bailer. Groundwater samples will be collected following removal of 3 well casing volumes. Field water quality parameters will be measured as each well is bailed. If there is insufficient water for 3 well casing volumes to be removed, the well will be bailed dry, and a sample collected when there is sufficient water in the well.

The samples collected during the initial investigation phase will be analyzed for volatile organic compounds using USEPA SW846 Method 8260. In addition, the VOC samples will be analyzed with a 24-hour turnaround time and dissolved methane samples will be analyzed with a 48-hour turnaround time. The data can be used to modify the investigation program while in the field. This will allow for a more

flexible program that will assist in identifying the contaminant source(s) while reducing the number of mobilizations.

The Companies recognize that split/duplicate samples may be requested by Ned Prather (land owner), other participating operators, and COGCC. This is encouraged, provided there is sufficient water volume for collection of the necessary samples.

2.3 Field QA/QC Samples

The field quality control (QC) samples that will be collected include a field duplicate, a matrix spike (MS)/matrix spike duplicate (MSD), and a trip blank. Each type and quantity of field QC samples to be used are presented and described below. The frequency of collection is one of each QC sample per twenty primary samples. Since there are fewer than twenty primary samples anticipated for collection during the initial investigation phase, one sample for each of the three field QC categories will be collected for laboratory analysis.

2.4 Field Documentation

Field activities conducted will be thoroughly documented so that the samples collected are credible and defensible. Field documentation will consist of written, geographic (i.e., GPS), and photographic evidence of the sampling event at each site.

2.5 Sample Location Description

The coordinates of each sample site will be measured using a hand-held GPS unit so that the sample locations can be mapped using the Universal Transverse Mercator (UTM) coordinate system. Date-stamped digital photographs will be taken at each sample site to document its location and site conditions during sampling. An overall view of the sampling area or property should also be taken so that the sample locations are documented.

2.6 Equipment Decontamination

Pre-cleaned, disposable sampling equipment will be used to perform most of the sampling activities described in this work plan. Pre-cleaned, disposable sampling equipment does not need to be decontaminated prior to use. However, to prevent cross contamination, the equipment should remain in its sealed plastic bag until it is used.

To avoid cross contamination, non-dedicated drilling and sampling equipment will be thoroughly cleaned prior to initiation of sampling activities and between each use at the site. Decontamination of

field instruments and sample containers used for groundwater sampling will include an Alconox®, or equivalent, wash and scrubbing with a brush or sponge, as appropriate, to remove potential contaminants, followed by **three** deionized water rinses. Once cleaned, the decontaminated equipment will be stored in a manner to avoid subsequent contamination prior to it use at the next site. One equipment rinsate sample will be collected and analyzed. Rinsate samples will be collected and analyzed for the same analytical parameters as the associated field sample that was collected with the decontaminated equipment.

Decontaminated augers will be used at each drill location. The drill bits will be decontaminated between each drill location. Decontamination of drill bits will also include an Alconox® or equivalent, wash and scrubbing with a brush or sponge, as appropriate, to remove potential contaminants, followed by **three** deionized water rinses. Once cleaned, the decontaminated drill bits will be stored in a manner to avoid subsequent contamination prior to use at the next drill location.

2.7 Project-Derived Wastes

Project-derived wastes, largely soil cuttings and groundwater from well development and sampling, will be containerized and moved to a Williams well pad. Other wastes generated during the project will be decontaminated and contained in plastic bags and properly disposed by Williams.

2.8 Surveying

Temporary monitoring well locations will be surveyed by HRL Compliance personnel using a Trimble handheld GPS unit. This GPS meets the current GPS accuracy specifications required by the COGCC.

2.9 Safe Work Plan

A Safe Work Plan addressing job specific hazards is provided as Attachment A.

Note: COGCC has requested that during the field activities, the water supply cistern at the Prather Cabin be investigated and sampled to determine whether it is now useable or whether it needs to be closed.

3.0 Analytical Laboratory, Methods, and Data Management

The samples will be shipped to ACZ Laboratory, Inc. in Steamboat Springs, Colorado. Expedited turnaround times of 24 hours for VOCs analysis and 48 hours for dissolved methane analysis has been negotiated with the laboratory. The laboratory Project Manager contact and shipping address are listed below. The laboratory will be notified in advance of all shipments and told of any incoming samples with special holding (i.e., short holding times, freezing) or analytical (i.e., short analysis time) requirements.

Laboratory contact information is as follows:

ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, Colorado 80487
1-800-334-5493 x110
(970) 879-6590 Phone
815-301-3857 Fax

Attn: Sue Webber
email: suew@acz.com

3.1 Analytical Methods

Groundwater samples collected from the temporary monitoring wells will be analyzed for volatile organic compounds (VOCs) using USEPA SW846 Method 8260 (Table 1).

Table 1 – Analytical Methods and QC Samples

Analysis	Bottle Requirements	Preservation Requirements	Holding Time	Field Quality Control Requirements		
				FD	MS/MSD	Trip Blank
VOCs (Method 8260B)	3 - 40 ml VOA Vials	HCl	14 days	1 per 20	1 per 20	1 per cooler

3.2 Laboratory Coordination

Given project schedule constraints, daily contact with the laboratory will be performed by a URS project chemist. Specifically, the laboratory will be contacted daily to confirm that samples are received and correctly logged in using the sample identification numbers; the correct project number, analytical methods, reporting limits, and quality assurance; and are scheduled for the appropriate analytes, and

turnaround time. URS will request preliminary analytical results and will review these results for conformance to the specified analyte list, analytical methods, reporting limits, and quality assurance (QA). URS will submit an example of the required electronic data deliverable (EDD) format to the laboratory and establish laboratory compliance with the required format prior to the laboratory receiving the first samples.

3.3 Data Deliverables

Analytical data generated from the project will be received by URS in electronic format as well as a Level IV fully validateable hard copy from the laboratory. The laboratory will also provide a compact disc copy of the hard copy data to URS and will provide the Companies with the analytical data in electronic format. URS will load the electronic formatted data into a database. The electronic data will be verified against the hard copy reports with a frequency of 10 percent. Field data such as sample data, water levels, and field parameters will be entered using the templates included in the DBMS.

3.4 Data Management

Analytical results generated during this project will be directly imported from the electronic data deliverable (EDD) supplied by the laboratory into a Microsoft Access-based data management system (DMS). Field measurements and GPS coordinates for sample locations will also be included in the DMS. The DMS will be used for creating data tables and graphics for the site investigation report. Following the completion of data validation, if performed, data qualifiers, if necessary, will be entered into the DMS.

4.0 Reporting and Schedule

4.1 Reporting

COGCC has requested URS provide a brief daily activity report during field activities.

A brief initial investigation report will be completed immediately following completion of the field activities described above. The laboratory analytical results will be incorporated in the report as a summary table. The report will summarize field activities, and will include boring logs for each borehole, a well completion table, a list of samples collected at each location, and other pertinent field observations. The report will also describe geologic and hydrologic conditions encountered (i.e. colluvium lithology and thickness, depth to bedrock and bedrock lithologic descriptions, depth to first groundwater, a qualitative note of the groundwater flow at each borehole, and to the extent determinable, a description of the relationship between groundwater and the spring discharge).

A draft report will be submitted to the Companies electronically within 48 hours following receipt of the analytical data. Following receipt of comments, the report will be finalized and submitted to the Companies and COGCC.

4.2 Schedule

The drilling and the temporary monitoring well construction activities have been scheduled for July 10 and 11, 2008. However, the drilling will not commence until approval of this work plan is obtained from COGCC. We anticipate that all scheduled groundwater and potential soil samples can be submitted via overnight delivery to ACZ Laboratory located in Steamboat Springs, Colorado. on July 10th for delivery on July 11th. Ground water sampling will occur on the day following drilling and well construction or tentatively on July 14. Assuming that ACZ can perform either a 24- or 48-hour rush turnaround the reported laboratory results can be available by July 17. This schedule is based upon an assumption that the drilling activities and monitoring well construction can be performed in two days.

Should the temporary monitoring wells not produce sufficient water for sampling during the same day as well installation, a field crew will return to the site the following day to check the water levels in the monitoring wells. Subsequent groundwater sampling will be performed by a two-man team from HRL Compliance Solutions, Inc.

Attachment A - Safe Work Plan