

Phase I Site Investigation Work Plan

Prather Spring Investigation Garfield County, Colorado

July 31, 2008

Prepared by
URS Corporation

for
Williams Production RMT Company
Petroleum Development Corporation
Marathon Oil Company
Nonsuch Natural Gas



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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. This spring was subsequently developed by addition of a spring box and 500-gallon cistern. The water source was permitted as a well as Permit 233234 with the State Engineers Office (SEO), 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.” The description of the well in the SEO records is enigmatic. 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 into a nearby stock pond and eventually discharges 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 and corresponding monitoring well 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, xylenes, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene 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 response to the contaminant release, on June 19, 2008 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

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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, termed Phase 1, is to identify the probable contamination source(s). The Companies understand that more than the one round or iteration of drilling, monitoring well installation, and sampling described in this work plan may be required to complete 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. Subsequent proposed field investigation activities (i.e. installation of deeper monitoring wells or drilling in a larger area) will be addressed in addendums to this work plan.

Phase 2 activities would be designed to verify and delineate the extent of any source(s) found during Phase 1 activities. Phase 2 activities would also characterize the potential impact that documented contamination may have to human health or the environment. Phase 3 activities would be designed to remediate the source(s) of the groundwater contamination identified from Phase 2 results, and address remediation of any impacted soils above regulatory standards.

2.0 Phase 1 Site Investigation Activities

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. The initial investigation phase is designed to collect subsurface soil and groundwater from saturated portions of the colluvium and/or shallow bedrock at the site. It is assumed that saturated colluvium and/or shallow bedrock will be potentiometrically unconfined. The boring locations and the initial drilling method to be utilized are anticipated to be successful at providing a robust set of groundwater and soil data to allow evaluation of the potential source and extent of impacted groundwater and surface water. However, subsequent site investigation activities may be necessary to delineate the actual origin of the contaminants and provide sufficient knowledge to develop a remedial strategy.

The boring locations and the initial drilling method to be utilized are designed to collect shallow soil and groundwater from colluvium and alluvium in an attempt to find and characterize a potential shallow contaminant source. However, subsequent site investigation activities may be required to drill into weathered bedrock and bedrock for the purpose of characterizing a potential fluid source from a deeper confined to semi-confined aquifer.

2.1 Site Conceptual Model and Rationale for Proposed Boring Locations

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 8 proposed soil borings and monitoring wells are shown on Figure 1. The locations shown on Figure 1 are believed to represent the most likely locations to encounter groundwater in the colluvial sediments overlying bedrock of the Uinta Formation. It is our current understanding that the Prather Spring is completed in water-saturated colluvial sediments. It is hypothesized that the source of the contaminants observed at the spring originates from a location(s) uphill and/or up-valley from the Prather Spring. To address the potential source of the impacted groundwater, several of the proposed borings are situated at the confluence of small side tributaries and the main drainage of McKay Gulch (i.e. PS-1, PS-2, PS-5, and PS-6). Assuming that temporary monitoring wells installed in borings PS-1 through PS-7 produce groundwater, samples collected from these locations may indicate the origin of impacted groundwater within McKay Gulch.

Drilling and sampling activities will start at location PS-5 near the impacted spring and proceed in an upstream direction to PS-7. However, subsequent locations may be modified by conditions encountered at each borehole location. Proposed soil boring PS-8 is located downstream from Prather Spring, and above the Prather cabin. The intent of this boring is to provide water quality data for shallow groundwater immediately downgradient of the spring. Depending on field observations and water quality data from

upstream borings, and site access issues, soil boring PS-8 may be conducted during Phase 2 of the investigation.

An alternate site conceptual model to explain the occurrence of groundwater in the colluvium is that groundwater originates from the underlying fractured bedrock, and enters the colluvium in the valley. Based on initial review of water quality data, the source of the water could be from infiltration on the adjacent ridgelines and downward migration through fractures, or upward flow of groundwater from deeper water-bearing zones. According to the geologic map for the Circle Dot Gulch quadrangle, the site is located on the top of a broad, shallowly-dipping anticlinal structure that is oriented in a northwest to southeast direction. Fractures in the bedrock resulting from the formation of this geologic structure may connect deeper water-bearing horizons in higher-pressure formations to McKay Gulch. The Companies believe that the proposed soil boring and monitoring well installations will allow delineation of the most likely origin of impacted groundwater within the colluvium. Whether the groundwater originates from a shallow water table aquifer recharged from surface infiltration in the area, or a deeper water-bearing zone may be interpreted from the occurrence or absence of groundwater in the colluvium.

2.2 Drilling Methods and Monitoring Well Completions

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).

Williams has contracted Geotechnical Engineering Group (GEG), in Grand Junction, Colorado, to provide drilling services for the initial field drilling activities described in this work plan. 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 or split spoon sampling will be performed at the first borehole location. If it is possible to collect cores using the continuous core barrel while drilling, or driving split spoons, subsequent boreholes will be cored starting at depths above the anticipated water table, to the total depth of the borehole. Split spoon samples may not be practical if there are large boulders or resistant bedrock. 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.

Visual observations of the spring suggest the discharge rate is between 10 to 20 gallons per minute. 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.

2.3 Soil Sampling

At each boring location, URS personnel will visually examine the soil cores and screen the soil cores with a photo-ionization detector (PID) and multi-gas meter (MGM) capable of detecting methane to identify potentially impacted soils, and identify appropriate intervals for soil sample collection. Prior to sample screening, the PID and MGM will be calibrated in accordance with the manufactures' recommendations. The PID used will be capable of detecting volatile organic compounds at approximate concentrations of 1 part per million (1 ppm). The MGM will be capable of detecting methane at an approximate concentration of 0.5% of ambient air. Samples of soil core from discrete 2-foot intervals will be placed in resealable plastic bags for field headspace testing using the PID and MGM. Instrument readings will be recorded on field boring log forms. If no impacted soils are encountered while drilling, a soil sample will be collected from the capillary zone or the inferred water table at each location. If impacted soils are encountered during drilling, a soil sample from the interval with the highest PID reading will be collected for laboratory analysis. At soil boring locations where impacted soils are observed, a second soil sample will be collected at the base of the colluvium at the interface with underlying bedrock, or the base of the soil boring.

Soil samples will be maintained under proper chain-of-custody (COC), shipped to the laboratory, and analyzed for volatile organic compounds (VOCs) using Method 8260B, and Total Volatile Petroleum Hydrocarbons (TVPH) and Total Extractable Petroleum Hydrocarbons (TEPH) using Method 8015B. Additional soil sample volume will be collected, as available, and held by the laboratory for additional analysis, if necessary. Additional analysis for semi-volatile organic compounds (SVOCs) using Method 8270 will be conducted on soil samples if the initial soil sample contains TEPH concentrations greater than 100 mg/kg.

2.4 Temporary Monitoring Well Construction

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. Depending upon the thickness of the water-saturated interval, a 5-

foot to 10-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 two feet above the top of the screen interval. The filter pack will consist of a commonly available well pack material (e.g., 10/20 silica sand or similar). A two-foot thick bentonite seal will be placed above the sandpack and hydrated with deionized water (less than one gallon). The remainder of the borehole will be backfilled with bentonite chips or pellets. 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 on the PVC riser and labeled with the designated identification on each well, and brightly-colored flagging will be attached to the casing. Wells that contain sufficient saturated volume for sampling will be completed with a locking steel protective cover and concrete pad in accordance with state well construction regulations.

Drilling equipment will be decontaminated following completion of each soil boring. A temporary decontamination pad will be constructed on a nearby Williams well pad. The pad will be constructed to contain all fluids and solids generated from decontamination. Decontamination procedures will consist of pressure-washing the equipment at the temporary decontamination 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.

2.5 Well Development

Each well will be developed following installation by removing a minimum of 3 and maximum of 10 saturated borehole volumes of water. A saturated borehole volume is equal to the volume of water inside the well casing and the saturated portion of the sand filter pack. A bailer or pump can be utilized for well development. The purpose of well development is to remove sediment from the well interior following well installation, and ensure that fresh formation water is freely entering the well. Upon commencement of development activities, a bailer will be used to collect a sample of the top of the water column to visually check for the presence of light non-aqueous phase liquids (LNAPL). During development, the field parameters of conductivity, temperature, and pH will be measured during development. If field parameters have stabilized to within 10% between successive measurements, and the water clarity has increased, purging activities can be discontinued. If the well goes dry during development, the water level will be allowed to recover and the well will be re-evacuated a second time. If the well goes dry easily during purging and requires longer than four hours to recover to 80% of the static water level conditions, the well will only be purged two times. During well development, the field geologist will monitor the development water for the same water quality indicator parameters noted above (i.e., conductivity, temperature, and pH) using a water quality meter. Indicator parameter data and other observations (i.e., color, odor and clarity) will be measured and recorded after the removal of each well casing volume.

2.6 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 purged using a disposable polyethylene bailer or pumped at a low flowrate using a peristaltic or similar pump with the pump intake suspended approximately one foot off of the bottom of each well. Groundwater samples will be collected following purging each well of three or more saturated borehole volumes of water, or stabilization of indicator parameters as described below. During well purging, the field geologist will sample the purge water for water quality indicator parameters using a water quality meter and, if possible (i.e. sufficient volume), via the use of a flow-through cell. Indicator parameter data, including pH, temperature, specific conductance, and other observations (i.e., color, odor and clarity) will be measured and recorded at a minimum after the removal of each well casing volume. If possible, additional water quality parameters (i.e., turbidity, dissolved oxygen, and oxygen reduction potential) will be measured and recorded on the field sheet. Purging will be considered complete when both, three (3) casing volumes have been removed from each well, and the indicator parameters have stabilized. Stabilization will be considered to be achieved when three consecutive readings of the primary field parameters (pH, temperature, and specific conductance) are within the following limits: Specific conductance +/- 3%; Temperature +/- 10%; and pH ± 0.1 units. If a well is observed to yield sufficient water, low-flow purging methods may be employed to reduce agitation of the groundwater. If used, such methods will be in accordance with established procedures (e.g., EPA, 1996, Low-flow groundwater sampling procedures).

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. Field water quality indicator parameters will only be measured if the well will produce sufficient water for parameter measurement and collection of samples.

Groundwater samples will be analyzed for volatile organic compounds using USEPA SW846 Method 8260B and dissolved methane using the RSK-175 method. The laboratory will be instructed to analyze the samples and transmit preliminary analytical results in the fastest turnaround time possible (i.e. 24-hour or 48-hour TAT). Depending upon the laboratory TAT and drilling and sampling progress, the preliminary data may be available to modify the investigation program while in the field. This will allow for a more flexible program that may assist in identifying the contaminant source(s) while reducing the number of mobilizations. If a 24-hour TAT is available, no chemical preservative will be used in the methane sample.

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 or soil volume for collection of the necessary samples.

2.7 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.

In addition to these QC samples, duplicate split samples will be collected and sent to a second laboratory for identical analyses. A minimum of one soil and one groundwater duplicate split sample will be collected as part of this investigation, with a maximum of one duplicate split sample per 10 primary samples (i.e. 10%).

2.8 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. The last reading prior to sample collection for each of the field water quality parameters for samples sent to laboratories will be tabulated.

Field instruments used for the measurement of water quality parameters will be calibrated in accordance with the manufactures' recommendations using fresh calibration standards.

2.9 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.

The naming convention for each sample location will be as follows:

For soil borings and soil samples, the sample name will include the borehole number, and depth interval, i.e. PSBH-01:6-8'.

For groundwater samples, the sample name will include the well number, i.e. PSMW-01.

For field duplicate and equipment blank samples, the characters “FD” or “EB” will be added to the end of the sample name, i.e., PSMW-01-FD or PSBH-01-6-8-EB. Trip blanks will be labeled “Trip Blank” and include the date.

2.10 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 its use at the next site. One equipment rinse sample will be collected and analyzed. Rinse 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 as described in an earlier section.

2.11 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. Final disposition of these site investigation generated wastes will depend upon final laboratory results and corresponding regulatory standards.

2.12 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.

2.13 Safe Work Plan

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

3.0 Analytical Laboratory, Methods, and Data Management

The samples will be shipped to Evergreen Laboratory, Inc. in Wheat Ridge, Colorado. Expedited turnaround times of 24 hours for VOCs analysis and 48 hours for dissolved methane analysis have been requested of 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:

Evergreen Analytical, Inc.

4036 Youngfield

Wheat Ridge, Colorado 80033-3862

303-425-6021 Phone

303-425-6854 Fax

Attn: Shea Penland

email: Shea@evergreenanalytical.com

The secondary laboratory for duplicate split sample analyses is as follows:

TestAmerica Laboratories, Inc.

4955 Yarrow Street

Arvada, CO 80002

303-736-0100 Phone

303-431-7171 Fax

Attn: Patrick McEntee

3.1 Analytical Methods

Groundwater samples collected from the temporary monitoring wells will be analyzed for volatile organic compounds (VOCs) using USEPA SW846 Method 8260B and dissolved methane using Method RSK-175 (Table 1). Soil samples will be analyzed for VOCs using USEPA SW846 Method 8260B and total volatile and extractable hydrocarbons (TVPH and TEPH) using USEPA SW846 Modified Method 8015 (Table 2). For soil samples exceeding 100 mg/Kg TVPH or TEPH, the soil sample will also be analyzed for semi volatile organic compounds (SVOCs) using USEPA SW846 Method 8270.

Table 1 – Analytical Methods and QC Samples – Groundwater Samples

Phase I Site Investigation Work Plan - Prather Spring Investigation

Analysis	Bottle Requirements	Preservation Requirements	Holding Time	Field Quality Control Requirements		
				FD	MS/MSD	Trip Blank
VOCs (Method 8260B)	2 - 40 ml VOA Vials	<6° C, HCl	14 days	1 per 20	1 per 20	1 per cooler
Dissolved Methane (Method RSK-175)	3 - 40 ml VOA Vials	<6° C	14 days	1 per 20	1 per 20	—

Table 2 – Analytical Methods and QC Samples – Soil Samples

Analysis	Bottle Requirements	Preservation Requirements	Holding Time	Field Quality Control Requirements		
				FD	MS/MSD	Trip Blank
VOCs (Method 8260B)	1 - 4 or 8oz jar	<6° C	14 days	1 per 20	1 per 20	1 per cooler
TVPH (SW8015 mod)	1 - 4 or 8oz jar	<6° C	14 days	1 per 20	1 per 20	—
TEPH (Diesel) (SW8015 mod)	1 - 4 or 8oz jar	<6° C	14 days	1 per 20	1 per 20	—
SVOCs (SW8270)	1 - 4 or 8oz jar	<6° C	14 days	—	—	—

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 data package will include labeled chromatograms for appropriate analyses. 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 data deliverable (EDD) into the project 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 data management system (DMS).

3.4 Data Validation

All data will be subject to data validation by qualified URS chemists. The validation will consist of an evaluation of sample-specific parameters for 100% of the data set as well as a review of laboratory performance parameters for 10% of the data set. Problems identified during the laboratory performance parameter review as potentially being systematic laboratory performance issues were then also evaluated for all data packages. The sample-specific and laboratory-performance review parameters are summarized below and detailed data validation procedures can be found in the Data Validation SOP (Attachment C).

The review of sample-specific parameters includes evaluating parameters that are field sample related. These include: case narrative comments, chain-of-custody and sample condition upon receipt, holding times, method blank results, surrogate recoveries, matrix spike recoveries, laboratory duplicate analyses, post-digestion spike recoveries (metals only), Inductively Coupled Plasma Spectroscopy (ICP) serial dilution analysis agreement (metals only), internal standard performance, and results for field quality control samples (e.g., field duplicates).

The review of laboratory performance parameters includes evaluating operations that are in the control of the laboratory, but are independent of the field samples being analyzed. These include: initial calibration, initial and continuing calibration verification, laboratory control sample analysis, compound identification, result calculation (i.e., quantitation), data transcription (i.e., verification), and method specific quality control requirements (e.g., thermal stability, tuning, resolution, mass calibration, interference check sample analysis). Evaluation of these parameters provides an assessment of overall system performance.

The sample-specific and laboratory performance evaluation procedures in the SOP for radiological parameters are based on guidance from the *Laboratory Data Validation Guidelines for Evaluating Radionuclide Analyses*, Rev 06 (SAIC June, 2000). The sample-specific and laboratory performance evaluation procedures in the SOP for non-radiological parameters were developed using guidance from the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review (October, 2004) and the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review (October, 2005).

3.5 *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). Representative field water quality measurements and GPS coordinates for sample locations will also be included in the DMS. The DMS will include all groundwater, surface water, and soils data collected by the Companies to date. The nomenclature of the data will be modified, as necessary, to ensure continuity of sampling locations between the Companies and the existing COGCC sample location designations. The DMS will be used for creating data tables and graphics for the site investigation report. Following the completion of data validation, 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.

An investigation report will be completed immediately following completion of the field activities described above and receipt of final validated analytical data from the laboratory. 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 3 days following completion of data validation, which will be completed within 24 hours following receipt of the final analytical data package. Following receipt of comments from the Companies, the report will be finalized and submitted to the Companies and COGCC.

4.2 Schedule

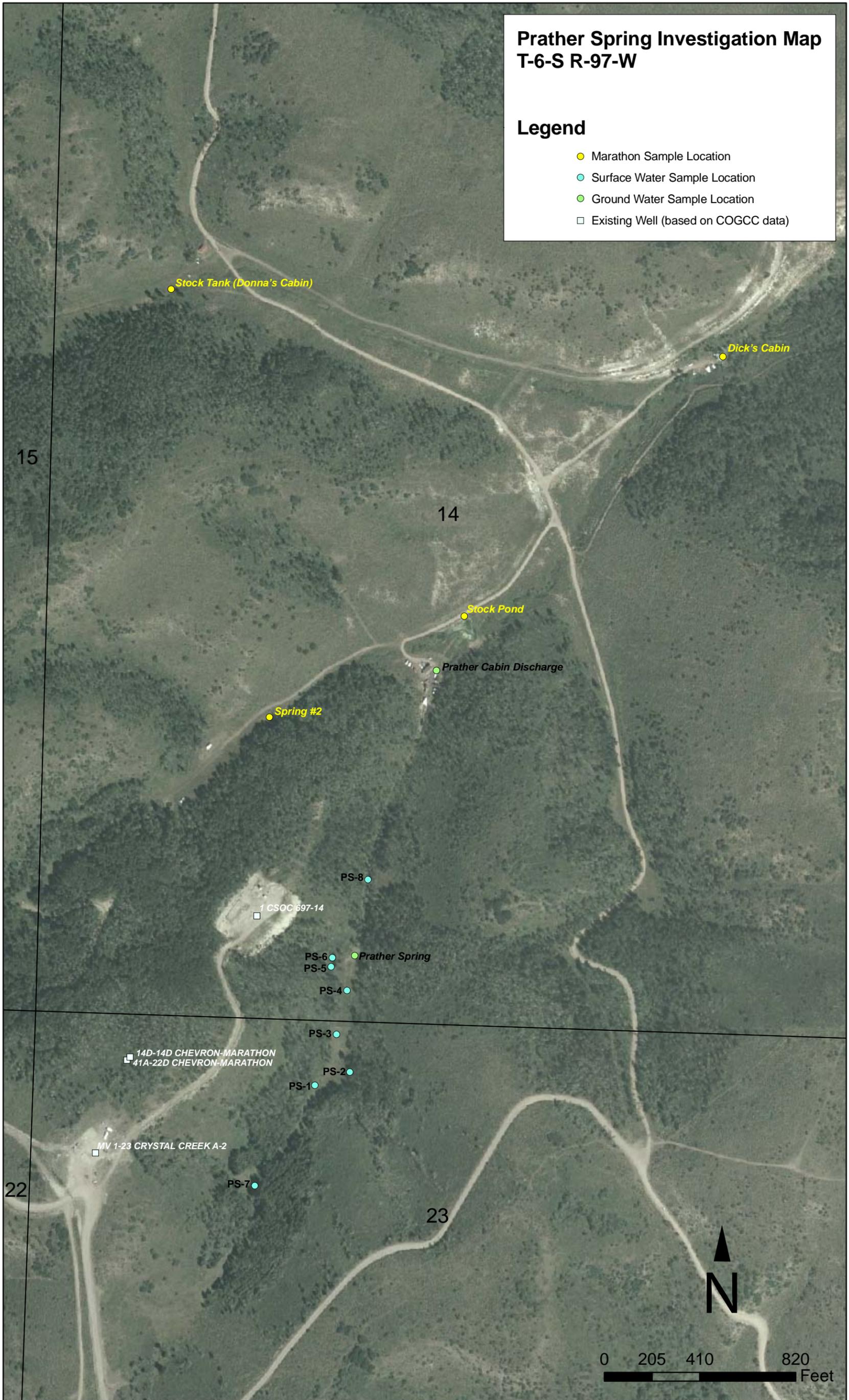
The drilling and the temporary monitoring well construction activities have been scheduled for July 15 and 16, 2008. However, the drilling will not commence until approval of this scope of work is obtained from COGCC. We anticipate that all scheduled groundwater and potential soil samples can be submitted via overnight delivery to Evergreen Laboratory located in Wheat Ridge, Colorado. Ground water sampling will occur on the day following drilling and well construction or tentatively on July 16th and 17th. Assuming that Evergreen can perform either a 24- or 48-hour rush turnaround the reported laboratory results can be available by July 18th or July 21st. This schedule is based upon an assumption that the drilling activities and monitoring well construction can be performed in two days. Additional time may be required and will alter this schedule.

Should one or more 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. Subsequent groundwater sampling will be performed by a two-man team from HRL Compliance Solutions, Inc.

Prather Spring Investigation Map T-6-S R-97-W

Legend

- Marathon Sample Location
- Surface Water Sample Location
- Ground Water Sample Location
- Existing Well (based on COGCC data)



Attachment A - Safe Work Plan

**URS Joint Consultant for Williams, Marathon, PDC, Nonsuch
Prather Spring Site Investigation Activities
Safe Work Plan**

Project: Phase 1 Site Investigation, Prather Spring **Project Number:** 22239335
Work Location: Parachute, Colorado **Date:** 7/7/2008
Scope of Work/ Task Descriptions: URS personnel will supervise drilling of soil borings and temporary monitoring wells, and collect groundwater samples.

Emergency Response Information

Contact	Phone Numbers
Principal - Mark Levorsen	(303) 796-4767 or (303) 913-0711
Project Manager – David Cox	(303) 796-4659 or (720) 289-0095
Client Contact – Mike Gardner	970-263-2760 or 970-623-4785 (cell)
Health and Safety Manager – Sally Miller	(303) 740-2721 or (720) 320-1814
Regional H&S Manager – Tim Joseph	(303) 740-2767 or (303) 884-2548
URS Nurse – Jeanette Schrimsher (Incident Reporting)	(866) 326-7321 (24-hour)
Emergency	911
Nearest Hospital (map with directions attached)	
Richard Henry	(303) 740-3978 or (303) 994-1747
Craig Heydenberk	(970) 384-4739 or (970) 456-2515
Mike Mestas	(970) 384-4731 or (970) 618-1872

- URS Safety Management Standards are attached. Note: Safety Management Standards are available from The SoURSe and at www.urshse.com (username = urshse, password = hardhat).
- X Job-specific activity hazard analyses are attached.
- X Employees have completed required field safety training.

Completed by: Tim Joseph Date: 8/2/07
 PM review: Mark Levorsen Date: 7/3/08
 H&S concurrence: Tim Joseph Date: 8/2/07

Required Personal Protective Equipment for Drilling and Sampling Activities:

Hard hat
Steel-toed boots
Safety glasses
Long pants
Ear protection while working near operating drill rig

Suggested Additional PPE:
Long-sleeved shirt
Orange vest while working near operating drill rig

Note: The URS Safety Management Standards for Drilling Safety Guidelines (Rev 2) is a separate PDF document that is intended to be used in conjunction with this Safe Work Plan

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Site-Specific Hazards and Controls	
Potential Hazards	Controls
Working near drilling operations	<ul style="list-style-type: none"> • Oil field rigs are very dangerous work environments with multiple hazards • Specific significant hazards include pressurized lines, cranes and pulleys, falls, cable spools, drill rod piles, engulfment by sand/soil and large moving mechanical parts • Hard hat, safety glasses and steel toe boots are always required. Hearing protection and Nomex coveralls may be required • Stay clear of all work activities whenever possible • Notify the drill crews when you will be entering their work areas • Stay with a client HSE escort at all times when on the drilling pad • Refer to applicable Drilling and Production Health and Safety and Emergency Response Plans.
Well field activities	<ul style="list-style-type: none"> • Watch out for large – fast moving vehicles • When possible, keep a safe distance from drilling platforms and other activities • Make eye contact with equipment operators before approaching • Stay away from stacked drill rod, cable spools and pinch points • Hard hats, steel toe shoes and safety glasses are required near any intrusive well field activities

General Physical Hazards and Controls	
Potential Hazards	Controls
All hazards	<ul style="list-style-type: none"> • Manage projects so that adequate time is allowed to complete tasks • Manage projects so that proper adequate equipment and supplies are available • Promote a positive safety attitude/culture • Employees must read this Safe Work Plan prior to work, and a copy must be available at the work site • Reevaluate the Task Hazard Analysis daily; consider changes in weather conditions, work activities, and other site conditions • Conduct a daily safety briefing or tailgate meeting • Document that each employee has completed the appropriate safety training and medical surveillance prior to working in the field; at a minimum, 4-hour Field Safety training is required • Attend any safety briefings required by site operators • Look out for each other and provide safety feedback to co-workers to increase safe behavior

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General Physical Hazards and Controls	
Potential Hazards	Controls
Chemical hazards	<ul style="list-style-type: none"> • Water samples may require the use of acid as a sample preservative • When handling bottles containing acid, wear safety glasses and nitrile gloves • Make sure lids are attached tightly so acid does not leak • Refer to SMS 2 <i>Chemical Hazard Communication</i>
Aggressive individuals or potentially dangerous locations (e.g., high crime areas, deserted buildings, rough terrain)	<ul style="list-style-type: none"> • Get approval from property owners prior to access and see if the owner will accompany you • Work in teams of two or more • If you must work alone, maintain contact with someone at the office; complete a communication plan in accordance with SMS 84, <i>Lone Workers</i> • Leave and/or contact help if you are threatened
Driving/vehicle safety	<ul style="list-style-type: none"> • Inspect vehicles prior to use, especially rental vehicles; know how to operate wipers, lights, etc. • Verify that equipment and supplies are secured (inside the cab as well as the truck bed) prior to vehicle movement • Understand and obey all local traffic rules • Wear seat belts and require passengers to wear seat belts • Don't speed, keep work site speeds below 15 mph unless posted otherwise • Don't drive for more than 8 hours in one day and do not work and drive for more than a total of 12 hours • Leave enough time to get to your destination without hurrying • When possible, avoid backing up, especially in parking lots • Park clear of traffic on right-of-ways; park vehicle between you and on-coming traffic • Wear high-visibility vests with reflective strips when working near vehicles • Refer to SMS 57 <i>Vehicle Safety Program</i> and SMS 32 <i>Work Zone Traffic Control</i>
Heat Stress	<ul style="list-style-type: none"> • Know the signs and symptoms of thermal stress • Use the buddy system in extreme conditions • Have plenty of water available and stay hydrated • Take breaks in a cool area as appropriate • Wear sun screen • Refer to SMS 59 <i>Cold Stress</i>
Remote locations	<ul style="list-style-type: none"> • Identify the best means of communication prior to leaving for the site • Cell phone coverage is spotty up on the ridge tops above McKay Gulch • Ensure that your cell phone or radio is charged and working and that you understand how to use it • Take plenty of water and some energy food • Take a map, know how to describe your location • Work in teams of at least two when working away from vehicles or when communication with the office is not available; complete a communication plan in accordance with SMS 84, <i>Lone Worker</i> • Refer to SMS 36 <i>Remote Travel Health and Safety</i>
Working alone	<ul style="list-style-type: none"> • In situations where one sampler will be present at the site (not advised), the sampler will make frequent cell phone contact with the client or a URS contact

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General Physical Hazards and Controls	
Potential Hazards	Controls
	<p>in the office.</p> <ul style="list-style-type: none"> • In the morning, the sampler should review their day's schedule with the client or the office contact, including the order in which the wells will be visited. • The sampler should check in with the client or the office upon leaving each water well location, and tell their contact where the next well location is to be sampled. • For sample collection at spring locations, a two-person sampling crew is always advised. One exception to this is if client employees will be riding along with the URS sampler to the spring. • Refer to SMS 84 <i>Lone Worker</i>.
Lifting	<ul style="list-style-type: none"> • Minimize the movement of heavy objects, and use dollies or carts whenever possible • Stretch before lifting • Store heavy objects just below waist height • Get help to lift heavy objects and plan the lift • Bend at the knees; do not use your back • Do not twist during lifts • Refer to SMS 45 <i>Back Injury Prevention</i>
Severe weather	<ul style="list-style-type: none"> • Identify shelters prior to start of work • Listen to radio for warnings • Discontinue work and seek shelter if severe weather is approaching • Secure equipment and watch for flying debris, doors slamming shut, etc. • Passenger vehicles with the windows rolled up provide good shelter during lightning • If stuck outside during a tornado go to a low lying area away from debris and watch for flooding • Trailers are not safe during tornadoes
Sharp objects	<ul style="list-style-type: none"> • Wear appropriate work boots and work gloves • Avoid handling site debris or placing hands where you can not see • Use caution when working with any tool • Watch out for barbed wire and electrical fences; cover with a car mat to cross, or walk around • Refer to SMS 64 <i>Hand Safety</i> and SMS 16 <i>Hand Tools and Portable Equipment</i>
Slips, trips, and falls	<ul style="list-style-type: none"> • Maintain good housekeeping; keep the work area free from debris • Survey the work area and mark dips, holes and other hazards • Avoid steep and uneven terrain; watch where you step • Wear sturdy boots with good tread • Be especially cautious if wet or icy conditions are present; remember that snow can hide icy surfaces • Take the time to find a safe route to the desired location • Do not perform any activity with a fall exposure of 6 feet or more without using fall protection. Consult the Health and Safety Manager. • Refer to SMS 21 <i>Housekeeping</i> and SMS 40 <i>Fall Protection</i>
Excavations	<ul style="list-style-type: none"> • Excavation work is not expected during this project. Consult the Health and Safety Manager

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General Physical Hazards and Controls	
Potential Hazards	Controls
Confined space entry	<ul style="list-style-type: none"> Confined space entry is not authorized for this project. Consult the Health and Safety Manager
Emergencies and Incident Reporting	<ul style="list-style-type: none"> Maintain a first aid kit, fire extinguisher and a roll of “Caution” tape in each vehicle and/or at the site Consider keeping a disposable camera available at the job site to document near-misses or incidents Report all incidents and near misses to the PM and the HSM or RHSM Know the location of the nearest working phones and know how to direct emergency responders to your location prior to starting work Know appropriate emergency contact numbers (911 or others as appropriate) Know the location and route to the nearest hospital or clinic; check with locals to confirm Report work-related injuries <u>immediately</u> to Jeanette Schrimsher, URS Occupational Health Manager (866) 326-7321 (24-hour number) Refer to SMS 65 <i>Injury Management</i> Refer to SMS 49 <i>Incident Reporting</i>

Biological Hazards and Controls	
Potential Hazards	Controls
Bloodborne Pathogens (hepatitis, HIV, etc.)	<ul style="list-style-type: none"> Use “universal precautions” and assume any blood or body fluids are contaminated Wear latex or nitrile gloves to prevent exposure Refer to SMS 51 <i>Blood-Borne Pathogens</i>
Ticks, spiders, mosquitoes, and other insects	<ul style="list-style-type: none"> Cover skin with light colored clothing Wear insect repellent; follow directions for use Tape the interface between boots and pants Check for ticks or insect bites after walking in habitat areas Avoid heavily vegetated areas and wet areas, especially during dusk/night Be familiar with symptoms of exposure to vectorborne disease (e.g., Lyme disease, West Nile virus) and seek treatment immediately if symptoms develop; refer to SMS 47 <i>Biological Hazards</i>
Poisonous Plants (poison ivy, poison oak, etc.)	<ul style="list-style-type: none"> Tape long sleeves to work gloves, and tape both legs to boots to avoid contact with poisonous plants If contact occurs, wash immediately with soap and water and wash clothing after contact Refer to SMS 47 <i>Biological Hazards</i>
Snakes	<ul style="list-style-type: none"> Wear high boots or snake chaps if there is a significant snake hazard Make noise when approaching snake habitat and, to the extent possible, avoid such areas Leave the immediate area if a snake is sighted; do not disturb or attempt to move snake
Small biting animals, including domestic animals	<ul style="list-style-type: none"> Do not reach into potential habitats, e.g., logs, crevices, tall grass Keep a distance from small animals to avoid potential disease (e.g., plague)

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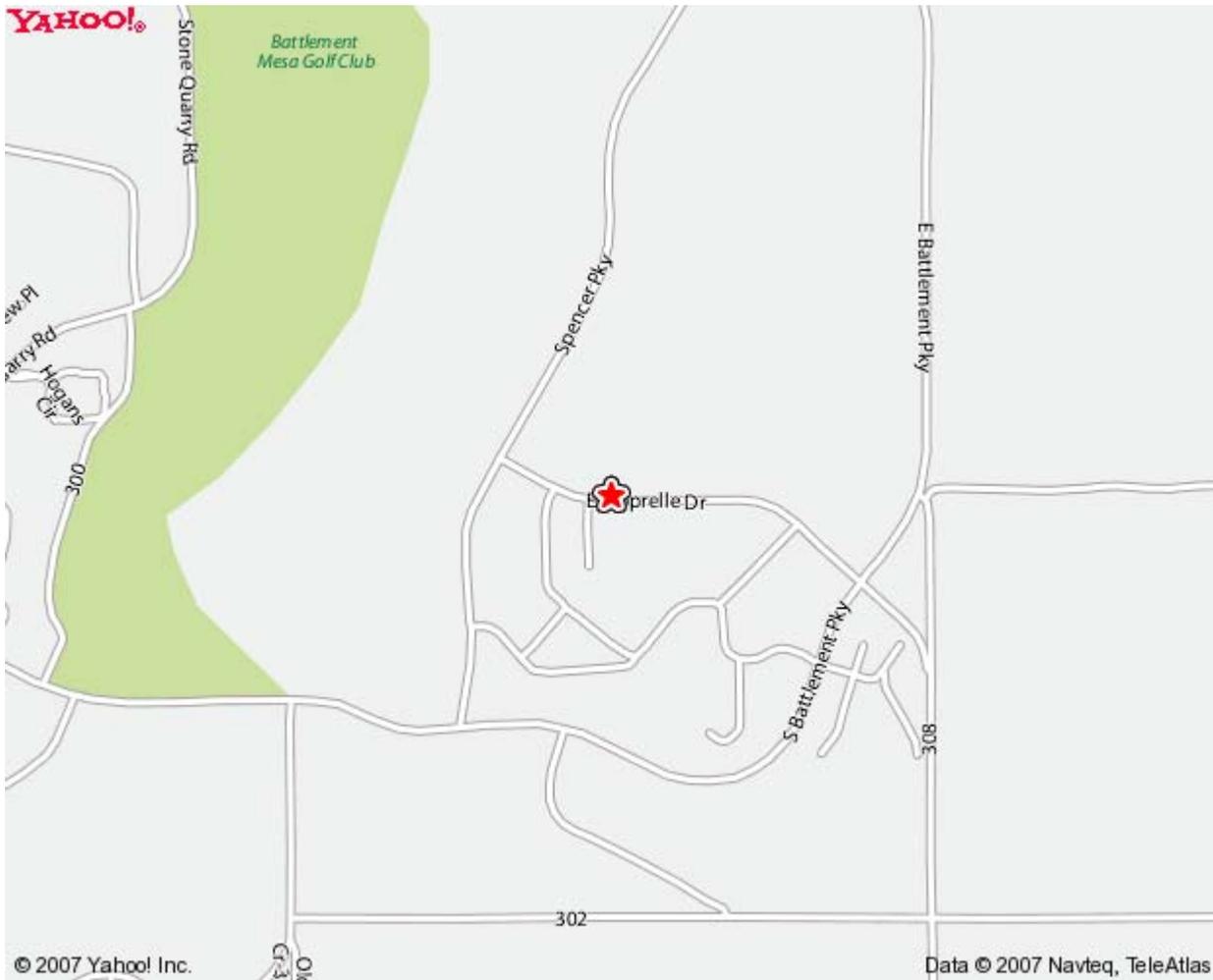
	<ul style="list-style-type: none"> • Check with owner prior to entering private property • Stay away from all animals including domestic dogs and cats • Never tease dogs • If approached by a dog and the owner is not there, do not reach your hand out. Stand still and let the dog sniff your shoe or leg • Do not stare at the dog's eyes • Raised hackles, growling, tail held stiffly, and staring are all signs that the dog may bite
<p>Animal droppings (hantavirus, histoplasmosis, etc.)</p>	<ul style="list-style-type: none"> • Avoid animal droppings, nesting materials, and dead birds or animals • If you must work in areas near droppings/nesting materials, do not disturb and do not create dust. If dust is anticipated, respiratory protection may be needed. Consult the Health and Safety Manager.
<p>Large mammals</p>	<ul style="list-style-type: none"> • Contact local Ranger Stations to identify hazards • Bears have been sighted in the McKay Gulch area • Make noise when walking in remote areas • If you encounter a bear, do not run; walk away slowly • Moose and bison can also attack if threatened • If signs of large mammals are indicated in the work area, contact a safety representative for additional control measures. • Also keep a safe distance from livestock

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Battlement Mesa Medical Center (Monday – Friday 8:30-5:00)

73 Sippelle Drive
Parachute, Colorado 81635

Telephone
970-285-7046

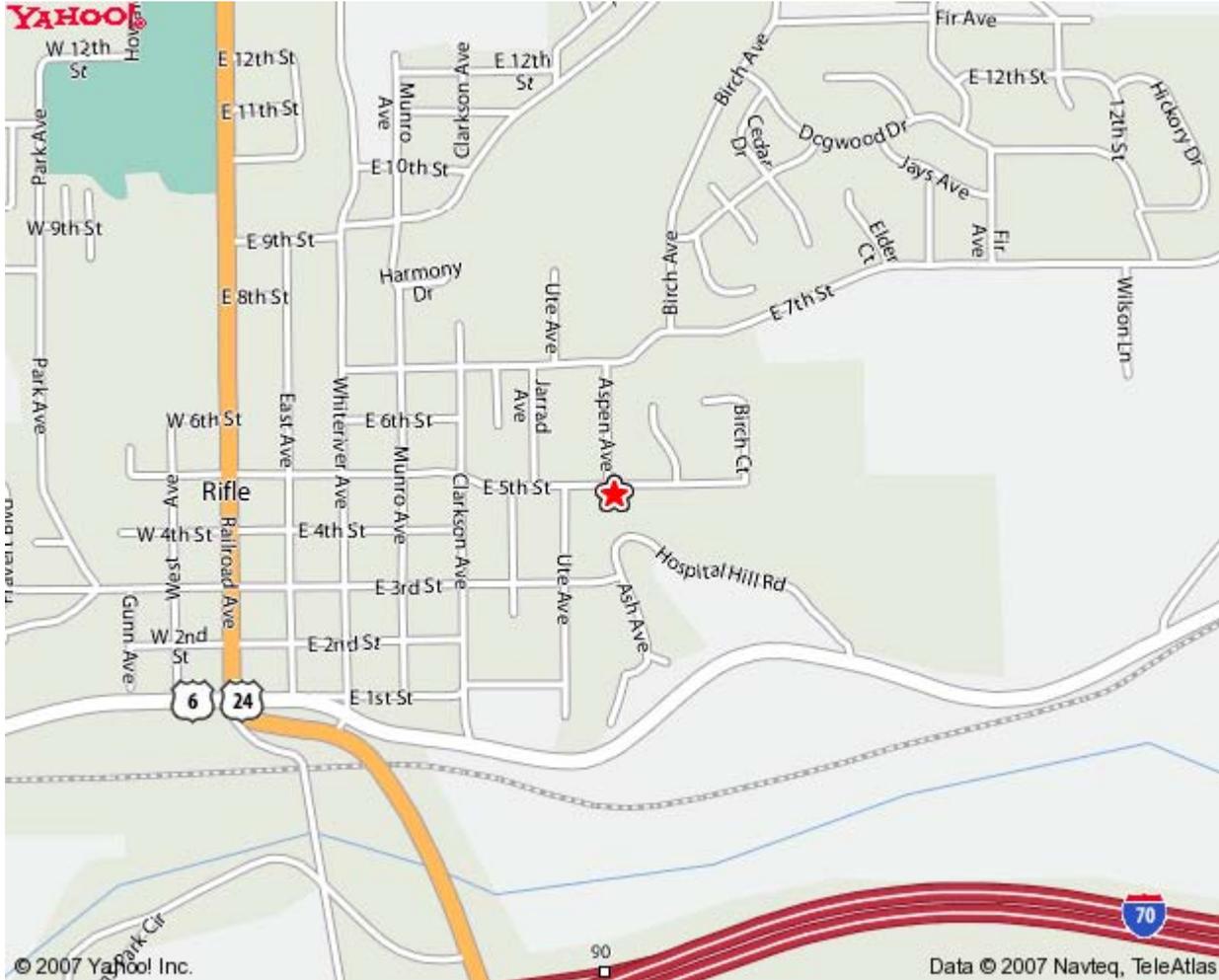


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Clagett Memorial Hospital

701 East 5th Street
Rifle, Colorado 81650

Telephone
970-625-1510



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Safe Work Plan
ACTIVITY HAZARD ANALYSIS
DRILLING**

Principal Steps	Hazards	Controls
All	General	<ul style="list-style-type: none"> • Inspect drilling equipment, cranes, winches, generators and compressors prior to use – correct problems • Verify that the kill switch works • Verify that preventative maintenance has been conducted • Wear proper PPE: Hardhat, safety glasses with side shields, and steel-toed boots as a minimum • Conduct tailgate safety meetings and facilitate a safe work culture • Pre qualify drilling subcontractors using SMS 46 • Verify that Drillers and Helpers have proper training and/or experience • Refer to URS SMS 56, Drilling Safety Guidelines, SMS 46, Subcontractor Health and Safety Requirements, and SMS 72, Behavior Based Safety.
Raise / lower mast	Rig stability	<ul style="list-style-type: none"> • Carefully evaluate steep, rough or tight terrain prior to situating the rig • Situate the rig on a flat surface • Use outriggers as necessary • Never move the rig with the mast up • Verify that equipment is disconnected prior to lowering the mast
	Overhead utilities	<ul style="list-style-type: none"> • If overhead utilities are present in work areas, place warning signs at ground level • Always check for overhead utilities before raising the mast • Maintain at least one mast length or 20 feet (whichever is greater) from all power lines • Contact the RHSM if high voltage lines are present • Refer to SMS 34, Utility Clearance and Isolation
Attach/detach rod and augers	Lifting	<ul style="list-style-type: none"> • Use your legs, not your back • Get help • Remove slip, trip and fall hazards from the work area • Do not twist with your back; take small steps to turn • Use the winch to lift auger flights • Personnel should never be between the flights and the rig or under the flights when using the cable winch • Refer to SMS 69, Manual Material Handling
	Hand tools	<ul style="list-style-type: none"> • Inspect tools prior to use • Use tools for their intended use only • Don't use damaged tools • Pull, don't push wrenches – make sure there is a good grip • Refer to SMS 16, <i>Hand Tools and Portable Equipment</i> and SMS 84, <i>Hand Safety</i>

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	Pinch points	<ul style="list-style-type: none"> • Never place your hand or other body parts under auger or in holes in the auger • Attach one flight at a time • Stand clear of outriggers • Wear leather gloves
Rig maintenance	Falls	<ul style="list-style-type: none"> • Fall protection is required when working at heights of greater than 6 feet (e.g., guard rails or a personal fall arrest system); refer to SMS 40, <i>Fall Protection</i> • Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible
	Equipment energization	<ul style="list-style-type: none"> • Lockout and tagout is required if accidental energization of the rig could cause injury • Refer to SMS 23, <i>Lockout and Tagout Safety</i>
	Hot work	<ul style="list-style-type: none"> • Clear all combustibles away from the work area • A fire extinguisher must be available • Notify the site superintendent of all hot work • Observe work areas for 30 minutes after hot work • Refer to SMS 20, <i>Hot Work</i>
	Hand Tools	<ul style="list-style-type: none"> • See above
	Chemical Hazards	<ul style="list-style-type: none"> • Review material safety data sheets • Follow manufacturer's instructions for use, handling and storage • Use recommended protective equipment • Label all containers • Refer to SMS 2, <i>Hazard Communication</i>
Advance the boring	Rotating equipment	<ul style="list-style-type: none"> • All team members should know the location of the kill switch • At least two persons must be present when operating the rig • Stand clear if possible • Use low-profile auger pins • Do not wear loose clothing, jewelry, hair, or equipment near the auger • Remove cuttings with a shovel, not your hand or foot
	Underground utilities	<ul style="list-style-type: none"> • Complete utility locates prior to drilling (Call 811 or 1- 800-922-1987 in Colorado and/or coordinate with the drilling contractor and site personnel) • Mark locations in white • Field verify utility locations • Document all utility locates • Observe the area for indications of utilities • Hand dig if questions remain or if required by the property owner • Refer to SMS 34, <i>Utility Clearance and Isolation</i>

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	Environmental Contamination (if applicable)	<ul style="list-style-type: none"> • Contain cuttings in drums or plastic sheeting • Wear proper PPE and minimize contact with soil, sediment, groundwater, etc. • Work upwind of the boring • If unusual soil discoloration or odors are encountered, stop work, evacuate area and contact HSM; approach will need to be re-evaluated and Level C PPE may be required • Follow all provisions of this Health and Safety Plan
	Dust (respirable silica)	<ul style="list-style-type: none"> • Minimize generation of dust from soil, sand or bentonite • Stay out of visible dust clouds • Wet materials if necessary to eliminate visible dust
	Noise	<ul style="list-style-type: none"> • Wear hearing protection when operating or working near the rig • Refer to SMS 26, <i>Hearing Conservation</i>

Attachment B – Data Validation SOP

STANDARD OPERATING PROCEDURE NO. 1.0
ANALYTICAL DATA VALIDATION

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1.0 PURPOSE AND SCOPE

This standard operating procedure (SOP) describes procedures to be used to conduct an independent review of environmental analytical laboratory data so that data of known and documented quality will be used for all decision making. Procedures for review of field data are included in the SAP.

This SOP includes two levels of data review, evaluation of sample-specific parameters and evaluation of laboratory performance parameters. All data generated will receive an evaluation of sample-specific parameters. In addition, 10% of the data packages received (per analysis type per sampling event/episode) containing data will also receive a review of laboratory performance parameters.

This SOP addresses the protocols that will be followed for the sample-specific parameters and laboratory performance parameters data review levels. The review of sample-specific parameters is described in Section 4.1. The review of laboratory performance parameters is discussed in Section 4.2. In addition, Section 5 discusses the associated documentation.

This SOP was developed using guidance from the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review (October, 2004) and the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review (October, 1999) and Laboratory Data Validation Guidelines for Evaluating Radionuclide Analyses, Rev (SA) (SAIC 1999).

2.0 RESPONSIBILITIES AND QUALIFICATIONS

The Project Manager or QA Manager has the overall responsibility for implementing this SOP. They will be responsible for assigning appropriate environmental staff to implement this SOP and for ensuring that the procedures are followed.

All personnel performing these procedures are required to be familiar with environmental data, its generation, and its reporting. In addition, all personnel are required to have a complete understanding of the procedures described within the SAP and this SOP, as applicable. Activity-specific training regarding these procedures will be provided by the QA Manager or designee to personnel implementing this SOP, as necessary.

All environmental staff are responsible for reporting deviations from this SOP to the Project Manager or QA Manager.

3.0 LIST OF RELATED SOPs

There are no other SOPs that are directly related to this SOP.

4.0 DATA REVIEW PROCEDURES

As noted in Section 1.0, all analytical data used for reporting and environmental decision making will receive a review independent of the laboratory to ensure that data are of known and documented quality.

The review of sample-specific parameters includes evaluating parameters that are sample related. These include: case narrative comments, chain-of-custody and sample condition upon receipt, holding times, method blank results, surrogate recoveries, matrix spike recoveries, laboratory duplicate or spike duplicate analysis, post-digestion spike recoveries, ICP serial dilution analysis agreement, internal standard performance sample-specific chemical recovery, and results for field quality control samples (e.g. field duplicates, rinsate blanks, field blanks, and trip blanks). The sample-specific review is described in Section 4.1. Sample-specific parameters will be reviewed and evaluated for all data.

The review of laboratory performance parameters includes evaluating operations that are in the control of the laboratory, but are independent of the field samples being analyzed. These include: initial calibration, initial and continuing calibration verification, laboratory control sample analysis, compound identification, result calculation (i.e., quantitation), radionuclide quantitation and implied detection limits, chemical separation specificity, data transcription (i.e., verification), and method specific quality control requirements (e.g. thermal stability, tuning, resolution, mass calibration, interference check sample analysis). Evaluation of these parameters provides an assessment of overall system performance. The review of laboratory performance parameters is discussed in Section 4.2. Laboratory performance parameters will be reviewed for at least 10% of the data packages (per method per sampling event) received.

During the data review process, data validation qualifiers, as defined in Table 1, will be assigned to the results, as necessary, to indicate any potential limitation on the use of the data. In addition, data qualifier codes and bias codes as defined in Table 2 will be added to the results to indicate the reason(s) for qualification and the associated bias direction, if discernable. Data validation narratives will be generated which document the results of all data review activities, all data qualification assigned, and any limitations on the use of the data.

4.1 REVIEW OF SAMPLE-SPECIFIC CRITERIA

The review of sample-specific criteria includes evaluating parameters that are sample related. Each of the subsections below describes how each parameter is evaluated. While most parameters to evaluate are pertinent to all methods, some are method specific (e.g., see Section 4.1.6). In general, the hierarchy for acceptance criteria used to evaluate each parameter is as follows:

- Criteria specified in the SAP.
- Method specified acceptance criteria.
- Acceptance ranges based on laboratory historical data.

According to this hierarchy, a parameter is first evaluated against the requirements set forth in the SAP. If the criteria are not specified in the SAP, then the parameter is evaluated against the requirements stated in the analytical method. If the method does not specify acceptance criteria, results for the parameter are compared to acceptance ranges based on laboratory historical data.

No recalculation of results from the raw data or transcription error checking will be performed during the review of the sample-specific criteria as recalculation and transcription error checking is completed during the review of laboratory performance criteria.

4.1.1 Case Narrative Comments

The data validation process begins with an examination of the case narrative. Any analytical problems noted in the case narrative are noted in the data validation narrative along with a summary of the effect on the usability of the data.

4.1.2 Chain-of-Custody and Sample Receipt

The chain of custody (COC) documentation, sample receipt, and log-in information are reviewed. The analytical results received are compared against those requested on the COC form. Any COC problems or discrepancies and any problems noted by the laboratory with regard to sample condition upon receipt are noted in the data validation narrative along with a statement of the effect on the usability of the data.

4.1.3 Holding Times

Collection-to-analysis holding times are calculated by computing the difference between the sample collection date and the sample analysis date. The collection dates are found on the COC and analysis dates are reported on the analysis run logs. The holding times are compared to the acceptance limits contained in the SAP and/or respective analytical methods, as applicable. Results for analyses not performed within holding time limits will be qualified as estimated (“J/UJ”). If the holding time is grossly exceeded (more than two times the holding time limit), the data reviewer should use professional judgement to evaluate the need to reject non-detectable results.

A reason code of “HT” will be assigned to all results qualified or rejected on the basis of holding times.

4.1.4 Blanks

Blank analysis results are used to assess the existence and magnitude of contamination problems. If a problem exists with any blank, the reviewer will evaluate whether there is an inherent variability in the data for the entire data set or if the problem is an isolated occurrence not affecting other data.

Blanks should be analyzed for every matrix and every batch, or at a frequency of 5 percent, which ever is more frequent. The results for all blanks should be plotted to determine that each blank result falls within the recommended tolerance limits of ± 3 standard deviations.

For radiological parameters, the net blank result (e.g., the blank result after subtraction of background) must be less than the associated uncertainty if the average blank or instrument background counts are subtracted to determine net counts. If the net blank result is larger than the associated uncertainty, contamination will be suspected. If the blank QC results fall outside the appropriate tolerance limits or if the net blank result is greater than the associated uncertainty, and the sample concentration is less than five times the blank concentration or within the combined uncertainty, the sample results will be qualified as nondetect (U) for the associated analyte. Results for associated samples that are greater than five times and less than ten times the blank amount will be qualified as estimated (J).

For non-radiological parameters, the results for method blanks and calibration blanks will be reviewed. Sample results for analytes detected in an associated blank at concentrations $<5x$ the equivalent blank concentration will be qualified as nondetect (U). For the common organic laboratory contaminants (i.e., acetone, methylene chloride, 2-butanone, cyclohexane, and phthalates), sample results $<10x$ the concentration in the associated blank will be qualified as nondetect (U). The result will be qualified as nondetect at the reported concentration if the reported concentration is greater than the reporting limit ($>RL$) or as nondetect (U) at the reporting limit if the reported concentration is $<RL$. Method blanks are associated with the samples in the sample preparation/extraction batch. Continuing calibration blank samples are considered to be associated with all samples analyzed in the analytical run.

If reported, negative blank concentrations will be evaluated for potential effects (low bias) on sample data when the absolute value of the negative concentration is $>RL$. If the negative concentration in a blank may potentially have produced more than a 25% effect on a reported sample result or sample reporting limit, the associated sample result will be qualified as estimated (J/UJ). For example, if the associated blank result is -2 mg/l, the RL is 1 mg/l, and the associated sample result is 5 mg/l, the sample result will be qualified as estimated because a potential low bias of 2 mg/l represents 40% of the reported concentration and the absolute value of the blank concentration is $>RL$.

A reason code of “MB” or “CCB” will be assigned to all results qualified on the basis of method blank or continuing calibration blank results, respectively. For results qualified as nondetect, the bias direction is considered to be indeterminate as the reporting limit is adjusted accordingly. For results qualified as estimated on the basis of blank results, the bias direction is low.

4.1.5 Matrix-Dependent Quality Control

Matrix dependent quality control (QC) samples are used to evaluate how the sample matrix affects the accuracy and precision of the analytical results.

In order to evaluate how the site-specific sample matrix affects the accuracy of the analysis; the laboratory will spike one or two additional aliquots of a field sample with known amounts of target analytes and prepare the spiked samples in a fashion identical to that of the field samples. The amount of each spiked analyte recovered can be used to infer the accuracy of the analysis on the site-specific sample matrix.

To assess the precision of the analysis on the site-specific sample matrix, a laboratory duplicate or spike duplicate sample is prepared. A laboratory duplicate sample is a laboratory split of a homogenized environmental sample that is prepared and analyzed in a manner identical to that of the original sample. A matrix spike duplicate is similar with the exception that both aliquots are spiked with known amounts of target analytes. The closeness of the agreement between the two results can be used to infer the precision of the analysis on the site-specific sample matrix.

For inorganic methods, one aliquot is typically spiked and for organic methods, two aliquots are typically spiked. For inorganic methods, a duplicate sample is typically used to assess precision whereas for organic methods, a spiked duplicate is typically used. These conventions were developed based on the probability of finding the target analytes in the sample matrix. However, some laboratories choose to do matrix spike and matrix spike duplicates for some of their inorganic analyses.

The subsections below describe how the results for matrix QC samples will be evaluated.

4.1.5.1 Matrix Spike (MS) Analysis

The matrix spike results, expressed as percent recovery of the spiked analytes, are used to assess effects of the general sample matrix on the accuracy of the analysis.

The matrix spike recoveries are compared to the appropriate acceptance ranges per Section 4.1 for instances in which the native sample concentration was less than four times the spike level. When sample concentrations of an analyte are \geq four times the spiking concentration, the results are considered to be inappropriate for assessing accuracy. The reviewer should also be aware that a matrix spike recovery may be outside acceptance limits when the parent sample was quantified by method of standard additions but the matrix spike was not. In such a case, the matrix spike recovery is not an appropriate measure of accuracy. Data associated with matrix spike recoveries that are outside the acceptance range will be qualified as follows using guidance from Functional Guidelines.

- If the recovery of an inorganic matrix spike analyte exceeds the upper limit of the acceptance range, suggesting a potential high bias in sample results, positive results for that target analyte in all associated samples are qualified as estimated (“J”); whereas, nondetect results for that analyte are considered to be acceptable for use without qualification.
- If the recovery of an inorganic matrix spike analyte is below the lower limit of the acceptance range, but $\geq 30\%$ ($\geq 10\%$ for organics), suggesting a potential low bias in sample results, both positive and nondetect results for that analyte in all associated samples for inorganic methods or only the parent sample for organics methods are qualified as estimated (“J/UJ”).
- If the matrix spike recovery for an inorganic analyte was $< 30\%$ ($< 10\%$ for organics), nondetect results are qualified as unusable (“R”) and positive results are qualified as estimated (“J”) per Functional Guidelines guidance.

For radiological parameters, the reviewer will compare recoveries for aqueous matrix spike samples to the acceptance range of 80 to 120 percent and recoveries for solid media to the acceptance range of 70 to 130 percent. However, the spike recovery limits do not apply when the sample concentration exceeds the spike concentration by a factor of 4 or more. The reviewer will verify that the matrix spike recoveries were calculated properly for at least one of the analytes.

- For aqueous samples, if the MS recovery is within 50 to 80 percent or 120 to 150 percent, results for the associated analytes will be qualified as estimate (J). If the LCS recovery is less than 50 percent or greater than 150 percent, the associated results will be qualified as unusable (R).

For aqueous samples, if the MS recovery is within 40 to 70 percent or 130 to 160 percent, results for the associated analytes will be qualified as estimate (J). If the LCS recovery is less than 40 percent or greater than 160 percent, the associated results will be qualified as unusable (R).

If a matrix spike duplicate is also prepared, the reviewer must use professional judgement and consider the recoveries for both the matrix spike sample and the matrix spike duplicate sample

prior to assigning data qualifiers for inorganic data. All instances in which professional judgement is used to assign data qualifiers will be detailed in the individual data review narratives.

The reviewer should note that for organic data, no qualification of associated samples in the batch or data package will be performed on the basis of matrix spike recoveries alone. The data reviewer should use professional judgement and consider the results of other QC measures such as surrogate recoveries in conjunction with MS/MSD results to determine the need for extending qualification for the affected analytes to the other associated samples.

A reason code of “MS” will be assigned to all results qualified as estimated or unusable (rejected) on the basis of matrix spike and/or matrix spike duplicate recoveries. The assigned bias code will reflect the inferred bias direction.

4.1.5.2 Laboratory Duplicate (LD) Sample Analysis

Duplicate Analysis (matrix duplicate or spiked duplicate)

Duplicate analyses are indicators of laboratory precision based on each sample matrix. Samples identified as field blanks should not be used for duplicate analyses. At least one duplicate should be analyzed for every matrix, every batch, or for every 20 samples (5 percent of samples), whichever is more frequent.

For radiological parameters, the duplicate analyses results must be in agreement when the 2 standard deviation (95 percent confidence limit) uncertainties are considered. For this to be true, the duplicate error ratio (DER) should be less than 1. The DER is calculated as follows:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

where,

S = First Sample Value (original)

D = Second Sample Value (duplicate)

$2\sigma_S$ = First Sample Uncertainty at the 2σ level

$2\sigma_D$ = Second Sample Uncertainty at the 2σ level

The reviewer will compare reported DERs to the evaluation criterion of less than one. The reviewer will recalculate at least one DER value. If the DER value is greater than 1, the results for affected analyte will be qualified as estimated (J) in all associated samples of the same matrix. Other equations used by laboratories to express duplicate agreement will be considered using professional judgment with the concept that the criterion should be consistent with agreement within the 95-percent confidence limits.

For non-radiological parameters, the duplicate and spike duplicate sample analysis results are used to evaluate the precision of the laboratory analyses. Laboratory duplicate or spike duplicate results are evaluated using concentration dependent evaluation criteria.

- When both results are $> 5x$ RL, compare the relative percent difference (RPD) between the sample results to a criterion of $\leq 20\%$ for aqueous samples and $\leq 35\%$ for soil and sediment samples.
- If either sample concentration is $\leq 5x$ RL, compare the absolute difference between the results to a criterion of $\leq 1x$ the greater RL for aqueous samples and $\leq 2x$ the greater RL for soil and sediment samples.

All evaluations are done using the higher RL and the RL is used in calculating the absolute difference for a nondetect result. If the applicable duplicate evaluation criterion is not met for an analyte, all associated sample data for that analyte will be qualified as estimated (J/UJ).

A reason code of “D” will be assigned to all results qualified on the basis of laboratory duplicate or spike duplicate results. A bias direction of indeterminate will be assigned to results qualified on the basis of duplicate results.

4.1.6 Method-Specific Quality Control Measures

The individual methods include method-specific QC measures. The procedures used to evaluate the results obtained for method specific quality control measures are described below. Section 4.1.6.1 describes method specific QC measure for inorganic methods and Section 4.1.6.2 describes methods specific QC measures for organic methods.

4.1.6.1 Inorganic Method Specific QC Measures

For inorganic methods, method specific QC measures may include post-digestion spikes, serial dilution tests, internal standard performance, and cation/anion balance calculation. Evaluation procedures for each of these QC measures are described below.

4.1.6.1.1 Post Digestion Spike Recovery

The analyte recoveries obtained for post-digestion spike analyses will be compared to the appropriate acceptance ranges per Section 4.1. Under some circumstances, laboratories will quantify results by the method of standard additions to compensate for low post-digestion spike recovery. In such a case, the low post-digestion spike recovery would not indicate poor accuracy. However, if the result for the sample on which the post-digestion spike analysis was performed was not obtained by the method of standard additions and the post-digestion spike recovery is outside of the acceptance limits, qualify the result for the sample on which the post-digestion spike was run based on the following guidance:

- If the recovery is $>$ the upper acceptance limit, detectable results are qualified as estimated (“J”). No action needs to be taken for non-detects.
- If the recovery is $<$ the lower acceptance limit, but $\geq 30\%$, detectable and non-detectable results are qualified as estimated (“J/UJ”).
- If the recovery is $< 30\%$, detectable results are qualified as estimated (“J”) and non-detectable results are qualified as unusable (“R”).

The data reviewer should use professional judgement in conjunction with other QC sample results, such as matrix spike recoveries, to determine the need for qualification of results for other samples (if any) associated with the post-digestion spike analysis.

A reason code of “PDS” will be assigned to all results qualified or rejected on the basis of post-digestion recoveries and the assigned bias code will reflect the inferred bias direction.

4.1.6.1.2 Serial Dilution Test

ICP serial dilutions are run to help evaluate whether or not significant physical or chemical interferences exist due to sample matrix. Serial dilution analyses are typically conducted at a frequency of 1/20 samples (one analysis per metals data package). When analyte concentrations are sufficiently high (the concentration in the original sample is minimally a factor of 50 above the instrument detection limit [IDL] or method detection limit [MDL]), the results obtained for a five fold-dilution of the original sample are compared to the original results by means of a percent difference (%D). The %D is compared to a precision acceptance limit of $\pm 10\%$. If the absolute value of the %D between the diluted and original result is $>10\%$, all results for that analyte in that sample batch are qualified as estimated (“J/UJ”).

Generally, the diluted result can be considered to be the more accurate result, as long as the diluted concentration is well above the detection limit. Therefore, the data reviewer can generally discern a potential bias direction from a comparison of the diluted and undiluted results. For example, if the diluted result is higher than the original result, the bias direction (associated with the original result) is considered to be potentially low.

A reason code of “DL” will be assigned to all results qualified on the basis of serial dilution results along with an appropriate bias code.

4.1.6.1.3 Internal Standards

Internal standards are used routinely in the analysis for metals by ICP-MS; however, internal standards may be used in the analysis of metals by ICP-ES. Internal standard recoveries for every sample and standard (as the requested level of reporting permits evaluation) will be compared to an acceptance range of 30-120%. Results associated with internal standard recoveries outside the acceptance range where the sample was not diluted and reanalyzed will be qualified as estimated (J/UJ). If upon reanalysis the internal standard recoveries are still outside the acceptance range, the results will be qualified as estimated (J/UJ).

A reason code of “IS” will be assigned to all results qualified on the basis of internal standard area counts.

4.1.6.1.4 Anion/Cation Balance

Because water is generally electrically neutral, the sum of the dissolved cation concentrations (expressed in milli-equivalents per liter) should equal the sum of the dissolved anion concentrations. For projects in which the major cations and anions are being analyzed, the data reviewer may evaluate whether there is an acceptable balance between anion concentrations and cation concentrations. It should be noted that both major cations and anions must be analyzed to

complete the anion/cation balance. In accordance with Standard Methods #1030F, the equation used to calculate anion-cation balances is:

$$\text{percent difference} = 100\% \times (\Sigma \text{cations} - \Sigma \text{anions}) / (\Sigma \text{cations} + \Sigma \text{anions})$$

Laboratory accuracy control limits for these types of analytes are typically $\pm 30\%$. This level of accuracy is considered to be fully acceptable in meeting the end use objectives of groundwater monitoring. A 30% bias in the metals analysis corresponds to an anion-cation balance percent difference of approximately 13%. Therefore, since a 30% bias is considered not to adversely affect the usability of the data, an evaluation criterion of a percent difference less than $\pm 13\%$ will be utilized for anion-cation balance evaluation. If the anion/cation balance is greater than $\pm 13\%$ the data reviewer should use professional judgement to discern likely causes of the imbalance and need for qualification of data.

4.1.6.2 Organic Method Specific QC Measures

For organic methods, method specific QC measures may include surrogate compound recovery and internal standard performance. Evaluation procedures for each of these QC measures are described below.

4.1.6.2.1 Surrogate Spike Compound Recovery

The surrogate recoveries obtained for each sample analysis for which surrogates were analyzed will be compared to the acceptance range specified in the SAP, method, or that provided by the laboratory, as appropriate (per Section 4.1). Results for analytes in the sample associated with surrogate recoveries outside the acceptance range will be qualified as follows:

- If the surrogate recovery is greater than the upper acceptance limit for any surrogate (for semivolatile organics by GC/MS, two or more surrogates in either fraction must be high), suggesting a potential high bias in reported results, all positive results for associated analytes in that sample are qualified as estimated (“J”) whereas non-detect results are considered to be acceptable for use without qualification.
- If the surrogate recovery is $<$ the lower acceptance limit but $\geq 10\%$ (for semivolatile organics by GC/MS, two or more surrogates in either fraction are out with at least one of them being less than the lower limit but $\geq 10\%$), suggesting a potential low bias in reported results, positive and nondetect results for associated analytes in that sample are qualified as estimated (“J” or “UJ”).
- If any surrogate recovery is $< 10\%$, positive results for associated analytes in that sample are qualified as estimated (“J”) whereas associated non-detect results are qualified as unusable (“R”).

It is important to note that professional judgement may be utilized in assigning data qualification especially for methods in which more than one surrogate compound is used or in which there may have been multiple reasons for qualification on an individual result, or there may have been multiple analyses of the same sample. The data review narrative will detail any instance in which professional judgement was used.

A reason code of “SUR” will be assigned to all results qualified or rejected on the basis of surrogate recoveries. An appropriate bias code will be assigned.

4.1.6.2.2 Internal Standards

The site wide SAP and/or analytical method, as appropriate (per Section 4.1) will be used to determine the QC acceptance criteria for internal standard area counts for GC/MS organic analysis. Internal standard area counts are not a direct measure of the accuracy of the analysis. Low internal standard area counts for sample analysis relative to those observed in the associated continuing calibration analysis may be indicative of low extraction or purging efficiency which decreases the analysis sensitivity (raises the detection limit). High internal standard area counts may be indicative of co-eluting interferences at the retention time of the internal standard in the sample, may be caused by a drift in detector sensitivity, or may be caused by injection of a different amount of sample extract. Co-eluting interferences to the internal standard may result in a low bias in reported results quantified by the given internal standard. Injection of a larger volume of extract would result in increased sensitivity of the analysis (lowered detection limit).

- If data validation indicates that internal standard area counts are below the lower acceptance limit, then results reported as not-detected shall be qualified as estimated (“UJ”) and results reported as detected will not require qualification since the calculation corrects for reduced extraction efficiency.
- If data validation indicates that internal standard area counts are above the upper acceptance limit, then results reported as detected or as not-detected shall be qualified as estimated (“J/UJ”).

A reason code of “IS” will be assigned to all results qualified on the basis of internal standard area counts.

4.1.6.3 Radiological Specific QC Measures

For radiological methods, method specific QC measures may include sample specific chemical recovery 4.1.6.3.1.

Sample Specific Chemical Recovery (radiological methodologies)

Laboratory performance on individual sample analyses subject to chemical process and separation is established by means of spiking with tracer quantities of other radioisotopes of the same element or carrier quantities of the inactive isotope of the same or a chemically similar element. All samples are spiked prior to preparation. The evaluation of these spikes is not necessarily straightforward, because the sample matrix may produce interferences which are outside the control of the laboratory.

While professional judgment will be used to evaluate the results obtained for sample-specific chemical recovery, the following qualification strategy may be used for results whose quantitation does not include correction for the low recoveries:

- For recoveries between 50 and 120 percent, the data are acceptable for use without qualification.

- For recoveries between 20 and 50 percent and 120 and 150 percent, associated results may be qualified as estimated (J).
- For recoveries greater than 150 percent or less than 20 percent, associated results may be qualified based on professional judgment as estimated (J) or unusable (R).
- If the calculation includes correction for low recoveries, the following strategy may be used:
 - For recoveries between 10 and 120 percent, the data are acceptable for use without qualification.
 - For recoveries between 5 and 10 percent and 120 and 150 percent, associated results may be qualified as estimated (J).
 - For recoveries greater than 200 percent or less than 5 percent, associated results may be qualified as unusable (R).

Any use of professional judgment will be explained in the data validation report.

4.1.6.4 Balance of Total versus Partial Analyses

Results for the total analysis of a particular analyte should be greater than the results for a partial analysis of that analyte. For example, the results for total metals should be greater than or equal to the results for dissolved metals and ammonia concentrations should not be greater than Total Kjeldahl Nitrogen (TKN) concentrations. Because all results are limited by the accuracy of the analysis, the criteria for accuracy of the analysis are used as the basis for criteria to evaluate the agreement between the results for the partial analysis and the total portion.

- In instances where the value for a partial analysis exceeds that for a total analysis and both of the results are $>5xRL$, the criterion utilized is that the two values should agree within $\pm 30\%$. For example, the partial analysis result should not be more than 30% higher than the total analysis result.
- In instances where the value for a partial analysis exceeds that for a total analysis and either of the results is $\leq 5xRL$, the absolute difference between the results is compared against an evaluation criterion of $\pm 2x RL$.

All evaluations are done using the higher RL and the RL is used for calculating the absolute difference for nondetect results. If the results for the partial versus total analyses do not satisfy the appropriate evaluation criterion, when the result for partial analysis was greater than that for the total analysis, the reviewer should use professional judgment to discern the probable cause and need for qualification of the data.

A reason code of “TvP” will be assigned to results qualified as estimated based on the comparison of the results for a total analysis and its corresponding partial analysis.

Standard Uncertainty (radiological parameters)

In addition to criteria for individual measures of accuracy and precision, the data will be evaluated against a criterion for “total” or standard uncertainty. To evaluate the standard uncertainty, one must first choose the measure of accuracy and precision for a given set of

samples that will be used in the calculation. If an MS measurement has been made on a site sample of similar matrix, then the MS result will be used as the contributing accuracy QC measure. If such a matrix-specific number is not available, then the Laboratory Control Sample (LCS) results will be used. If no LCS is available, then the calibration verification or calibration check analyses will be used. For precision, the duplicate measurements on the sample performed by the laboratory will be used.

A standard uncertainty (SU) value will be calculated for each batch of samples analyzed. The standard uncertainty will be calculated using the equation shown below. This equation is modified after Equation 19.4 of the MARLAP manual (USEPA et al. 2004).

$$SU(\%) = \sqrt{\left(\frac{1}{n(n-1)}\right) \left[(A - Ec_{ms})^2 + (P - Ec_p)^2 \right]} * 100$$

where:

Ec_{ms} = counting error (square root of the number of counts or half the 2 sigma error)

Ec_p = square root of the sum of squares of the duplicate counting errors

A = measured accuracy

P = measured precision

n = 2

For example, if the MS recovery is 80 percent ($A=0.2$), the duplicate RPD is 22 percent ($P=0.22$), and the 1 sigma counting error for the MS sample is 0.8 mg/kg for a reported concentration of 4 mg/kg ($Ec_{ms} = 0.2$). Additionally, the counting error for the first sample used for the duplicates analysis is 1.1 for a reported concentration of 5 mg/kg and the counting error for the second sample used for the MS was 1.3 mg/kg for a reported concentration of 4 mg/kg, then

$$Ec_p = \frac{\sqrt{(1.1)^2 + (1.3)^2}}{(5+4)} = 0.38$$

Thus, calculated standard uncertainty is:

$$SU(\%) = \sqrt{\left(\frac{1}{(2(2-1))}\right) \left[(0.2 - 0.2)^2 + (0.22 - 0.38)^2 \right]} * 100 = 11\%$$

Thus, for standard uncertainty, if A and P are small compared to Ec , then the standard uncertainty value calculated will be close to Ec . Conversely, if A and P are large compared to Ec , then a typical error value is calculated.

For sample batches whose calculated standard uncertainty is greater than 50 percent, each sample within the batch will be qualified as estimated (J).

4.1.7 Field Quality Control Samples

The types of field quality control samples that will be collected under this SAP include field duplicates, rinsate blanks, field blanks, and trip blanks. The evaluation for each type of field quality control sample is described below.

4.1.7.1 Field Duplicate Agreement

Field duplicate sample results will be used as an indication of overall precision (i.e., field and laboratory precision) and/or the representativeness of the samples to the medium sampled.

Results for radiochemical activity in field duplicate samples will be reviewed by evaluating differences in results relative to the two sigma counting error (uncertainty) for each result, as reported by the laboratory. The difference between the field duplicate result and the field original result is compared against a laboratory reported uncertainty (2 sigma counting error) for each sample result. If one of the field duplicate pair is nondetect (with no uncertainty reported), the uncertainty is calculated as if equal to that of the positive result. Field duplicate sample results differing from the field original results by a magnitude more than the combined uncertainty for both the field original and field duplicate results (i.e., DER greater than 1) will be discussed in the data validation report.

For non-radiological parameters, analytical results obtained for field duplicate sample pairs are compared to each other using the concentration dependent criteria described below.

- When both the sample and duplicate values are $>5xRL$, acceptable sampling and analytical precision is indicated by an RPD between the results of $\leq 30\%$ ($\leq 50\%$ for soil samples).
- Where the result for one or both analytes of the field duplicate pair is $<5xRL$, satisfactory precision is indicated if the absolute difference between the field duplicate results is $<2xRL$ ($<3.5xRL$ for soil samples).

All evaluations are done using the higher RL and the RL is used for calculating the absolute difference for nondetect results. If the above criteria are not met for an analyte, all associated sample data for that analyte should be qualified as estimated (J/UJ).

A reason code of “FD” will be assigned to results qualified as estimated on the basis of field duplicate agreement.

4.1.7.2 Rinsate Blank Results

The results for rinsate blanks reported in the data package will be reviewed. Sample results for analytes detected in an associated rinsate blank at concentrations $<5x$ the equivalent blank concentration ($<10x$ for common laboratory contaminants) will be qualified as nondetect (“U”). The result will be qualified as nondetect at the reported concentration if the reported concentration is $>RL$ or as nondetect (U) at the RL if the reported concentration is $<RL$.

For aqueous blanks applied to soil/sediment samples, qualification is assigned based on comparison of the sample result to the equivalent concentration in the blank. The equivalent concentration is determined by assuming that all of the analyte present in the blank aliquot analyzed is present in the soil sample aliquot analyzed. The reviewer should note that the blank analyses may not involve the same weights, volumes, or dilution factors as the associated

samples. These factors must be taken into consideration when applying the 5x or 10x criterion, such that a comparison of the total contamination is actually made.

A reason code of “RB” will be assigned to all results qualified on the basis of rinsate blank results. A bias code of indeterminate will be assigned.

4.1.7.3 Field Blank Results

The results for field blanks reported in the data package will be reviewed. Sample results for analytes detected in an associated field blank at concentrations <5x the equivalent blank concentration (<10x for common laboratory contaminants) will be qualified as nondetect (U). The result will be qualified as nondetect at the reported concentration if the reported concentration is >RL or as nondetect (U) at the RL if the reported concentration is <RL.

For aqueous blanks applied to soil/sediment samples, qualification is assigned based on comparison of the sample result to the equivalent concentration in the blank. The equivalent concentration is determined by assuming that all of the analyte present in the blank aliquot analyzed is present in the soil sample aliquot analyzed. The reviewer should note that the blank analyses may not involve the same weights, volumes, or dilution factors as the associated samples. These factors must be taken into consideration when applying the 5x or 10x criterion, such that a comparison of the total contamination is actually made.

A reason code of “FB” will be assigned to all results qualified on the basis of rinsate blank results. A bias code of indeterminate will be assigned.

4.1.7.4 Trip Blank Results

The results for trip blanks reported in the data package will be reviewed. Sample results for analytes detected in an associated trip blank at concentrations <5x the equivalent blank concentration (<10x for common laboratory contaminants) will be qualified as nondetect (U). The result will be qualified as nondetect at the reported concentration if the reported concentration is >RL or as nondetect at the RL if the reported concentration is <RL.

For aqueous blanks applied to soil/sediment samples, qualification is assigned based on comparison of the sample result to the equivalent concentration in the blank. The equivalent concentration is determined by assuming that all of the analyte present in the blank aliquot analyzed is present in the soil sample aliquot analyzed. The reviewer should note that the blank analyses may not involve the same weights, volumes, or dilution factors as the associated samples. These factors must be taken into consideration when applying the 5x or 10x criterion, such that a comparison of the total contamination is actually made.

A reason code of “TB” will be assigned to all results qualified on the basis of rinsate blank results. A bias code of indeterminate will be assigned.

4.1.8 Reporting Limits

The contracted laboratories are reporting positive results below their standard reporting limits (RLs) when the values are greater than the instrument detection limit (IDL) or method detection limit (MDL). These detection and/or reporting levels and associated degree of uncertainty are discussed below.

The MDL is defined in 40CFR136, Appendix B as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is determined from the analysis of spiked samples containing the analyte in a given matrix. MDLs are preparation- and method-specific. The MDL is calculated by multiplying the standard deviation of the measurements by the student t-value for seven replicate analyses (i.e., 3.14).

At the MDL, results may have a high degree of uncertainty in the actual concentration (often more than 100%). Results reported as detected at the IDL may also have about a 50% chance of being nondetects (i.e. false positives meaning that the true sample concentrations are less than the IDL or MDL).

RLs or Practical Quantitation Limits (PQLs) are typically set at some factor above the IDL or MDL to ensure greater confidence in the accuracy of the associated quantitative value. Thus, at the RL (or PQL), a value typically set at 3-10 times the IDL or MDL, the degree of uncertainty would be more like +/- 25%. Thus, the PQL is the smallest concentration of the analyte that can be reported with a specific degree of confidence (i.e., the low concentration point of the calibration curve is less than or equal to the RL/PQL). When the RL/PQL is adjusted for sample weight, percent moisture, and dilution factor for individual samples, the result is a sample-specific quantitation limit or SQL.

To reflect the higher degree of uncertainty associated with values reported between the IDL/MDL and RL/PQL, these results are qualified as estimated (“J”). A qualifier code of SQL, denoting sample quantitation limit, is assigned to results qualified for this reason. A bias direction of indeterminate is assigned.

4.1.9 Other Items Identified in the Case Narrative

If an issue identified in the case narrative is not covered by the subsections above and is found to potentially adversely affect data quality, the data reviewer shall evaluate the problem based on SAP and/or method requirements, as applicable. If the SAP and/or analytical method does not specify requirements related to the criterion under evaluation, the data reviewer should utilize professional judgement to evaluate the effect of the reported item or condition on the associated analytical data. All uses of professional judgement shall be described in the report of the data validation process.

4.1.10 Completeness of the Data Package

The analytical data packages are evaluated for completeness of deliverables against the following criteria:

- Presence of tabulated results for all specified compounds identified and quantified and RLs for all analytes.
- Presence of results for all methods requested on the COC forms for each sample.
- Presence of a case narrative, COC forms, and the sample receiving forms.
- Presence of: QC summary forms for blank results; QC summary forms for MS results with calculated percent recoveries; QC summary forms for post-digestion spike recoveries (as required) with calculated percent recoveries; QC summary forms for laboratory duplicates

and/or spike duplicate results and calculated RPDs; QC summary forms for serial dilution test with calculated %Ds; and QC summary forms for LCS sample results with calculated percent recoveries.

- When full data packages are requested, the package will also be reviewed for QC summary forms for initial and continuing calibration verification as well as supporting raw data for all of the aforementioned items and any pertinent review parameter discussed in Section 4.2.

Data package deliverables that do not meet the above criteria are documented, and the missing deliverables will be requested from the contracted laboratory. Any documents not obtainable from the laboratory are noted in the data review narrative.

4.2 REVIEW OF LABORATORY PERFORMANCE PARAMETERS

The review of laboratory performance parameters includes evaluating operations that are in the control of the laboratory, but are independent of the field samples being analyzed. Evaluation of these parameters provides an overall representation of the analytical system at the time of analysis. For data, laboratory performance parameters will be reviewed for 10% of the data packages received per analysis type per sampling event/episode. If review of any of the laboratory performance parameters indicates a systematic problem may exist, that review parameter will be evaluated for all data packages from that laboratory for that sampling event/episode.

Each of the subsections below describes in general how each laboratory performance parameter is evaluated. As noted in the introduction to Section 4, the hierarchy for criteria used to evaluate each parameter is as follows. A parameter is first evaluated against the requirements set forth in the SAP. If the SAP does address that parameter, the parameter is evaluated against the requirements stated in the analytical method. If the method does not specify acceptance criteria, results for the parameter are compared to acceptance ranges based on laboratory historical data.

While conducting the review described below, the data reviewer will evaluate whether the case narrative adequately summarizes all issues potentially affecting data quality (i.e., is the case narrative a reliable indicator of potential problems within the entire data package?). This assessment will be used to determine the need to evaluate specific laboratory performance parameters for the entire data set rather than just the predetermined portion of the data set (i.e., 10%).

4.2.1 Initial Calibration

The requirements set forth in the SAP and/or method, as applicable, will be used to evaluate whether:

- The initial calibration was performed at the required frequency using the proper number of standards at the proper concentrations,
- Whether the RL or CRQL is supported by the low point standard,
- Whether adequate response was obtained for each analyte for each standard,
- Whether the applicable linearity criteria were met, and

- Whether the initial calibration was verified properly.

If the initial calibration evaluation criteria for any analyte are not satisfied, then all results for that analyte associated with the initial calibration will be qualified as estimated (“J/UJ”). A reason code of “ICAL” or “ICV” will be used depending on whether the condition was due to the initial calibration or verification of the initial calibration. If the data reviewer can discern a probable magnitude and/or direction of bias to the associated sample results based on the information provided, then appropriate qualifier bias codes will be assigned.

4.2.2 Continuing Calibration Verification

The requirements set forth in the SAP and/or method, as applicable, will be used to evaluate whether:

- The continuing calibration verification was performed at the required frequency using the proper standard at the proper concentration,
- Whether adequate response was obtained for each analyte, and
- Whether the responses obtained indicate that the instrumentation is still operating within an acceptable range (drift).

If the continuing calibration evaluation criteria for any analyte are not satisfied, then all results for that analyte associated with the continuing calibration will be qualified as estimated (“J/UJ”). A reason code of “CCV” or “CCAL” will be used for inorganic and organic methods, respectively. If the data reviewer can discern a probable magnitude and/or direction of bias to the associated sample results based on the information provided, then appropriate qualifier bias codes will be assigned.

4.2.3 Laboratory Control Sample Analysis

Laboratory control samples (LCSs) are “clean” well-characterized samples used to monitor the laboratory's day-to-day performance of routine analytical methods. LCSs are prepared by spiking samples of a “clean” matrix with known amounts of target analytes and then processing the sample in the same fashion as all other samples. LCSs are used to monitor the accuracy and precision of the analytical process independent of matrix effects. The accuracy of the analytical process is evaluated using the calculated percent recoveries (%Rs) of the spiked analytes.

The reviewer will verify that all target analytes were spiked into the LCS sample. The LCS percent recoveries will then be compared to the acceptance limits in the SAP, method, or laboratory historical limits (if the laboratory acceptance limits are considered to be comparable to those specified in the methods), as applicable.

- If the LCS recovery for an analyte is greater than the upper acceptance limit, suggesting a potential high bias in reported results, all positive results for that analyte in all associated samples will be qualified as estimated (“J”) whereas nondetect results will be considered acceptable for use without qualification because the high bias does not affect nondetect results.

- If the LCS recovery for an **inorganic** analyte is less than the lower acceptance limit but $\geq 30\%$, suggesting a potential low bias in reported results, positive and nondetect results for that analyte in all associated samples will be qualified as estimated (“J” or “UJ”).
- If the LCS recovery for an **inorganic** analyte is $< 30\%$, positive sample results will be qualified as estimated (“J”), whereas nondetect results will be qualified as unusable (“R”) for all associated sample results.
- If the LCS recovery for an **organic** analyte is less than the lower acceptance limit but $\geq 10\%$, positive and nondetect results for that analyte in all associated samples will be qualified as estimated (“J” or “UJ”).
- If the LCS recovery for an **organic** analyte is $< 10\%$, positive sample results will be qualified as estimated (“J”) whereas nondetect results will be qualified as unusable (“R”) for all associated sample results.

In the case of unacceptably low LCS recoveries, the reviewer will verify that the laboratory re-prepared and re-analyzed all associated samples, including the LCS and that acceptable results were obtained for the new LCS.

A reason code of “LCS” will be assigned to all results qualified as estimated or rejected on the basis of LCS recoveries.

4.2.4 Compound Identification

For 10% of the results reported in the data packages under going an evaluation of laboratory performance parameters, the reviewer will verify that results positively identified meet all identification acceptance criteria as specified in the SAP and/or analytical method. In addition, the reviewer will examine the data for false negative results.

For organics, this may encompass comparing retention times against retention time windows, evaluating the agreement between dual column confirmation results, comparing relative retention times (RRTs) for samples to RRTs for standards, and comparison of mass spectral data to reference spectra, depending on the analytical technique employed (note: this listing is not all inclusive).

For inorganic methods, compound identification is generally not reviewable from the data packages. However, for some methods, there are items the reviewer can check such as comparing the %RSDs for replicate measurements to a method specific criterion and that target analytes elute in the proper order and expected retention time.

4.2.5 Target Analyte Quantification

The reviewer will verify that reported sample concentrations can be recalculated from the raw data for 10% of the reported sample results in the data packages under going an evaluation of laboratory performance parameters. The reviewer will verify that reported results were calculated using the proper signal response for the sample, calibration factor or relative response factor, internal standard response, dilution factor, internal standard concentration or mass, percent solids, sample weights or volumes, final extract volume, etc. as applicable to the analytical method.

If errors are found in the reported sample results, the laboratory will be contacted and corrected results will be requested. The data review narrative will detail any such instances and the resultant resolution. The reviewer will collate the revised data into the data package and mark the all revised and all superseded data accordingly.

In some cases, multiple analyses for the same sample may be reported. The multiple analyses may be due to high target analyte concentrations that necessitate dilutions, interferences, or QC failures (e.g. low surrogate recoveries). When there is more than one set of data reported for a sample, the reviewer will need to select the best set of data to report based on all of the supporting QC information. This may involve selecting results from each of the multiple analyses. The data review narrative will detail the results selected for reporting and the supporting rationale. The data sheets will be marked to indicate which results were selected for reporting and which were not.

4.2.6 Radionuclide Quantitation and Implied Detection Limits

The raw data will be reviewed to ensure that the reported quantitation results are accurate and that the required detection limits were met.

Radionuclide activities must be calculated according to the appropriate procedures specified in the analytical methods. Detection limits specified in the SAP must be met unless other detection limits are approved or the nature of the sample matrix precludes attaining the detection limit in the SAP. For example, the high solids content of the formation waters that will be analyzed may not allow the detection level for gross alpha to be achieved. Analytical uncertainties must be reported with all results, regardless of the sign or size of the result. The reported uncertainty must include all uncertainties associated with the analysis. If the reported uncertainty only includes counting uncertainty, this fact must be documented in the case narrative.

For solid samples, a minimum of 100 grams must be homogenized prior to subsampling an aliquot for analysis. Homogenization of the entire sample is recommended for all samples and is required for liquid samples with more than one phase. The minimum homogenized sample aliquot size used for analysis must be 1 gram for dry solids or 1 milliliter for liquid samples, although further dilution may be performed after chemical dissolution or extraction.

The reviewer will review the raw data to verify the correct calculation of sample results reported by the laboratory. The reviewer will recalculate a minimum of one sample result for each matrix. The reviewer will verify that there are no transcription or reduction errors (e.g., dilutions, percent solids, sample weights) on one or more samples. The reviewer will verify that all analytical uncertainties have been propagated and reported or otherwise documented. The reviewer will verify that appropriate aliquot sizes have been used for sample preparation and mounting.

The reviewer will check the detection limits by verifying that, for blanks and other samples with uncertainties greater than the result, the 2 standard deviation uncertainty multiplied by 1.65 is less than or equal to the specified detection limit.

If errors are found in the calculations, the laboratory will be contacted to resolve the problem. Professional judgment will be used to assign data qualification.

If inappropriate sample sizes are used, all associated results will be qualified as estimated values (J).

Net negative results at a frequency more than that expected from a 2 standard deviation uncertainty that have combined uncertainties smaller than the absolute values of the negative results may be an indication of improper blank subtraction or measurement error. In such cases, the data reviewer will contact the laboratory to determine the root cause of the error and whether the raw data can be re-processed to correct the problem. If contact with the laboratory is unable to resolve the problem, data associated with this condition may be qualified as unusable (R) or estimated (J) depending on the magnitude of the potential error taking into consideration project objectives.

If detection limit requirements were not met, the cause will be investigated. The effect on data usability will be evaluated and documented in the data validation report.

If analytical uncertainties are not reported for radionuclides and they cannot be obtained from the laboratory, the associated results will be qualified as unusable (R).

If any discrepancies are found, the reviewer may contact the laboratory to obtain additional information. If a discrepancy cannot be resolved, the data reviewer will use professional judgment to determine if data qualification is warranted. All uses of professional judgment will be documented in the data validation report.

4.2.7 Chemical Separation Specificity (radiological analyses)

For analytes that are chemically separated prior to analysis (e.g., alpha speciation by spectroscopy), the chemical separation specificity will be evaluated. Chemical separation specificity evaluates the laboratory's ability to chemically separate various isotopes with similar chemical properties. There should be no radionuclides that interfere with the quantitation of the radionuclide of interest once the chemical separation process has been completed.

For example, the chemical separation specificity can be verified for alpha spectroscopy measurements by observation of the alpha energy spectrum. Thus, for alpha spectroscopy, the reviewer will check that the energy of the observed peak of interest is within 40 kilo electron volts (keV) of the energy for the radionuclide of interest. The reviewer will also check the energy spectra for any peaks that overlap or that have associated peaks that may interfere with the peak radionuclide of interest. Lastly, if interfering radionuclides are present and can be corrected from associated peaks in the spectrum, the reviewer will check to see if the peak area for the radionuclide of interest has been properly corrected.

Data will be qualified as nondetect (U) if the energy of the peak of interest is more than 40 keV from the energy of the radionuclide of interest and no other peaks are found within 40 keV. Results will be qualified as unusable (R) or estimated (J) if the energy spectrum contains any peaks that overlap with or have associated peaks that may interfere with the peak of the radionuclide of interest and it is impossible to correct for the interference, or if the results have not been properly corrected for the interfering radionuclide. The reviewer will use professional judgment in choosing the proper qualifier dependent on the magnitude of the potential interference relative to project objectives.

4.2.8 Verification

The reviewer will verify that information reported on the summary forms was calculated properly and that the results are traceable back to the raw data. In addition, the reviewer may also verify that all spike solutions and standards were used within their recommended shelf lives.

If errors are found in the reported sample results, the laboratory will be contacted and corrected results will be requested. The data review narrative will detail any such instances and the resultant resolution. The reviewer will collate the revised data into the data package and mark all revised and all superseded data accordingly.

4.2.9 Method Specific Quality Control Checks

The supporting QC data will be reviewed to evaluate if the method-specific QC checks were conducted and whether the method-specified acceptance criteria were met. The table below summarizes the method specific QC checks typical of each analytical technique. The reviewer will consult the SAP and analytical method for evaluation criteria used to evaluate method-specific QC checks.

QC Check	ICP-ES	ICP-MS	Wet Chemistry	GC	GC/MS	HPLC
Tuning		✓			✓	
Interference Check Sample	✓	✓				
Thermal Stability		✓				
Spectral Resolution		✓			✓	
Mass Calibration		✓			✓	
Chromatography			✓	✓	✓	✓

ICP-ES = Inductively coupled plasma atomic emission spectroscopy.

ICP-MS = Inductively coupled plasma mass spectroscopy.

GC = Gas chromatography.

GC/MS = Gas chromatography mass spectroscopy.

HPLC = High pressure liquid chromatography.

5.0 DOCUMENTATION

This section describes the documentation that will be generated as part of the data review procedure. Section 5.1 describes data review worksheets which are generic tools the validator may elect to use to facilitate the review. All data validation results will be documented in a narrative report. Section 5.2 describes the contents of the resultant data validation reports.

5.1 DATA REVIEW WORKSHEETS

Figures 1 and 2 provide generic data review worksheets for the sample-specific criteria and laboratory performance criteria reviews, respectively, which may be used to facilitate the data review process. These forms are intended to be used as general guides for each of the parameters requiring evaluation under each type of review; use of these forms is not mandatory.

Due to space limitations and the number of analytical methods, the specific evaluation criteria are not included in the tables. The SAP and/or analytical methods should be consulted for specifications of all pertinent evaluation criteria. The data reviewer may choose to jot these criteria on the forms in the column titled “criteria.” A separate form may be completed for each method. Additional pages may be added as necessary to detail all aspects of the data review.

5.2 DATA REVIEW NARRATIVE REPORTS

All data review activities will be detailed in a data validation narrative report. At a minimum, the report will include an introduction (Section 1), a summary of the data review process (Section 2), data review narratives for the review of laboratory performance parameters (Section 3), data review narratives for the review of sample-specific parameters conducted on each package (Section 4), and an overall assessment of the data (Section 5). The overall assessment will state any limitations to the usability of the data as well as address the quantitative and qualitative data quality indicators of sensitivity, accuracy, precision, completeness, representativeness, and comparability. All data review reports will be peer reviewed by a qualified person to assure compliance with the procedures described in this SOP.

TABLE 1
DATA VALIDATION QUALIFIER DEFINITIONS

QUALIFIER	DEFINITIONS ^{1,2}
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numeric value is the approximate concentration of the analyte in the sample (i.e., estimated value).
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification.”
NJ	The analysis indicates the presence of an analyte that has been “tentatively identified” and the associate numerical value represents its approximate concentration.
R	The data are unusable and have been rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte can not be verified.

¹ USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, July 2002.

² USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, October 1999.

TABLE 2
DATA VALIDATION QUALIFIER REASON AND BIAS DIRECTION CODES

Qualifier Code	Data Quality Condition Resulting in Assigned Qualification
General Use	
HT	Holding time requirement was not met
P	Preservation requirement(s) not met
MB	Method blank or preparation blank contamination
LCS	Laboratory control sample evaluation criteria not met
MS	Matrix spike and/or matrix spike duplicate accuracy evaluation criteria not met
D	Duplicate or spike duplicate precision evaluation criteria not met
FB	Field blank contamination
RB	Rinsate blank contamination
FD	Field duplicate evaluation criteria not met
TvP	Partial analysis results greater than total analysis results; difference is greater than accuracy limitations of the method
ID	Target compound identification criteria not met
IS	Internal standard evaluation criteria not met
CO	Suspected carry-over
SQL	Reported sample concentration is between the method detection limit and the sample quantitation limit.
RL	Reporting limit exceeds decision criterion (for nondetects)
LR	Over linear range without re-analysis
Inorganic Methods	
ICV	Initial calibration verification evaluation criteria not met
CCV	Continuing calibration verification evaluation criteria not met
CCB	Continuing calibration blank contamination
ICS	Interference Check Sample evaluation criteria not met
PDS	Post-digestion spike recovery outside acceptance range
MSA	Method of standard additions correlation coefficient < 0.995
DL	Serial dilution results did not meet evaluation criteria
Organic Methods	
TUNE	Instrument performance (tuning) criteria not met
ICAL	Initial calibration evaluation criteria not met
CCAL	Continuing calibration evaluation criteria not met
SUR	Surrogate recovery outside acceptance range
Bias Codes	
	Bias Direction
H	Bias in sample result likely to be high
L	Bias in sample result likely to be low
I	Bias in sample result is indeterminate

Figure 1: Data Review Worksheet for Sample-Specific Parameters

Data Package _____ Lab _____

Date _____ Matrix _____ Sampling Event _____

Case Narrative Comments: _____

Parameter	Criteria	Criteria Satisfied?	Details	Actions (qualified data)
COC and Sample Receipt		Y N NA		
Holding Times		Y N NA		
Method Blank		Y N NA		
Matrix QC*	(Field ID or Batch QC?)			
<ul style="list-style-type: none"> • MS • MS/MSD • LD 		Y N NA Y N NA Y N NA		
Method QC*				
<ul style="list-style-type: none"> • Surrogates • PDS/GFAA QC • Serial Dilution • Internal Standards • Total vs. Partial • Cation/Anion Balance 		Y N NA Y N NA Y N NA Y N NA Y N NA Y N NA		
Field QC*	(Field ID)			
<ul style="list-style-type: none"> • Field Duplicate • Rinsate Blank • Field Blank • Trip Blank • Other (e.g., splits) 		Y N NA Y N NA Y N NA Y N NA Y N NA		

Parameter	Criteria	Criteria Satisfied?	Details	Actions (qualified data)
Other review parameters evaluated based on case narrative comments or review of laboratory performance parameters		Y N NA		

* As applicable to the method.

Completeness of the package: _____

Additional Comments/Concerns: _____

General Overall Assessment:

_____ Data are usable without qualification.

_____ Data are usable as qualified (detailed in narrative).

_____ Some or all data are unusable for any purpose (detailed in narrative).

Figure 2: Data Review Worksheet for Laboratory Performance Parameters

Data Package _____ **Lab** _____
Date _____ **Matrix** _____ **Sampling Event** _____

Parameter	Criteria	Criteria Satisfied?	Details	Actions (qualified data)
Initial Calibration <ul style="list-style-type: none"> Number/Conc. of points Low standard vs. RL Goodness of Fit Analytical sequence 		Y N NA Y N NA Y N NA Y N NA		
Initial/Continuing Calibration Verification <ul style="list-style-type: none"> Adequate frequency? Adequate recovery? Stability of CFs/RRFs? Replicate agreement? 		Y N NA Y N NA Y N NA Y N NA		
Laboratory Control Sample <ul style="list-style-type: none"> Second source? Adequate recovery? Replicate agreement? 		Y N NA Y N NA Y N NA		
Compound Identification <ul style="list-style-type: none"> RTs or RRTs Second Column Conf. Mass Spectrum 		Y N NA Y N NA Y N NA		
Quantification Were the proper internal standards and response factors used, as applicable? Are reported sample results adjusted for? <ul style="list-style-type: none"> DFs Sample Size Dry Weight Agreement between replicate instrument measurements?		Y N NA Y N NA Y N NA Y N NA Y N NA		
Verification <ul style="list-style-type: none"> CFs/RRFs calculated properly? %Rs calculated properly? %Ds calculated properly? Transcription errors? 		Y N NA Y N NA Y N NA Y N NA		
Method Specific QC <ul style="list-style-type: none"> Thermal Stability Tuning Resolution Mass Calibration ICS 		Y N NA Y N NA Y N NA Y N NA Y N NA		

Attachment C – EDD Format

EDD Structure for Prather Springs Site Investigation Analytical Data

Each project EDD should be a Microsoft Access 2000 database with a single table called Lab_Results. The table has one row of data for each analyte in each sample. The structure of the table is as follows:

FIELD NAME	Data Type	Description
FIELD_SAMP_ID *	Text (30)	Field Sample Identification (used on the COC)
LAB_SAMP_ID	Text (20)	Laboratory Sample Identification
COLLECTION_DATE	Date/Time	Date and time of sample collection
RECEIVED_DATE	Date/Time	Date and time that sample was received by laboratory.
EXTRACTED_DATE	Date/Time	Date and time of laboratory sample extraction for this Field_Samp_ID, Analytical_Method, Analyte, and RUN_NUMBER.
ANALYTICAL_DATE	Date/Time	Date and time that this Field_Samp_ID, Analytical_Method, Analyte, and Run_Number was analyzed by the laboratory.
ANALYTICAL_METHOD *	Text (50)	Analytical Method – See table (Lookup_Analytical_Method) for valid values.
SAMP_FRACTION	Text (1)	Fraction of sample analyzed T Total D Dissolved
EXTRACTION_METHOD	Text (7)	Code for method used to prepare or extract a sample. If no extraction method, value should be “NONE”
ANALYTE*	Text (75)	Analyte – See table (Lookup_Analyte) for valid values.
RUN_NUMBER*	Number	This field permits the numerical coding of multiple or repeat analyses of a sample (one Lab_Samp_ID) by the same analytical method.
MATRIX	Text (2)	Sample matrix type. – See table (Lookup_Matrix) for valid Values
CONC	Number (Double)	Concentration of the Analyte expressed in Units. Conc = “0” if PARVQ = “ND”
PRECISION	Number (Integer)	Number indicating the precision (number of digits after the decimal point) that applies to the reported CONC, MDL, and RL fields.
RL	Number (Double)	Concentration of Reporting Limit (also known as quantitation limit) in UNITS.
MDL	Number (Double)	The concentration of Method Detection Limit in UNITS.
UNITS	Text (10)	Concentration units used in CONC, RL and MDL. —See table (Lookup_Units) for valid Values
DILUTION	Number (Double)	Laboratory dilution factor for CONC, RL, and MDL (No dilution = “1”).
LAB_FLAG	Text (6)	Used by the laboratory to indicate samples that may be

FIELD NAME	Data Type	Description
		affected by laboratory QA/QC issues. At a minimum, the laboratory will use this field to enter a unique flag to indicate that the associated value reported is below the RL concentration.
LAB_BATCH_NUMBER	Text (10)	Batch designator for a group of environmental samples and their associated QC samples prepared together.
BASIS	Text (1)	Basis for reporting solid sample results Wet Reported as wet weight Dry Reported as dry weight – See table (lookup_Basis) for additional valid values
METHOD_TYPE	Text (3)	Analytical suite classification – See Table (Lookup_Method_Type) for valid values.
PARVQ	Text (2)	Parameter Value Qualifier: The code identifies the qualifier of and analytical results. ND Not Detected = Value is equal to CONC – See table (lookup_PARVQ) for additional valid values
EXPECTED_VALUE	Number (Double)	Target result for field duplicates, ambient blanks, equipment blanks, and trip blanks. Value should correspond with UNITS value.
SAMP_CODE*	Text (2)	Sample type (e.g. normal environmental, duplicate, blank, spike, etc...). – See table (Lookup_Sample_Code) for valid values
LAB_BATCH_NUMBER	Text (10)	Batch designator for a group of environmental samples and their associated QC samples analyzed together.
LAB_CODE	Text (4)	Code for analytical laboratory performing analyses – see table (Lookup_Lab_Code) for valid values

Fields marked with “*” are primary key fields; each row must have a unique combination of values for these five fields. (FIELD_SAMP_ID , ANALYTICAL_METHOD , ANALYTE, RUN_NUMBER, and SAMP_CODE)

The laboratory MUST populate the ANALYTICAL_METHOD, EXTRACTION_METHOD, BASIS, ANALYTE, MATRIX, UNITS, METHOD_TYPE, PARVQ, SAMP_CODE, and LAB_CODE fields with valid values from tables in our database. Those tables are included in EDDtemplate.mdb.

If there is information in the EDD that is not in a lookup table (i.e., the LABCODE value for the analytical laboratory), the e-mail submittal should include information notifying the data manager.



TECHNICAL MEMORANDUM

TO: Adell Heneghan, P.E., Marathon Oil Company **DATE:** July 10, 2008
FR: Randy March, P.E., P.G., Golder Associates Inc. **OUR REF:** 083-81544A.0001
RE: **ADDENDUM TO PHASE I SITE INVESTIGATION WORK PLAN – PRATHER
SPRING INVESTIGATION**

This document is issued as an Addendum to the above-referenced work plan, which was submitted to the Colorado Oil and Gas Conservation Commission (COGCC) on July 7, 2008. Companies involved in the Prather Spring investigation propose that the investigative scope of work be expanded to include water quality sampling at the following locations.

1. **Prather Spring** (located approximately 0.25-miles upstream from Ned Prather's hunting cabin)
2. **Ned Prather's Cabin** (samples will be collected from the kitchen faucet, and will be indicative of the potable water provided to the cabin from the recently installed water tank)
3. **Spring #2** (located south and west of Ned Prather's cabin)
4. **Dick Prather's Cabin** (this faucet is fed by a third spring)
5. **Stock Pond** (located immediately downstream from Ned Prather's cabin)
6. **Stock Pond Discharge** (downstream from the Stock Pond at the road crossing)
7. **Stock Tank** (piping to this tank is fed by a fourth spring located north of Ned Prather's cabin)
8. **Prather Stream Upgradient** (the stream will be sampled between the Prather Spring and Ned Prather's cabin)
9. **Prather Stream Downgradient** (the stream will be sampled between the Stock Pond and Dick Prather's Cabin)
10. **McKay Gulch** (the stream will be sampled downstream from Dick Prather's cabin)

The intent of this supplemental sampling program is to allow evaluation of water quality trends, with the ultimate objective of protecting human health and the environment. To this end, these locations

TECHNICAL MEMORANDUM

Marathon Oil Company
Adell Heneghan

-2-

July 10, 2008
083-81544A

will be sampled twice weekly for volatile organic compounds (VOCs) using USEPA SW846 Method 8260. This VOC water quality sampling program will continue for four weeks or until the source of contamination is determined, whichever occurs first. Subsequent sampling would be as agreed upon by COGCC following source determination or after four weeks of sampling.

This supplemental sampling program will be implemented in accordance with investigative elements described in the work plan, including the following:

- Field QA/QC sampling, as described in Section 2.3;
- Equipment decontamination, as described in Section 2.6;
- Analytical laboratory testing, as described in Section 3.0;
- Analytical methods, as described in Section 3.1;
- Laboratory coordination, as described in Section 3.2;
- Data deliverables, as described in Section 3.3; and
- Data management, as described in Section 3.4.

It is proposed that this supplemental water quality sampling program be initiated the week of July 14, 2008, and that the resulting analyses be submitted to COGCC weekly.

**Phase I Site Investigation – Prather Spring
Phase 1 Joint Workplan Addendum #2
For Groundwater, Surface Water and Spring Sampling**

1.0 Introduction

This addendum to the Joint Workplan describes groundwater, surface water, and seep/spring sample collection activities that are being conducted in support of the Phase I Site Investigation – Prather Spring. The intent of this supplemental sampling program is to allow evaluation of water quality trends to assist in the objectives of the Phase I site investigation. The overall objective of the Phase I investigation, which is presented in the Phase I Site Investigation Work Plan (Joint Workplan) (URS, 2008) is to identify the probable contamination source(s).

2.0 Sampling Locations

The groundwater, surface water and seep/spring sample locations are listed in Table 1 and are shown in Figure 1. New, additional sampling location “Spring 2 DS 100” is not shown on Figure 1, but will be included once the new location has been surveyed.

3.0 Field Procedure

Surface water and seep samples, and groundwater samples will be collected in accordance with Standard Operation Procedures (SOP) 1.0, Surface Water Sampling and Seep Sampling, and SOP 2.0 Monitor Well Groundwater Sampling, respectively. Field observations, water levels, and water quality parameters, as applicable, will be recorded on a sampling location specific field data sheet. Field data sheets for surface water and seep, and monitor well groundwater sampling activities are included in SOPs 1.0 and 2.0, respectively.

Also described in this section is the measurement of surface water and seep/spring flow.

Surface Water and Seep/Spring Sampling

A water sample will be collected using a clean (i.e., decontaminated) container (plastic or stainless steel cup or jug), if the surface water or spring location allows for submerging of the sampling device without agitating sediments that may be present. Should sampling with a container not be possible, a length of clean plastic or silicone tubing connected to a peristaltic pump will be tied to a wooden pole and the end of the tubing submerged below the water surface without agitating sediments. Water samples can either be collected in a clean container prior to placement in laboratory-provided sample bottles or placed directly into the laboratory-provided bottles from the sampling container or the end of the tubing. Water quality parameters will be measured in the spring or stream after sample collection has been completed to prevent agitating sediments prior to sample collection. Should the volume or depth of water in the spring or surface water not be sufficient to submerge a water quality instrument, water quality parameters can also be measured on

collected water in a clean plastic container. Water collected in the plastic container for water quality parameter measurement will not be used for laboratory sample analysis. Water quality parameters to be measured and recorded on a field data sheet, which is included at the end of SOP 1.0, include temperature, pH, conductivity, turbidity, dissolved oxygen, and oxidation reduction potential.

Surface Water and Seep/Spring Flow Measurements

Surface water and seep/spring flows will be measured either using the volumetric method, the flume method, or a calibrated flow meter, if a flow measurement is possible at all. The flow measurement will be completed after the water sample has been collected to avoid agitation of sediments during the flow measurement process. The volumetric method applies to water outflow from a pipe or other structure where a measuring device like a cup or jug can be placed in the water stream. For the volumetric method, a graduated cylinder, cup, or jug will be placed into the water flow and the time to fill the container to a designated marker will be measured. The flume measuring method applies to surface water flow where a flume can be placed in the flowing water. The flume will be placed level in the flowing water in a way that no water flows under, over, or around the flume. Soil from the stream can be placed around the flume to preclude water from flowing under or around the flume. After some equilibration time during which the water level builds up in the upgradient part of the flume, the reading on the flume will be recorded on the field data sheet, and later translated in a flow rate according to the manufacture's table. The flow will be documented in "gallons per minute" (gpm) on the surface water and seep sampling field data sheet, which is included at the end of SOP 1.0.

If a flow cannot be measured by either method, the surface water or seep/spring flow will be described on the field data sheet, including depth and width of the surface water, or the diameter of the outflow pipe, and the intensity of the flow. A flow estimate will be included on the field data sheet, and will be noted as such ("estimated").

Groundwater Sampling

Groundwater sampling procedures will generally follow the procedures outlined in the Joint Workplan. Depth-to-water will be measured and recorded prior to purging and sampling of the well on a sample location-specific field data sheet, which is included at the end of SOP 2.0. Groundwater purging and sampling will be conducted using either a dedicated, clean Teflon bailer, a submersible pneumatic or electrical pump, or a peristaltic pump with tubing suspended in the well to near the bottom of the well. Purging will be considered complete when either three (3) casing volumes of water have been removed, or the key indicator parameters (pH, specific conductance, temperature) have stabilized.

If a well goes dry before three casing volumes have been purged or indicator parameters have stabilized, a sample will be collected when sufficient water has recharged the well. Water quality parameters will only be measured if the well will produce sufficient water for sample collection and parameter measurement. Water quality parameters will be recorded on sample location-specific field data sheets.

Field data sheets will be copied and sent to URS on a weekly basis (Stacey_Malerba@urscorp.com) for data entry into the electronic database.

4.0 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 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[®] wash, or equivalent, 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 such a manner as to avoid subsequent contamination prior to its use at the next site.

One equipment rinse sample will be collected and analyzed. Rinse samples will be collected and analyzed for the same analytical parameters as the associated field sample that was collected with the decontaminated equipment.

5.0 Project-Derived Wastes

Project-derived wastes, groundwater from well purging and sampling, and water from decontamination will be containerized and moved to one of the companies' well pad. Other wastes generated during the project will be decontaminated and contained in plastic bags and properly disposed by the companies. Final disposition of these site investigation-generated wastes will depend upon final laboratory results and corresponding regulatory standards.

6.0 Safe Work Plan

A Safe Work Plan addressing job specific hazards has been provided as Attachment A in the Joint Workplan.

7.0 Sampling Analysis and Frequency

The surface water, groundwater, and spring sampling frequency is presented on Table 1. Table 2 presents the parameters, analytical methods, sample handling information (i.e., bottles, preservatives, and holding times), and collection frequency. The parameters are grouped by analysis class, sample collection frequency, and similar sample containers and preservative requirements.

Twice-weekly analysis of organic parameters began in mid-July 2008. Weekly analysis of trace and other metals, major cations, major anions, and other parameters will begin in mid-August, 2008.

Sampling frequency and individual sampling events for late fall and winter months will be dependant on site access during inclement weather conditions. Sample locations will need to be reached safely by vehicle, which might be difficult during periods of heavy snowfall or thick snow cover on the ground. Low temperatures might render sampling surface water impractical once surface water locations are frozen. There will be no make-up sampling events for samples missed due to inclement weather conditions or “frozen” sampling locations at the site. Tap samples of sampling locations “Ned Prather Cabin”, and “Dick Prather Cabin” will not be collected after cabins have been shut in for winter.

8.0 Analytical Laboratory

Primary samples will be sent to Evergreen Analytical, Inc. for analysis under standard chain-of-custody (COC) procedures. The address for Evergreen and the laboratory contact person are listed below:

Evergreen Analytical, Inc.
 4036 Youngfield
 Wheat Ridge, CO 80033-3862

 303-425-6021 phone
 303-425-6854 fax
 Attn. Shea Penland
 Shea@evergreenanalytical.com

The turn-around time (TAT) requested will be variable, but generally will be a week or less. The required TAT will be clearly indicated on the chain-of-custody (COC) report.

9.0 Field Quality Assurance/Quality Control (QA/QC) Samples

The table below summarizes the types of QA/QC samples to be collected and the required frequency.

Type of Field QC Sample	Frequency
Field duplicate (FD)	1 per 20 samples or 1 per week if fewer than 20 samples are collected
Matrix spike/Matrix Spike duplicate (MS/MSD)	1 per 20 samples or 1 per week if fewer than 20 are samples collected
Trip blank (TB)	1 per cooler containing samples for VOCs analysis
Split sample (S)	1 sample per month

If possible, field duplicates and splits should be collected at locations where target analytes are expected to be present. If possible, additional sample volume for MS/MSDs should be collected at locations where target analytes are not expected or are expected at relatively low concentrations.

Field duplicate samples will be given a field ID that distinguishes the field duplicate sample from the primary field sample. Additional volume for MS/MSD analyses will be labeled with the same field ID as the parent (primary) sample. Field personnel will make a note on the COC that the laboratory should use the additional analysis for matrix QC analyses.

Split samples will be submitted to Test America for analysis under routine COC procedures. The address for Test America and the laboratory contact person are listed below:

Test America Laboratories, Inc.
2960 Foster Creighton Road
Nashville, Tennessee 37204

1-800-765-0980 phone
615-726-3404 fax
Attn. Mark Hollingsworth

Both laboratories will analyze all other laboratory QA/QC samples required by the analytical methods (i.e. initial calibration, calibration verification, method blanks, laboratory control samples, etc.) in accordance with method specifications.

10.0 Reporting

Analytical results will be reported to HRL Compliance Solutions (HRL) and URS in hardcopy data packages including results, QC summary information, and raw data. Electronic data deliverables (EDDs) will also be delivered to HRL and URS to facilitate entry of data into the electronic database. URS will provide preliminary EDD data to COGCC within 48 hours of receipt, and fully validated data once validation process is complete. Attachment C of the Joint Workplan presents the EDD specifications.

11.0 Data Validation

Data validation will be conducted per the requirements of the data validation SOP included as Attachment B to the Joint Workplan. Data validation narrative reports will be prepared to document all data validation activities and findings, including any data qualifiers assigned or limitations on data use. All data will be entered into the electronic database.

Table 1 – Sample Collection Locations and Frequency Summary

SITE IDENTIFICATION INFORMATION			ORGANICS		INORGANICS				Criteria for modifying frequency	
Sample Location ID	COGCC Facility ID (use on COC as field ID)	Golder Station Number ¹	Matrix	VOCs	Methane	Trace & Other Metals	Major Cations	Major Anions		Other Parameters
PS-MW5	NA		GRW	1x/mo	1x/mo	1x/mo	1x/mo	1x/mo	1x/mo	3 sets of data AND no detection of HCs
PS-MW6	NA									
PS-MW4	NA									
PS-MW3	NA									
PS-MW11S	NA									
PS-MW11D	NA									
New proposed monitoring wells	NA									
Ned Prather Spring	705381	1	SFW	1x/wk	NA	1x/wk for 1 mo, then 1x/mo	3 sets of data AND no detection of HCs (detection of HCs in an upgradient location would result in restoring the next downgradient location to the monitoring program)			
Ned Prather Spring DS 440	NA	8								
Spring 2	705382	3								
Spring 2 DS 100 ² (at end of fence)	NA	NA								
Ned Prather Stock Pond	705384 (general) 705390 (E side) 705391 (S side) 705392 (W side)	5								
Ned Prather Stock Pond DS 500 (discharge at road crossing)	NA	6								
Ned Prather Cabin ^{3,4}	705394 (inside) 705386 (outside)	2								
Dick Prather Cabin ³	705383 (inside) 705395 (outside)	4								
McKay Gulch	NA	10								
Donna Stock Tank	705385	7								
New spring or surface water location	NA	NA								

- 1) Golder's technical memorandum dated July 10, 2008 is considered Phase 1 Joint Workplan Addendum #1.
- 2) This location, at the end of the fence, is a replacement for the location known as "Spring 2A".
- 3) No samples will be collected from "Dick Prather Cabin" and "Ned Prather Cabin" after the cabins have been shut in for winter.
- 4) Water sample only needs to be analyzed for VOCs 1x/wk while city water is provided to the cabin.

Sampling frequency is depended on weather conditions and site access, and may be reduced or suspended during winter months when site access is limited and/or surface and spring water might be frozen.

GRW = Groundwater
SFW = Surface Water

NA = Not available at time of this addendum was prepared. COGCC will generate facility ID.
DS = Downstream and numeric value indicates approximate number of feet downstream from feature in sample ID name

Wk = week
Mo = month
HCs = Hydrocarbons

Table 2 - Aqueous Sample Collection, Handling, and Analysis Summary

Analyte Class	Analysis	Method	Reporting Limit	Holding Time	Bottle and Preservation
Organics	Volatile Organics (including BTEX)	SW8260M extended	Varies by analyte	14 days	3 x 40 ml glass vial, pH < 2 with HCl, ≤6°C
	Methane	RSK-175	1.0 mg/l	7 days	3 x 40 ml glass vial. ≤6°C
Trace and Other Metals	Arsenic, dissolved	SW6020	0.002 mg/l	6 months	field-filtered into 1 L poly bottle, pH < 2 with HNO ₃ , ≤6°C
	Barium, dissolved		0.025 mg/l		
	Boron, dissolved		0.2 mg/l		
	Cadmium, dissolved		0.001 mg/l		
	Chromium, dissolved		0.005 mg/l		
	Copper, dissolved		0.025 mg/l		
	Lead, dissolved		0.005 mg/l		
	Selenium, dissolved		0.005 mg/l		
	Silver, dissolved		0.002 mg/l		
Major Cations	Calcium, dissolved	SW6010B	0.387 mg/l		
	Iron, dissolved		0.07 mg/l		
	Magnesium, dissolved		0.15 mg/l		
	Manganese, dissolved		0.005 mg/l		
	Potassium, dissolved		0.34 mg/l		
	Sodium, dissolved		0.4 mg/l		
Major Anions	Bromide	EPA 300.0	0.2 mg/l	28 days	1 L poly bottle, ≤6°C
	Chloride		0.5 mg/l		
	Sulfate		0.5 mg/l		
	Nitrite + Nitrate as N ¹		0.061 mg/l		
	Fluoride	SM4500-F C	0.2 mg/l	28 days	
	Bicarbonate alkalinity	SM2320B	5 mg/l	14 days	
	Carbonate alkalinity		5 mg/l		
	Hydroxide alkalinity		5 mg/l		

Analyte Class	Analysis	Method	Reporting Limit	Holding Time	Bottle and Preservation
	Total alkalinity		5 mg/l		
	Total Dissolved Solids (TDS)	EPA 160.1	10 mg/l	7 days	
	Sulfide	SM4500-S C/F	0.5 mg/l	7 days	5 ml of 10N Zinc acetate, pH > 9 with NaOH ≤6°C
Other Parameters	Conductivity	SM2510B	1 mmhos/cm	48 hours	≤6°C
	Cation/Anion Charge Balance	SM1030F (calculation)	NA	NA	NA

SW = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, USEPA Office of Solid Waste (SW-846), including all updates.

SM = Standard Methods for the Examination of Water and Wastewater, 20th Edition, EPA.

EPA = Methods for the Chemical Analysis of Water and Wastewater (MCAWW), 1983, EPA

NA = Not applicable

¹ Nitrate+Nitrite will be analyzed at each location as part of the baseline dataset. Due to the short holding time associated with this analysis, remote nature of the Prather investigation area, and low levels of nitrate at existing sample locations, nitrate+nitrite analyses will not be conducted for routine sampling events.

**Phase I Site Investigation – Prather Spring
Phase 1 Joint Workplan Addendum #3
For Bedrock Well Installations**

1.0 Introduction

This addendum to the Joint Workplan describes the activities associated with the advancement of additional boreholes and installation of groundwater monitoring wells in bedrock underlying the colluvial deposits at the Prather Spring site. The drilling is being conducted in support of the Phase I Site Investigation – Prather Spring. The intent of this program is to continue the investigation of soil and groundwater sampling and analysis to meet the objectives of the Phase I investigation. The overall objective of the Phase I investigation, which is presented in the Phase I Site Investigation Work Plan (Joint Workplan) (URS, 2008), is to identify the probable contamination source(s).

2.0 Background

In July, 2008 six boreholes were drilled and monitoring wells were installed at the project site to characterize groundwater. Five of these wells were installed to characterize shallow, unconfined groundwater encountered along the colluvial/bedrock interface. One well, PSMW-11D, was installed within the bedrock with a screened interval at the approximate elevation of the Prather Spring. Laboratory analytical data of a groundwater sample collected from well PSMW-11D contained petroleum hydrocarbons. Petroleum hydrocarbons were not detected in samples collected from shallow wells within the saturated colluvial flow zone. The wells described in this addendum will be installed to identify potential sources of contamination within the underlying bedrock groundwater flow regimes.

3.0 Drilling and Monitoring Well Installation

A minimum of seven monitoring wells will be installed at locations staked by URS (Figure 1). Three of these will be co-located with existing shallow monitoring wells (i.e., PSMW-3, PSMW-4 and PSMW-5/6) to evaluate vertical differences in potentiometric head between the shallow and deeper groundwater. Two additional bedrock monitoring wells will be installed upvalley (south) of the existing wells on the east and west sides of the valley within Section 23 on the Puckett Land Company (Puckett) property. Two wells will be installed near Spring 2. These wells will likely be screened in the bedrock water-bearing units that correspond with the elevation of Spring 2. However, if shallow groundwater is encountered in saturated colluvium, paired wells may be installed in the shallower flow zone to evaluate the occurrence of groundwater in these units. The wells near Spring 2 may be moved from the proposed locations shown on Figure 1 based on new data obtained during the field work and/or upon conference with representatives of the Companies. All well locations will be verified with the Companies, COGCC, and the respective landowners prior to the commencement of this field activity.

The soil borings will be advanced into the bedrock using fluid coring and/or rotary techniques. If conditions allow, HX-diameter core samples of bedrock will be collected from each borehole. The borehole will be initially advanced using hollow-stem augers from ground surface until auger refusal in competent bedrock. The borehole will be advanced through the shallow, first water-bearing unit in unconsolidated material using a temporary outer casing or auger into the

competent bedrock to prevent vertical connection of the saturated colluvium with the bedrock flow zone. . Fluid coring will be initiated within the competent bedrock extending to the total depth of the borehole. During drilling, a URS geologist will visually describe rock cores and cuttings, which will include field screening using a photo-ionization detector (PID) and multi-gas meter (MGM) to identify intervals potentially containing petroleum hydrocarbons.

If field screening or other evidence of petroleum hydrocarbons is encountered (i.e., visual or olfactory indications) while drilling, a soil (rock) sample will be collected, if possible. If no impacted soil or rock intervals are encountered, only one sample will be collected from the borehole at a depth that corresponds to the inferred water-bearing zone. Soil samples may not be collected if the bedrock cores are cemented such that soil sampling is impractical. A description of the analyses to be performed on the soil samples is described in Section 5.0.

Temporary monitoring wells will be installed at each borehole that encounters groundwater. Monitoring wells will consist of 1.5- or 2-inch diameter schedule 40 PVC and be marked with their well IDs, capped and locked. Bedrock monitoring wells will be tremie-grouted in a bottom to top fashion above the bentonite seal of the well screen to prevent vertical connection of hydraulically separated water-bearing units. Monitoring wells will be constructed generally according to specifications outlined in the Joint Workplan.

4.0 Groundwater Development and Sampling

Each well will be developed following installation by removing between three and ten borehole volumes of water as described in the Joint Workplan. Once the wells have been developed, URS personnel will collect groundwater samples and submit them for analysis to the onsite mobile laboratory following procedures outlined in the Joint Workplan. The frequency of continued sampling of these proposed monitoring wells is described in the Phase 1 Joint Workplan Addendum #2 for groundwater, surface water, and spring sampling.

5.0 Analytical Laboratory

In order to expedite analytical results, a mobile analytical laboratory will be onsite during the drilling operations to analyze soil and/or groundwater samples. ChemSolutions from Larkspur, Colorado will provide analytical services in accordance with ISO-17025 accreditation procedures for the specified analytical methods.

Soil samples will be analyzed for volatile organic compounds (VOCs) (Method 8260B), total volatile petroleum hydrocarbons (TVPH) (Method 8015 mod), and total extractable petroleum hydrocarbons (TEPH) (Method 8015 mod) by the onsite laboratory. A soil/rock sample fraction will be collected and retained for analysis of semi-volatile organic compounds (SVOCs) (Method 8270) should the initial soil sample contains either TVPH or TEPH concentrations greater than 100 milligrams per kilogram (mg/kg). If SVOC analysis is necessary (i.e., if either the TVPH or TEPH concentration exceeds 100 mg/kg), the retained fraction will be sent to Evergreen Analytical under proper chain-of custody procedures for analysis. Analytical methods performed by Evergreen will follow those described in the Joint Workplan.

Water samples will be analyzed for VOCs (Method 8260B), TVPH (Method 8015 mod), and TEPH (Method 8015 mod) by the onsite laboratory.

6.0 Field Quality Assurance/Quality Control (QA/QC) Samples

As an additional quality control (QC) measure, split samples will be collected and sent to Test America for identical analyses. A minimum of one soil split sample and one groundwater split sample will be collected as part of this investigation.

Field duplicates and addition sample volume for matrix spike/matrix spike duplicates (MS/MSD) analyses samples will be collected per the requirements of Section 2.7 the Joint Workplan. For sample equipment that is decontaminated, a minimum of one rinsate blank per equipment type per field effort will be collected and analyzed for the same parameters as the associated field samples.

7.0 Surveying

Obtaining precise elevation data relative to the site wells will be necessary to calculate potentiometric head levels for groundwater monitoring locations. Well locations will be surveyed using methods capable of obtaining vertical elevation precision of 0.01 foot. Wells will be surveyed relative to a site datum.

8.0 Data Validation and Management

Quality review, validation, and management of analytical data will be performed as described in the Joint Workplan.

9.0 Reporting

The results of the investigation will be compiled and presented in a brief summary report. The report will summarize field activities, and will include boring logs, a well completion table, a list of samples collected at each location, and other observations made in the field. The report will also describe geologic and hydrologic conditions encountered. The laboratory analytical results will be incorporated in the report as a summary table. If necessary the report will include recommendations for additional characterization activities.

**Phase I Site Investigation – Prather Spring
Phase 1 Joint Workplan Addendum #4
For Soil Excavation Adjacent to Cistern**

1.0 Introduction

This addendum to the Joint Workplan describes excavation activities near *Ned Prather Spring*, and sample collection activities that are being conducted in support of the Phase I Site Investigation – Prather Spring. The overall objective of the Phase I investigation, which is presented in the Phase I Site Investigation Work Plan (Joint Workplan) (URS, 2008a) is to identify the probable contamination source(s). The intent of this supplemental excavation and sampling program is to allow evaluation of potential petroleum hydrocarbon impacts that will help meet the objectives of the Phase I site investigation. Excavation of the cistern was requested by the Colorado Oil and Gas Conservation Commission (COGCC) in a letter from Mr. Chris Canfield addressed to the four Companies dated July 10, 2008, “The cistern associated with the spring box must be removed and replaced. Samples of the any sediment or other solid materials within the cistern will be collected and submitted for laboratory analysis.”

2.0 Background

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. Prather Spring had been developed and the water captured by excavating soil around the naturally occurring spring discharge point, and constructing a cement collection trough (spring box), which was subsequently covered with soil. The spring box discharges via poly vinyl chloride (PVC) pipe to the stream and to a buried plastic tank (cistern) with a capacity of approximately 500 gallons. Piping from the cistern routes the spring water to the hunting cabin. An overflow pipe is connected to the cistern to allow excess spring water to discharge to the stream at a location of approximately 30 feet below the primary spring discharge point. The surface runoff from the developed spring and cistern overflow feed an apparently perennial stream that flows north down to the stock pond located below the Ned Prather cabin (Figures 1, 2, and 3).

One of the property owners, Mr. Ned Prather, is concerned that natural gas well drilling materials (drilling mud) had been released and migrated into the cistern, where it remains a potential source of contamination to the spring water. The proposed excavation may support the identification of the source that contaminated Prather Spring. The soils surrounding the cistern and related piping may be excavated to evaluate potential petroleum hydrocarbon impacts in this area. The excavation, if necessary, will be limited to areas immediately adjacent to the cistern. This spring intake reportedly originates from a location approximately 10 feet into the hillside, above the exposed spring discharge pipe. Every effort will be made to not disturb the spring water collection system and cistern intake. The top of the cistern will be evaluated for access ports. The access ports will be opened for the purpose of collecting both aqueous and sediment

samples from within the cistern, if available. At this time, the cistern will not be removed or replaced, nor will associated piping be disturbed. When representative samples have been taken from the excavated soils and from the cistern, the soil will be replaced and the site will be restored. A submersible camera will be used to photograph the contents of the cistern.

3.0 Sampling Locations

Soil, sediment, and water samples will be collected from around Prather Spring, including the immediate vicinity of the spring, and spring cistern at locations that will be determined by the URS field engineer, client representatives, and Colorado Oil and Gas Conservation Commission (COGCC) representatives present during the excavation. Sampling locations will be documented in the field logbook and on date and time-stamped photographs.

4.0 Field Procedure

Initially, the field effort will consist of opening the cistern from the port, collecting water and sediment samples from within the cistern as available, photographing the contents of the cistern and then closing and recovering the cistern. The analytical results will be used to determine whether or not the cistern should be excavated and replaced at a later date. The analysis parameters for solid material are listed in Table 1 and the analysis parameters for aqueous samples are listed in Table 2. Section 10 lists the QA/QC sample requirements.

Should excavation and replacement be necessary, field work will include onsite preparation of two temporary storage areas for excavated soils, sediment control, excavation of soil adjacent to the spring's cistern, soil sampling for field screening and laboratory analysis, water sampling from the spring intake (cement trough), if possible, and water and sediment (if present) sampling from the cistern for laboratory analysis, and site restoration.

Site-specific conditions and geographic limitations will be taken into consideration to properly and safely manage the excavation of soils adjacent to the cistern, staged equipment and excavated soils, and to provide for physical separation between moving equipment and event participants and observers.

Temporary Excavated Soils Storage Areas

Two temporary, lined (i.e., Visqueen) storage areas will be prepared to receive approximately 20 cubic yards each of excavated soils. Excavated soils will be inspected for presence of petroleum hydrocarbon impacts by use of a photo-ionization detector (PID), and visual and olfactory indications. Excavated material will be segregated into "clean" and "impacted" soil piles during the excavation process. Segregation will be accomplished in agreement with the URS field engineer, COGCC representative, and client representatives. "Clean" soils will be used for backfilling of the excavation at the end of the event. Soil samples will be collected from the "impacted" soils pile (if

impacted soils are present) for laboratory analysis for subsequent, proper disposal. Soil piles that will remain onsite after completion of the excavation activities will be covered with plastic sheeting so that precipitation will run off the plastic onto the ground without penetrating the soil piles. The temporary storage areas will be located in areas away from the stream that are readily accessible to excavation equipment and haul/dump trucks.

Sediment Control

It is likely that the excavation activities in the vicinity of the cistern will come in contact with the spring discharge water (surface water runoff) that flows toward the stock pond. Straw wattles and/or rock check dams will be placed in the surface water runoff from the spring discharge point to minimize the amount of sediment that might be carried downstream toward the stock pond, located northeast of Prather Cabin.

Surface water will be evaluated for excessive turbidity once it has passed the last sediment control structure. Water quality evaluation can be conducted visually or with a turbidity meter. A turbidity value greater than 20 nephelometric turbidity units (NTU) is considered excessive. In the event that excessive turbidity is observed below the last sediment control structure, additional measures will be taken to reduce the amount of sediment travelling toward the stock pond. Excavation activities may be temporarily suspended until water quality has improved to acceptable levels (<20 NTU).

Cistern Excavation

Topsoil in the excavation area will be carefully removed and stockpiled separate from the underlying colluvial material. The top soil will be utilized for site restoration activities at the end of the excavation activities. Excavation of the soil surrounding the cistern will be conducted using a backhoe or track hoe, and hand-held equipment such as a shovel in tight or sensitive areas of the excavation. A spotter will support the equipment operator. All equipment that is used in the excavation work will be cleaned prior to beginning excavation activities. Heavy equipment will be washed with a power washer to remove gross contamination from previous work before coming to the site. Hand-held equipment such as shovels, trowels or equivalent tools will be decontaminated as described in Section 5.0.

The excavation will be advanced in a way that the slope and depth of the excavation will be safe for soil sampling activities and visual inspection. The excavation will be laid back/sloped in a way that the risk for a slope failure is minimal. The depth of the excavation is planned to end at a level with the bottom of the cistern. Should impacted soils be encountered at a depth level with the bottom of the cistern, the field crew will make a decision as to how to safely advance the excavation, if at all, in a manner to protect the health and safety of workers and to protect the integrity of the cistern and associated hardware.

Soil Sampling

During the excavation activities URS personnel will visually examine and field screen excavated material with a PID and multi-gas meter (MGM) capable of detecting methane to identify potential petroleum hydrocarbon impacted soils, and evaluate soil samples for laboratory analysis. Prior to sample screening, the PID and MGM will be calibrated in accordance with the manufacturers' recommendations. The PID used will be capable of detecting volatile organic compounds at approximate concentrations of 1 part per million (1 ppm). The MGM will be capable of detecting methane at an approximate concentration of 0.5% of ambient air. Samples of excavated soil material will be placed in re-sealable, quart-size plastic bags (Ziploc bag) for field headspace testing using the PID and MGM. Instrument readings will be recorded in the logbook or on test pit excavation log forms. If impacted soils are encountered during excavation, soil samples will be collected for laboratory analysis. PID field screening results will be used to select soil samples for laboratory analysis. If no impacted soils are encountered during excavation or once impacted soils have been removed in the excavation, a confirmation soil sample will be collected from near the base of each side wall of the cistern excavation, and from the bottom of the excavation. URS will attempt to obtain a soil sample at the connection of the intake to the cistern.

Soil samples for environmental evaluation of the site's conditions will be collected using clean (i.e., decontaminated) sampling equipment such as shovels, trowels, or hand-held augers. This equipment will be dedicated to environmental sample collection. Each sample will be collected with freshly gloved hands. Sample collection locations will be noted in the field logbook and on a clearly marked sketch including dimensions of the excavation at the time of sample collection. Date and time-stamped photos will document the soil sampling activities. A minimum of two and maximum of ten soil samples will be collected for laboratory analysis. Soil samples will be placed in laboratory-provided containers and preserved and handled as described in Table 1.

Water Sampling

URS understands that the cistern has a manhole/lid that provides access to the inside of the cistern. The headspace inside the cistern will be checked for the presence of VOCs and methane using a PID and MGM. The recorded values will be documented in a field logbook. A water sample will be collected from inside of the cistern for laboratory analysis.

A water sample for laboratory analysis will be collected using a clean (i.e., decontaminated) container (plastic or stainless steel cup or jug) by submerging the sampling device under water without agitating sediments that may be present. Should sampling with a container not be possible, a length of clean plastic or silicone tubing connected to a peristaltic pump will be tied to a wooden pole and the end of the tubing submerged below the water surface approximately two feet (2 feet) to minimize agitation of potential sediment in the base of the cistern. The sample collection depth is ideally below the elevation of the cistern tank outlet, but above the base of the cistern to avoid agitating sediment that is potentially present in the base of the cistern. Water samples can either be collected in a clean container prior to placement in laboratory-provided sample bottles or placed directly into the laboratory-provided bottles from the sampling container or the end of the tubing. However aliquots collected for analysis of volatile constituents

will be collected first and will be placed directly into sample bottles so as to reduce the potential for volatilization. Water quality parameters will be measured on a separate aliquot of spring water collected in a clean plastic container after sample collection has been completed. Water collected in the plastic container for water quality parameter measurement will not be used for laboratory sample analysis.

One water sample and a duplicate sample will be collected from inside the cistern. Water samples will be placed in laboratory-provided containers and preserved and handled as described in Table 2.

Water quality parameters to be measured and recorded on a field data sheet include temperature, pH, conductivity, turbidity, dissolved oxygen, and oxidation reduction potential. A sample field data sheet is included at the end of SOP 1.0 attached to Addendum #2 – Surface Water and Groundwater sampling.

Spring Flow Measurements

The flow of the spring discharge from the 4-inch diameter PVC discharge pipe at the head of the stream will be measured either using the volumetric method or a calibrated flow meter. Spring flow measurements will be completed upon first arrival at the site, prior to any excavation activity, and after completion of excavation activities. The volumetric method applies to water outflow from a pipe or other structure where a measuring device like a cup or jug can be placed in the water stream. For the volumetric method, a graduated cylinder, cup, 5-gallon bucket, or jug will be placed into the water flow and the time to fill the container to a designated marker will be measured. The flow will be documented in “gallons per minute” (gpm) on the surface water and seep sampling field data sheet, which is included at the end of SOP 1.0.

If a flow cannot be measured by either method, the surface water or spring flow will be described on the field data sheet, including depth and width of the surface water, or the diameter of the outflow pipe, and the intensity of the flow. A flow estimate will be included on the field data sheet, and will be noted as such (“estimated”).

Sediment Sampling

A sediment sample will be collected from the bottom of the cistern, if sediments are present in the cistern. Depending on the thickness and consistency of the sediments, the sediments will be collected as a solid matrix by using a container attached to a clean extension rod or wooden board to scrape the sediments from the bottom of the cistern into the container. Collected sediments will be gathered in a clean (decontaminated) plastic or stainless steel bowl. Supernatant water will be gently decanted in a way that no or only limited amounts of fines are lost with the decanted water. The leftover sediments will be placed using clean equipment and freshly gloved hands into laboratory provided jars/containers. Aliquots collected for analysis of volatile constituents will be collected first and will be placed into appropriate sample bottles quickly so as to reduce the potential for volatilization.

Should the consistency of the sediments not allow collecting the sediments with a container, the sediments will be collected as slurry through tubing connected to a peristaltic pump. The slurry will be discharged into a clean container (bucket) that will be large enough to hold sufficient volume of slurry (1 to 5 gallons). The solid particles are allowed some time to settle out at the bottom of the bucket before decanting the supernatant aqueous phase. Decanting will be done in such a manner that a minimum of fines are lost during the decanting process. The remaining solids will be placed into laboratory provided jars/containers with clean equipment and freshly gloved hands and preserved and handled as described in **Table 1**.

The collection method will be noted and described in the field logbook. Date and time-stamped photos will document the sampling process. One sediment sample will be collected for the bottom of the cistern.

One set of water quality parameters will be collected for the cistern water prior to sediment sample collection. Key water quality parameters will include pH, specific conductance, temperature, turbidity, dissolved oxygen, and oxidation reduction potential, and will be recorded on a field data sheet or the field logbook.

Site Restoration

The excavation will be filled with “clean” soils resulting from the excavation process and clean fill material that was brought onsite, if needed. The excavation will be backfilled in approximately 1-foot lifts and soils will be compacted with the backhoe shovel. Re-grading of the ground surface will restore the pre-excavation site topography. Top soil that was stored separately from excavated soils will be placed on the re-graded soils to finalize site restoration activities.

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.

Field data sheets and logbook entries will be copied and sent to URS (Stacey_Malerba@urscorp.com) for data entry into the electronic database.

5.0 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 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[®] wash, or equivalent, 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 such a manner as to avoid subsequent contamination prior to use at the next site.

Heavy equipment such as a backhoe or track hoe should arrive clean at the project site in a ready-to-work condition. Heavy equipment will have been cleaned with a power/steam washer to remove soils and dirt from previous activities. Excess grease at joints of the excavator arm or shovel should be removed to avoid cross contamination of soils with grease.

One equipment rinsate sample will be collected and analyzed from non-dedicated sampling equipment for each matrix (soil, sediment, water). Rinsate samples will be collected and analyzed for the same analytical parameters as the associated field sample that was collected with the decontaminated equipment.

6.0 Project-Derived Wastes

Excavated material will be segregated into clean and potentially impacted material, and initially stockpiled on plastic sheeting (i.e., Visqueen) near the cistern excavation location. Field confirmed clean material will be reused in the backfilling and regrading of the excavation. Potentially hydrocarbon-impacted material will be properly disposed by the Companies based upon review of laboratory analytical results. Final disposition of these site investigation-generated wastes will depend upon final laboratory results and corresponding regulatory standards.

Project-derived wastes such as water from equipment decontamination will be containerized and moved to one of the Companies' well pads. Other wastes generated during the project will be decontaminated and contained in plastic bags and properly disposed by the Companies.

7.0 Safe Work Plan

A Safe Work Plan addressing job specific hazards has been provided as Attachment A in the Joint Workplan. Specific hazards associated with the cistern excavation activities that have not been adequately described in the Safe Work Plan will be addressed in an addendum to the Safe Work Plan.

8.0 Sampling Analysis and Frequency

Solid media analytical parameters, holding times, preservation requirements, and sample containers are presented on Table 1. Table 2 presents the same information for fluid (aqueous) media. An extended list of analysis parameters is presented in Tables 1 and 2. This list of analytes has been used previously to characterize exploration and production pit fluids, pit solids, and other media in Colorado Energy Basins (URS 2008b). The analyte list includes potential constituents of concern derived from review of a sizeable compilation of Material Safety Data Sheets (MSDS) obtained from seven (7) oil and gas

companies that participated in the study. The parameters are grouped by analysis class, sample collection frequency, and similar sample containers and preservative requirements.

Sampling activities associated with the cistern excavation activities are considered a one-time event. No provisions are made for reoccurring or routine sampling activities related to work described in this Joint Workplan Addendum #4.

9.0 Analytical Laboratory

Primary samples will be sent to Paragon Analytics, Inc. (Paragon) for analysis under standard chain-of-custody (COC) procedures. Paragon was the laboratory used for the energy basin study (URS 2008b) earlier this year, and is capable of conducting the wide range of laboratory analyses dictated for this compilation of analyses. The address for Paragon and the laboratory contact person are listed below:

Paragon Analytics, Inc.
225 Commerce Drive
Fort Collins, CO 80524

Debbie Fazio, Project Manager
970-490-1511 phone
970-490-1522 fax
Attn: dfazio@paragonlabs.com

The turn-around time (TAT) requested will be variable, but generally will be a week or less. The required TAT will be clearly indicated on the chain-of-custody (COC) report.

10.0 Field Quality Assurance/Quality Control (QA/QC) Samples

The table below summarizes the types of QA/QC samples to be collected and the required frequency.

Type of Field QC Sample	Frequency
Field duplicate (FD)	1 per 20 samples and matrix
Matrix spike/Matrix spike duplicate (MS/MSD)	1 per 20 samples and matrix
Trip blank (TB)	1 per cooler containing samples for VOCs analysis
Rinsate blank (RB)	Minimum of 1 per type of decontaminated equipment
Split sample (S)	Minimum of 1 sample per matrix

If possible, field duplicates and splits should be collected at locations where target analytes are expected to be present. If possible, additional sample volume for MS/MSDs should be collected at locations where target analytes are not expected or are expected at relatively low concentrations.

Field duplicate samples will be given a field ID that distinguishes the field duplicate sample from the primary field sample. Additional volume for MS/MSD analyses will be labeled with the same field ID as the parent (primary) sample. Field personnel will make a note on the COC that the laboratory should use the additional analysis for matrix QC analyses.

Split samples will be offered to the COGCC representative for analysis by the laboratory of their choice under routine COC procedures. If limited solid material is available for the split sample(s), the field personnel will prioritize the analysis and divide up the material accordingly.

Laboratories will analyze all other laboratory QA/QC samples required by the analytical methods (i.e. initial calibration, calibration verification, method blanks, laboratory control samples, etc.) in accordance with method specifications.

11.0 Reporting

Analytical results will be reported to URS in hardcopy data packages including results, QC summary information, and raw data. Electronic data deliverables (EDDs) will also be delivered to URS to facilitate entry of data into the electronic database. URS will provide fully validated data to COGCC (electronic deliverable from the database) once the validation process is complete. This process is expected to take approximately 1 week after the receipt of the analytical data package. Attachment C of the Joint Workplan presents the EDD specifications.

12.0 Data Validation

Data validation will be conducted per the requirements of the data validation SOP included as Attachment B to the Joint Workplan. Data validation narrative reports will be prepared to document all data validation activities and findings, including any data qualifiers assigned or limitations on data use. All data will be entered into the electronic database.

13.0 References

URS 2008a.

URS 2008b.

Table 1
Solid Media Analytical Parameters, Holding Times, and Preservation Requirements

Analytical Parameter	Analytical Method	Sample Holding Time (from collection)	Preservation	Number of Containers and Minimum Volume
Metals (including Hg)	SW 6010/SW 6020 and SW 7470A	6 months (28 days mercury)	≤6°C	1 - 8 oz. Amber Glass Jar
Anions ¹	EPA 300.0	28 days		
paste Alkalinity	EPA 310.1			
paste pH	EPA 105.1			
paste Specific Conductance	EPA 120.1			
Nitrate + Nitrite	EPA 353.2			
Percent Solids	PAI SOP			
Volatile Organic Compounds (VOCs)	SW 8260B	14 days	≤6°C	Terracore kit consisting of: 1 - 2 oz. Amber Glass Jar 2 - 40 mL Glass Vials w/ water, 1 - 40 mL Glass Vial w/ methanol
Total Petroleum Hydrocarbons (Diesel Range Organics [DRO] and Motor Oil Range Organics [MRO])	SW 8015BM	14 days to extraction 40 days after extraction	≤6°C	1 - 8 oz. Amber Glass Jar
Semi-volatile Organic Compounds (SVOCs)	SW 8270C			
Oil & Grease	SW 9071			
Glycols (Ethylene + Propylene)	SW 8015B	7 days to preserve, 14 days to analyze		

TCLP = Toxicity Characteristic Leaching Procedure

ZHE = Zero-headspace extraction

¹ Anions include: chloride, sulfate, fluoride, bromide, nitrate, and nitrite

**Table 2
Fluid Media Analytical Parameters, Holding Times, and Preservation Requirements**

Analytical Parameter	Analytical Method	Sample Holding Time (from collection)	Preservation	Number of Containers and Minimum Volume
Metals (including Hg)	SW 6010/SW 6020 and SW 7470A	6 months (28 days mercury)	pH ≤2 with HNO ₃ , ≤6°C	1 - 500 mL Poly Bottle
Anions ¹	EPA 300.0	28 days	≤6°C	1 - 1L Poly Bottle
Alkalinity	EPA 310.1	14 days		
Total Dissolved Solids (TDS)	EPA 160.1	7 days		
pH	SW 9040	4 days from receipt at lab		
Specific Conductance	EPA 120.1			
Nitrate+Nitrite ²	EPA 353.2	28 days	pH ≤2 with H ₂ SO ₄ , ≤6°C	1 - 125 mL Poly Bottle
Sulfide	EPA 376.1	7 days	NaOH/ ZnAc, ≤6°C	1 - 500 mL Poly Bottle
Total Petroleum Hydrocarbons (Diesel Range Organics [DRO] and Motor Oil Range Organics [MRO])	SW 8015BM	7 days to extraction, 40 days after extraction	≤6°C	1 - 1L Amber Glass Bottles
Volatile Organic Compounds (VOCs)	SW 8260B	14 days	pH ≤2 with HCl, ≤6°C	3 - 40 mL Glass VOA vials
Semi-volatile Organic Compounds (SVOCs)	SW 8270C	7 days to extraction, 40 days after extraction	≤6°C	2 - 1L Amber Glass bottles
Glycols (Ethylene + Propylene)	SW 8015B	7 days to preserve, 14 days to analyze	≤6°C	3 - 40 mL Glass VOA vials
Oil & Grease ³	EPA 1664	7 days to extraction, 40 days after extraction	pH ≤2 with H ₂ SO ₄ , ≤6°C	1 - 1L Amber Glass Bottles

¹ Anions include: chloride, sulfate, fluoride, bromide, nitrate, and nitrite.

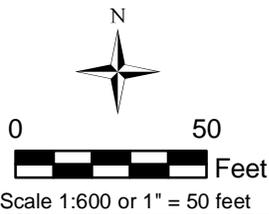
² Combined nitrate and nitrite aliquot will be analyzed only if sample for anion analysis by Method 300.0 is not analyzed within 48 hours.



NOTES:
 1. Coordinate System: UTM,
 NAD83, Zone 13N, meters
 2. Vertical Datum: NAVD29

	Surface Water Sampling Location
	Monitoring Well
	Creek
	Cistern (approximate location)

N



0 50
 Feet
 Scale 1:600 or 1" = 50 feet



FIGURE 1 Prather Spring Area Investigation Location Map

*Work Plan Addendum #4
 Phase I Prather Spring Site Investigation*

File Name cistern_loc.mxd	Rev. Date 11/21/08	Dr. By GCK
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Figure 2 – Prather Spring Discharge Pipe



Figure 3 – View to East Below Discharge Pipe. Orange Flagging in Creek Marks Location of Cistern Outlet Pipe. Cistern Vent Pipe (1-inch diameter PVC) is Tied to Steel Fence Post Shown in Background of Photograph



**Phase I Site Investigation – Prather Spring
Phase 1 Joint Workplan Addendum #5
Additional Site Investigation Activities**

1.0 Introduction

This addendum to the Joint Workplan describes the activities associated with conducting a geophysical survey, a soil gas survey, and installation of groundwater monitoring wells within the colluvial deposits and fractured bedrock at the Prather Spring site. As directed by the COGCC, the Joint Companies are also investigating the origin of impacts to groundwater at Spring 2. The appearance of petroleum hydrocarbon constituents and a concurrent increase in chloride levels were observed at Spring 2 following submittal and approval of the original Joint Workplan. These activities are being conducted in support of the Phase I Site Investigation – Prather Spring. The intent of this program is to continue the investigation of soil and groundwater sampling and analysis to meet the objectives of the Phase I investigation. The overall objective of the Phase I investigation is to identify the probable contamination source(s), (Joint Workplan URS, 2008a).

2.0 Background

In July, 2008 six boreholes were advanced and six monitoring wells were installed in the Ned Prather Spring drainage to characterize groundwater. Five of these wells were installed within the colluvial/fractured bedrock (shallow) flow zone, and one well, PSMW-11D, was installed within a deeper bedrock flow zone (URS 2008b). In August and September 2008, further borings (including bedrock coring) and well installations were performed to further characterize subsurface geology and hydrostratigraphy in the Ned Prather Spring drainage, as well as to begin subsurface characterization within the Spring 2 drainage. In the Ned Prather Spring drainage, three additional wells were installed within the shallow flow zone, and five additional wells were installed within deeper bedrock flow zones. In the Spring 2 drainage, four shallow flow zone wells and three deeper flow zone wells were installed.

Laboratory analytical data of groundwater samples collected from the wells have not contained petroleum hydrocarbons at concentrations of the same magnitude as observed in either the Ned Prather Spring or Spring 2. However, laboratory analytical data of major ions, coupled with groundwater potentiometric levels, review of rock cores, and other site data, has led to the development of a refined hydrogeologic site model. This model suggests that shallow groundwater may flow preferentially within relatively narrow, discrete zones of higher transmissivity, potentially related to fractures within the upper bedrock (URS 2008c).

3.0 Scope of Work

A combination of shallow geophysical surveys and soil gas surveys will be used to identify potential areas with greater fracture density, and the location(s) of elevated petroleum hydrocarbon concentrations and/or chloride concentrations in shallow groundwater flow zones. Immediately following these surveys, monitoring wells will be placed in areas where shallow groundwater is inferred to be impacted based upon the preliminary results of the geophysical and soil gas surveys. If preliminary results from the two surveys are inconclusive as to the location of groundwater impacts, the additional monitoring wells will be installed in cross-valley

transects and in select areas to “bracket” potential flow paths into the drainages from potential uphill sources.

3.1 Electromagnetic Geophysical Survey

An electromagnetic geophysical survey will be performed to help characterize the colluvial/bedrock interface and potential high-angle fracture zones within the shallow bedrock. The survey will be performed by Cordilleran Compliance Services, Inc. using a Geonics EM-34 ground conductivity meter. The EM-34 uses an inductive electromagnetic method to provide variable depths of exploration. The EM-34 can be used in and two dipole modes (horizontal or vertical) to obtain subsurface spatial data that is sensitive to vertical geologic anomalies. The instrument will be calibrated at the site to optimize the survey for site subsurface conditions and the depth range of interest. The survey will be conducted by performing transects in a grid pattern both parallel and perpendicular to the drainage axis. The transects will begin near the affected spring in each drainage (i.e., Spring 2 and the Ned Prather Spring) and will continue upvalley, extending past currently installed monitoring wells, as far as practical based on topography and trees. The transect data will be correlated with the borehole logs from existing monitoring wells. The exact location of transects and the grid spacing will be determined in the field, however potential transects are shown on Figure 1.

3.2 Soil Gas Surveys

Two types of soil gas surveys will be performed. One survey will be performed in the Prather Spring and Spring 2 valleys. The second soil gas survey type will be completed up on the ridgeline above these two drainages, at the locations of several drip, or condensate, tanks, associated with natural gas pipelines.

3.3 Soil Gas Survey in the Valleys

A soil gas survey will be conducted in both drainages to help identify soils and/or shallow groundwater potentially affected by petroleum hydrocarbons. Results of the soil gas survey will be used in combination with the geophysical survey to assist in locating monitoring wells within the two affected drainages.

The first activity will be to install soil gas monitoring points along transects across both the Ned Prather Spring and Spring 2 drainages. The purpose of these monitoring points is to evaluate the presence in soil gas of petroleum constituents that could volatilize from affected groundwater above potentially narrow groundwater flow zones that convey petroleum hydrocarbons to the springs. Borings in the drainages will be advanced to depths near the inferred water table based on the geophysical survey and/or known water levels in existing wells. Proposed soil gas probe locations are shown on Figure 2. Proposed locations may be moved, added, or deleted based on the results of the geophysical survey and/or initial soil gas analytical results.

Soil gas monitoring boreholes will be advanced using a drilling rig equipped with auger drilling techniques. Temporary soil gas monitoring points will be installed within each borehole. The monitoring points will consist of a short length of slotted pipe or tubing, connected to solid pipe or tubing. The borehole will be temporarily sealed at the ground surface to prevent dilution from the ambient air. Soil gas contained in the interstitial soil pore spaces will be sampled by evacuating the pipe or tubing with an air pump. Relative air-soil permeability testing will be conducted by comparing air flow rates measured using a vacuum gauge and/or flow meter. Purge volume and rate testing will be conducted prior to sampling to optimize these parameters.

The purge volume and rate testing will be done to check for short-circuiting to the surface within the expected radius of influence around the borehole.

Soil gas will be screened using a photoionization detector (PID) to screen for volatile organic compounds. Samples from each soil gas probe will be collected and contained within Tedlar bags for analysis. The Tedlar sample bags will be filled passively by drawing the soil gas out of the ground under vacuum. The tubing and Tedlar bag will be dedicated to each probe location. Tedlar bag samples will be stored in plastic coolers and kept cool pending onsite analysis. This will keep them out of direct sunlight, and prevent damage to samples in the field or in transit to the mobile laboratory. Samples will be analyzed within 24 to 48 hours after collection by the mobile laboratory, ChemSolutions.

3.4 Soil Gas Survey on the Ridgeline

The second soil gas survey activity will be to investigate the shallow subsurface immediately downhill from several above ground storage tanks that are known to contain natural gas liquids (NGLs or condensate) located at the head of the Prather drainage valley. The proposed soil gas probe locations are shown on Figure 3. Boreholes for the condensate tank surveys will be installed adjacent to three tanks. Boreholes will be advanced to an approximate depth of 5-10 feet below ground surface, based on the site-specific lithology encountered during drilling. Proposed locations may be moved, added, or deleted based on the results of the initial soil gas analytical results.

Soil gas monitoring boreholes will be advanced using a drilling rig equipped with both direct-push (e.g., Geoprobe) and auger drilling techniques. Temporary soil gas monitoring points will be installed within each borehole. The monitoring points will consist of a short length of slotted pipe or tubing, connected to solid pipe or tubing. The borehole will be temporarily sealed at the ground surface to prevent dilution from the ambient air. Soil gas contained in the interstitial soil pore spaces will be sampled by evacuating the pipe or tubing with an air pump. Relative air-soil permeability testing will be conducted by comparing air flow rates measured using a vacuum gauge and/or flow meter. Purge volume and rate testing will be conducted prior to sampling to optimize these parameters. The purge volume and rate testing will be done to check for short-circuiting to the surface within the expected radius of influence around the borehole.

If deemed advantageous during the field investigation, soil gas samples may be collected within the direct-push drill tooling. To collect samples through the direct-push tooling, a ¼-inch outside diameter (O.D.) stainless steel probe is inserted into the hole and the hole is then sealed around the top of the probe using modeling clay to prevent dilution from the ambient air. The rod will be retracted approximately 6 inches from the bottom of the boring to disengage an expendable drive point allowing soil vapor to enter the rod. Gas contained in the interstitial soil spaces will be sampled through 3/8-inch O.D. low density polyethylene tubing inserted down through the center of the steel rod and connected to a dedicated, slotted, steel adapter tip at the bottom of the boring.

Soil gas will be screened using a photoionization detector (PID) to screen for volatile organic compounds. Samples from each soil gas probe will be collected and contained within Tedlar bags for analysis. The Tedlar sample bags will be filled passively by drawing the soil gas out of the ground under vacuum. The tubing and Tedlar bag will be dedicated to each probe location. Tedlar bag samples will be stored in plastic coolers and kept cool pending onsite analysis. This

will keep them out of direct sunlight, and prevent damage to samples in the field or in transit to the mobile laboratory. Samples will be analyzed within 24 to 48 hours after collection by the mobile laboratory, ChemSolutions.

4.0 Drilling and Monitoring Well Installation

The exact number of additional monitoring wells to be installed is dependent upon the results of the geophysical and soil gas surveys. If the petroleum hydrocarbon and/or chloride impacted groundwater flowpath can be identified with greater certainty with these surveys, wells will be installed to confirm the survey results. If the surveys cannot identify definitive flow path(s), additional monitoring wells will be installed along transects across the valley as shown in Figure 2. If transects are utilized, approximately eight additional wells will be installed in the Prather Spring drainage and approximately six additional wells will be installed in the Spring 2 drainage. The total depth of any proposed well is not anticipated to penetrate below the elevation of the Prather Spring or Spring 2 discharge points (8,239 and 8,210 ft msl, respectively). The wells will be screened within the basal five feet of colluvium and the upper one to ten feet of bedrock. This uppermost bedrock interval is observed in rock core to display the greatest fracture density, and likely provides the most permeable conduit for shallow groundwater flow. Proposed wells may be moved, added, or deleted based on the results of the geophysical survey, soil gas survey, and/or initial groundwater analytical results. To the extent practical, well locations will be verified with the Companies, COGCC, and the respective landowners prior to the well installations, although field decisions based on initial field results will be made as necessary.

The soil borings will be advanced into the bedrock using solid-stem auger drilling techniques. Where conditions allow, split-spoon samples will be collected from each borehole to verify the contact between the colluvium and the fractured bedrock. When split-spoon refusal is encountered, the borehole will be advanced with the solid-stem augers until auger refusal in competent bedrock, or to a maximum depth of 10 feet below the bedrock surface. During drilling, a URS geologist will visually describe lithologic and hydrologic properties of split spoon samples and cuttings, which will include field screening using a photo-ionization detector (PID) to identify intervals potentially containing petroleum hydrocarbons.

Monitoring wells will be installed at each borehole that encounters groundwater. Monitoring wells will consist of 1.5- or 2-inch diameter schedule 40 PVC and be marked with their well IDs, capped and locked. Monitoring wells will be constructed generally according to specifications outlined in the Joint Workplan.

5.0 Groundwater Development and Sampling

Each well will be developed following installation by removing between three and ten borehole volumes of water as described in the Joint Workplan. Once the wells have been developed, groundwater samples will be collected and submitted for analysis to the onsite mobile laboratory following procedures outlined in the Joint Workplan. The frequency of continued sampling of these proposed monitoring wells is described in the Phase 1 Joint Workplan Addendum #2 for groundwater, surface water, and spring sampling. It is anticipated that sampling of monitoring wells will be discontinued for the winter following the first major snowfall in the area.

6.0 Analytical Laboratory

In order to expedite analytical results, a mobile analytical laboratory will be onsite during the drilling operations to analyze soil gas and groundwater samples. ChemSolutions from Larkspur,

Colorado will provide analytical services in accordance with ISO-17025 accreditation procedures for the specified analytical methods.

Soil vapor samples will be analyzed for VOCs (Method 8260B) and water samples will be analyzed for VOCs (Method 8260B), TVPH (Method 8015B), and specific conductance by the onsite laboratory.

7.0 Field Quality Assurance/Quality Control (QA/QC) Samples

As an additional quality control (QC) measure, split samples will be collected and sent to an independent fixed-based laboratory for identical analyses. A minimum of one groundwater split sample will be collected as part of this investigation.

Field duplicates and additional sample volume for matrix spike/matrix spike duplicates (MS/MSD) analyses samples will be collected per the requirements of Section 2.7 the Joint Workplan. For sample equipment that is decontaminated, a minimum of one rinsate blank per equipment type per field effort will be collected and analyzed for the same parameters as the associated field samples.

8.0 Surveying

Obtaining precise elevation data relative to the site wells will be necessary to calculate potentiometric head levels for groundwater monitoring locations. Well locations will be surveyed using methods capable of obtaining vertical elevation precision of 0.01 foot. Wells will be surveyed by a registered surveyor relative to the existing site datum, to meet COGCC standards.

9.0 Data Validation and Management

Quality review, validation, and management of analytical data will be performed as described in the Joint Workplan.

10.0 Reporting

The results of the investigation will be compiled and presented in a brief summary report. The report will summarize field activities, and will include boring logs, a well completion table, a list of samples collected at each location, and other observations made in the field. The report will also describe geologic and hydrologic conditions encountered. The laboratory analytical results will be incorporated in the report as a summary table. If necessary the report will include recommendations for additional characterization activities.

11.0 References

URS Corporation (URS). 2008a. Phase I Site Investigation Work Plan, Prather Spring Investigation, Garfield County, Colorado. July.

URS. 2008b. Interim Prather Spring Phase One Site Investigation Drilling Report, Parachute, Colorado. August.

URS. 2008c. Prather Spring Site Investigation Phase 1 - Interim Progress Meeting. September 29, 2008.



NOTES:
 1. Horizontal Datum: UTM, NAD83, Zone 13N, meters
 2. Vertical Datum: NAVD29

Monitoring Wells	
	Shallow
	Intermediate
	Deep
	Creek
	Proposed EM34 Transect Lines
	Topographic Contour (10-ft.)

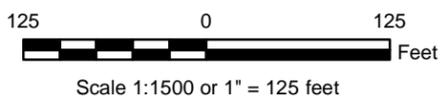


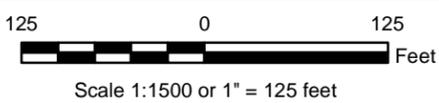
FIGURE 1 Proposed EM34 Transect Lines

Addendum #5
 Phase I Prather Spring Site Investigation

File Name
 em34_transects.mxd

Rev. Date
 10/07/08

Dr. By
 GCK



Proposed Locations		Monitoring Wells		Creek
	Shallow Bedrock and Colluvium Well		Shallow	
	Soil Gas Survey Boring		Intermediate	
			Deep	

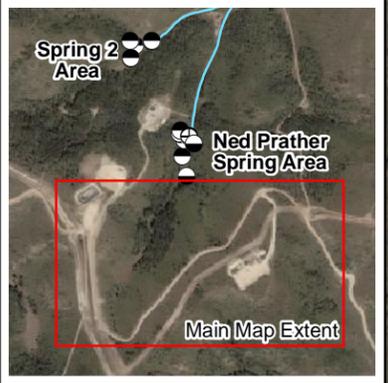
NOTES:
 1. Horizontal Datum: UTM, NAD83, Zone 13N, meters
 2. Vertical Datum: NAVD29



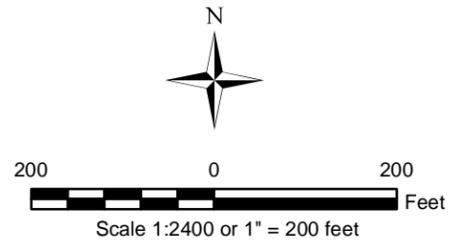
FIGURE 2 Proposed Soil Gas Survey Boring Locations and Additional Monitoring Wells

Addendum #5
 Phase I Prather Spring Site Investigation

File Name soil_gas_survey.mxd	Rev. Date 10/07/08	Dr. By GCK
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	Proposed Soil Gas Survey Boring and Sample Location	Monitoring Wells
	Soil Gas Investigation Area	Shallow
		Intermediate
		Deep



NOTES:
 1. Horizontal Datum: UTM, NAD83, Zone 13N, meters
 2. Vertical Datum: NAVD29



FIGURE 3 Condensate Tank Soil Gas Survey Areas

Addendum #5
 Phase I Prather Spring Site Investigation

File Name tank_areas.mxd	Rev. Date 10/07/08	Dr. By GCK
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MEMORANDUM

TO: David Lee, Nonsuch Natural Gas Inc.
Curtis Ryland, Marathon Oil Company
John Nussbaumer, Petroleum Development Corporation
Mike Paules, Williams Production RMT Company

FROM: Debbie Baldwin, COGCC

RE: Impacts to ground and surface water – SW Sec 14 T6S R97W

DATE: 6/19/08

As you know, on 6/3/08 Chris Canfield, COGCC Environmental Protection Specialist II, received a complaint from Mr. Ned Prather informing us that he had been to his cabin in SW Section 14 T6S R97W on 5/30/08, that he had drunk water from his spring, he had become ill, and had been taken to the hospital. On 6/4/08 Chris met Mr. Prather and together they inspected his spring, stock pond, and water supply in his cabin. Chris collected water samples from these, from 3 other springs in the area, and a fluid sample from an open pit at the Nonsuch Natural Gas CSOC 697-14 (05-045-97948) wellpad. Preliminary results indicated that volatile organic compounds, including benzene were detected in the samples collected from Mr. Prather's spring, stock pond, and faucet. Benzene concentrations exceeded the WQCC standard of 5 µg/l. The COGCC should be receiving the final analytical results from these samples by 6/20/08 and we will make this information available to all of you and to Mr. Prather. Chris met with Mr. Prather again today and is having another round of samples collected from the previously sampled sites and several other sites of concern to Mr. Prather. The analytical results from this second round of sampling will also be provided to you.

The COGCC is in the process of investigating this very serious situation. We believe that the impacts detected in the spring, pond, and faucet are the result of an unauthorized discharge of E&P waste from oil and gas operations in the vicinity and we are attempting to identify the source. To do this we need to compile information from the companies that conduct or have conducted oil and gas operations in the area. Nonsuch, Marathon, PDC, and Williams all have or had oil and gas operations in close proximity to and possibly upgradient of Mr. Prather's spring; therefore, Notices of Alleged Violation (NOAV) have been issued to all four companies.

The abatement and corrective action required by the NOAVs, includes providing COGCC with information related to specific wells and wellpads. But in addition you are required to consult with Mr. Prather and to implement mitigation measures by 7/7/08. The mitigation measures include fencing the impacted surface water to restrict access by livestock and wildlife and providing him with a supply of water for drinking and other household uses and for watering his livestock. Mr. Prather has been very patient while we have been gathering information and having the laboratory analyze all of the samples Chris collected. I believe it would be in everyone's best interest if Nonsuch,

Marathon, PDC, and Williams would act quickly and help Mr. Prather while the COGCC continues our investigation. I hope that you all will work together on the required mitigation measures.

Chris Canfield will be on vacation during the week of 6/23/08, so if you have questions or would like to discuss this matter, then please contact me at 303-894-2100 ex 111 or I would be happy to meet with all of you in person if that would expedite action on implementing the mitigation measures.

I look forward to your prompt attention to this very serious matter. Regards

Debbie Baldwin, Environmental Manager

COGCC
1120 Lincoln Street Suite 801
Denver, CO 80203
debbie.baldwin@state.co.us

cc: D. Neslin, Acting Director
D. Dillon, Engineering Manager
D. Andrews, NW Engineering Supervisor
C. Canfield, NW EPS II
C. Harmon, Enforcement Officer



July 30, 2008

Bob Coleman, Marathon Oil Company
David Lee, Nonsuch Natural Gas, Inc.
John Nussbaumer, Petroleum Development Corporation
Mike Paules, Williams Production RMT Company

Sent via e-mail

RE: Prather Spring Investigation

This letter addresses several outstanding issues related to the Prather Spring investigation:

1. The Colorado Oil & Gas Conservation Commission (COGCC) has not received a revised Form 27 and Phase I Site Investigation Work Plan (i.e. revisions of the original jointly-submitted documents to incorporate all of the items discussed and agreed to by Chris Canfield, Adell Heneghan, and Mark Levorsen on July 11, 2008 and summarized by Adell Heneghan in her letter of July 14, 2008). Those revised documents were to have been provided to the COGCC by July 18, 2008. Please provide these revised documents by the close of business on August 1, 2008.
2. The COGCC has not received any analytical data since the original jointly-submitted Form 27. Furthermore, that data was provided only in the form of summary tables. The COGCC must be provided with full laboratory reports and all analytical results in an electronic data deliverable (EDD) format. Please provide these by the close of business on August 1, 2008.
3. With the sole exception of an early report of a site access issue, the COGCC has not received any progress reports regarding the ongoing investigation. We understood we would be receiving daily updates. Please begin providing such updates immediately. We would prefer to receive progress reports (e.g. simple factual statements about the progress of the field activities, not opinions or interpretations) via e-mail. We realize Matthew Lepore has voiced an objection to this requirement; however, it would be impractical and inefficient for us to receive updates as daily telephone conversations.
4. The COGCC has received reports of the discovery of several dead animals, including at least one elk calf, a robin, and a chipmunk (or some other rodent). We would like you to investigate whether these mortalities are related to the impacted spring or surface water.

If you have any questions please contact me either by phone at 970-625-2497, extension 3 or via e-mail at chris.canfield@state.co.us.

Respectfully,

Chris Canfield, P.G.
Environmental Protection Specialist, Northwest Region

July 10, 2008

Bob Coleman, Marathon Oil Company
David Lee, Nonsuch Natural Gas, Inc.
John Nussbaumer, Petroleum Development Corporation
Mike Paules, Williams Production RMT Company

Sent via e-mail

RE: COGCC Review of Phase I Site Investigation Work Plan
Prather Spring Investigation

Colorado Oil & Gas Conservation Commission (COGCC) Staff has reviewed the Phase I Site Investigation Work Plan for the Prather Spring Investigation prepared by URS and provided in support of the Form 27 submitted jointly by Williams Production RMT (Williams), Marathon Oil Company (Marathon), Petroleum Development Corporation (PDC), and Nonsuch Natural Gas (Nonsuch) (collectively, the "Companies"). Staff has determined that the proposed work plan is inadequate to fully address the items of concern associated with this action. The following document provides a synopsis of what additional actions will be required.

Prather Spring: The work plan defines the Prather Spring as a permitted man-made well based on State Engineers Office (SEO) data. According to the property owner, it is a natural spring with minor improvements based on the construction of a spring box. It appears that incorrect paperwork was filed with the SEO on behalf of the property owner when the spring was registered resulting in the spring appearing in the SEO database as a man-made well. The legal status and corresponding description needs to be confirmed and clarified in the work plan and should be taken into consideration during planned field activities.

Impacted Media: The Form 27 and subsequent sections of the work plan indicate that the only impacted media is groundwater. The Form 27 must be revised to reflect all impacted media including:

- soils/sediments (contaminated soils are present at two locations)
- vegetation (distressed vegetation is present at two locations)
- groundwater (the subject spring)
- surface water (both the stock pond and a reach of approximately 1,000 foot of an unnamed tributary to McKay Gulch)

The work plan should also be revised to include investigation of all impacted media as well.

Data Continuity: All groundwater, surface water and soils analytical data collected by the companies to date, and all future data, must be consolidated into a common database with necessary nomenclature changes to ensure continuity of the sampling locations. An example is provided in attached Table 1.

Monitoring Plans: A comprehensive monitoring plan that includes both groundwater and surface water sampling locations needs to be included. The plan must include ongoing collection and analysis of samples from existing sampling locations as well as samples from planned new monitoring locations and must use a common nomenclature for the sample locations (see Data Continuity and Table 1).

Areal Extent of Investigation: The area proposed for investigation needs to be expanded to account for significant topographic changes in the vicinity and provide a mechanism to differentiate between potential source locations. The proposed well locations are clustered in one area which will make it difficult to quantify source locations if impacts are identified. In addition, where potential source areas have already been positively identified the investigation should include screening or data collection between those sources and Prather Spring (i.e. upgradient investigation).

Site Activities: This section needs to be updated to include the following:

- A multi-gas meter should also be used in addition to the photo ionization detector (PID) during drilling and sampling in case well leakage is the actual source and methane is present.
- Auger decontamination – all augers must be decontaminated between each well, not just the lead auger. It is critical that cross-contamination not occur.
- Well development protocols must be specified.
- Well purging must be for a minimum of three (3) borehole volumes (i.e. not casing volumes) or until field parameters stabilize.
- Coring or the collection of split spoon samples must be conducted at each boring location.
- Should impacts be identified either visibly or with ambient-temperature headspace screening using the PID, then soil samples will be collected and submitted for analyses; not just a “possible submittal” as stated in the work plan.
- It would also be prudent to collect at least one soil sample at the colluvium/alluvium bedrock interface for each location and submit for analysis to demonstrate the absence of impacts.
- If potentially impacted soils are found during PID screening, samples will be collected for analysis of Total Volatile Petroleum Hydrocarbons (TVPH) / Total Extractable Petroleum Hydrocarbons (TEPH).
- Positive results (>5mg/kg TVPH and/or >100mg/kg TEPH) from preliminary soil analysis will trigger subsequent VOC and SVOC analyses.
- One aqueous sample (of the six (6) proposed) shall be collected in duplicate and submitted to a second lab for any and all analytical procedures performed by the primary lab. If more than six (6) aqueous samples are collected in Phase 1 the frequency of samples submitted to a secondary lab shall be 10% or greater of those collected and submitted for analysis at the primary lab.

- A minimum of 1 soil replicate will be collected and submitted to a secondary lab if any soil samples are collected and submitted for analyses to the primary lab. If multiple soil samples are collected the frequency of samples submitted to a secondary lab shall be at a frequency of 10% or greater of those collected and submitted for analysis at the primary lab.
- The subject spring box and all contaminated soils around it must be removed and the spring box replaced. Collection and analysis of soil samples will be required to confirm the effectiveness of the removal action.
- The cistern associated with the spring box must be removed and replaced. Samples of any sediment or other solid materials within the cistern will be collected and submitted for laboratory analysis.
- Either replace the hot water heater inside Mr. Prather's cabin or evaluate the potential for inhalation of benzene while using his shower.

Data Delivery: Copies of all data should be submitted to the COGCC in electronic format and should include all raw data, validation data, chromatograms and supporting documentation. Location coordinates should also be included in NAD 83 as well as UTM in accordance with COGCC Rule 215.

Please be aware that Staff believes, given the geology of the area, it may be necessary to install nested monitoring points to adequately characterize the area as the impacts may not be confined to the colluvium/alluvium and may actually be travelling in shallow fractured bedrock. If results of Phase 1 activities support this assumption, additional monitoring point installation may require bedrock drilling and/or tracer studies.

If you have any questions please contact me either by phone at 970-625-2497, extension 3 or via e-mail at chris.canfield@state.co.us.

Respectfully,

Chris Canfield, P.G.
Environmental Protection Specialist, Northwest Region

Attachments: Table 1, Common Data Nomenclature

Table 1
Common Data Nomenclature

Facility ID	Name in COGCC-WQ Database	COGCC Sample Locations (06/04/08)	Marathon Sample Locations (06/06/08 & 06/09/08)	EarthTech/COGCC Sample Locations (06/19/08)
705381	Ned Prather Spring	Ned's Spring	Ned Prather Spring (also referred to by Marathon as the "source spring" or "system outlet")	Ned's Spring
705394	Ned Prather Cabin (inside)	Ned's Cabin		N/A
705386	Ned Prather Cabin (outside)	N/A	Cabin (aka Ned Prather Cabin)	Ned's Cabin Bypass
705382	Second Spring	Second Spring	Spring No. 2	Unnamed Tributary to McKay Gulch
705382	Second Spring	N/A	N/A	Second Unnamed Tributary to McKay Gulch
705384	Ned Prather Stock Pond	Ned's Stock Pond	Pond (06/09 sample), Stock Pond (06/20 sample)	
705392	Ned Prather Stock Pond (West Side)	N/A	N/A	Ned's Pond North
705391	Ned Prather Stock Pond (South Side)	N/A	N/A	Ned's Pond West
705390	Ned Prather Stock Pond (East Side)	N/A	N/A	Ned's Pond East
705383	Dick Prather Cabin (inside)	Dick's Spring	DP Faucet or D Cabin	N/A
705395	Dick Prather Cabin (outside)	N/A	N/A	Dick's Cabin Outside
705396	Dick Prather Stock Pond	N/A	N/A	Dick's Pond
705397	Spring Below Dick Prather Cabin	N/A	N/A	Spring Below Dick's Cabin
705393	Stream Below Ned Prather Stock Pond	N/A	N/A	Below Ned's Stock Pond
705385	Donna's Stock Tank	Donna's Spring	Stock Tank	Donna's Stock Tank
API 045-07948	CSOC 697-14 1	CSOC 697-14 No. 1 Produced Water	N/A	N/A

COGIS - NOAV Report**Operator Information**

DocNum:	200191134	Date Rec'd:	6/19/2008
Operator:	PETROLEUM DEVELOPMENT CORP	Oper. No.	69175
Address:	1775 SHERMAN ST. SUITE 3000 ATTN: J. NUSSBAUMER DENVER , CO 80203		
Company Rep.	JOHN NUSSBAUMER		
Well Name/No.	CHEVRON-MARATHON 11D-14D		
Location	NWNW 23 T6S R97W 6		
Fac.ID:	291570	Fac.Type:	WELL
API number:	05-045 -14440	County	GARFIELD
COGCC Rep:	DEBBIE BALDWIN	Phone:	(303) 894-2100

Alleged Violation:**Date of Alleged Violation:** 5/30/2008**Approx. time of violation:**

Unauthorized discharge of E&P waste has occurred from oil and gas operations in the vicinity of Mr. Prather's spring, cabin, and pond and has impacted ground and surface water. On 5/30/08 Mr. Ned Prather visited his cabin located in SW 14, 6S, 97W, Garfield County. He drank water from his spring (DWR #233234), felt a burning sensation in his throat, became ill, and was taken to the hospital. On 6/3/08 Mr. Prather filed a complaint (200190483) with the COGCC. On 6/4/08 Chris Canfield met Mr. Prather and collected water samples from his spring box, the faucet in his cabin from which he drank, and his stock pond, which is fed by the same spring. Mr. Canfield also collected water samples 3 springs providing water for 3 other cabins in the immediate area and fluids in the pit associated with Nonsuch Natural Gas's CSOC 697-14 #1 Well (05-045-07948). Volatile organic compounds (VOC) were detected in water samples from Mr. Prather's spring, pond, and faucet, including benzene which exceeded the WQCC standard of 5 µg/l.

Act, Order, Regulation, Permit Conditions Cited:

209, 324A.a, 324A.b, 902.a, 906.a, 906.b.(3), 907.a.(1), 907.a.(2)

Abatement or Corrective Action Required to be Performed by Operator

Provide written descriptions of: 1. any pits constructed or used on the wellpad, including size, volume, whether or not the pit was lined; 2. all fluids (water, drilling, completion, and frac fluids, flowback, etc.) placed in the pit, including volumes, dates, etc. Include haul tickets for all fluids brought from offsite to the pit(s); 3. whether condensate was observed in the pit during flowback or completion; and 4. tanks or other containers that were used at this site to manage fluids and any spills/releases that occurred. Submit: 1. Site Investigation & Remediation Work Plan (Form 27) for COGCC review, and 2. all analytical data collected to date. In addition consult with and mitigate impacts to Mr. Prather's springs, including 1. fencing impacted surface water to restrict access by livestock and wildlife, and 2. providing him with a supply of water for drinking and other household use and for watering livestock.

Abatement or Corrective Action Required to be Completed by: 7/7/2008*This section to be completed by Operator when alleged violation is corrected*

Company Rep:	Title:
Signature?	Date: 6/19/2008 6:09:28 PM

Company Comments:

COGCC Signature?	Date: 6/17/2008 4:50:00 PM
Resolution approved by:	Title:

Final Resolution

Date	Case Closed?	Letter Sent?	COGCC person
No Final data found.			

COGIS - NOAV Report**Operator Information**

DocNum:	200191138	Date Rec'd:	6/19/2008
Operator:	PETROLEUM DEVELOPMENT CORP	Oper. No.	69175
Address:	1775 SHERMAN ST. SUITE 3000 ATTN: J. NUSSBAUMER DENVER , CO 80203		
Company Rep.	JOHN NUSSBAUMER		
Well Name/No.	CHEVRON-MARATHON 41A-22D		
Location	NWNW 23 T6S R97W 6		
Fac.ID:	291568	Fac.Type:	WELL
API number:	05-045 -14441	County	GARFIELD
COGCC Rep:	DEBBIE BALDWIN	Phone:	(303) 894-2100

Alleged Violation:**Date of Alleged Violation:** 5/30/2008**Approx. time of violation:**

Unauthorized discharge of E&P waste has occurred from oil and gas operations in the vicinity of Mr. Prather's spring, cabin, and pond and has impacted ground and surface water. On 5/30/08 Mr. Ned Prather visited his cabin located in SW 14, 6S, 97W, Garfield County. He drank water from his spring (DWR #233234), felt a burning sensation in his throat, became ill, and was taken to the hospital. On 6/3/08 Mr. Prather filed a complaint (200190483) with the COGCC. On 6/4/08 Chris Canfield met Mr. Prather and collected water samples from his spring box, the faucet in his cabin from which he drank, and his stock pond, which is fed by the same spring. Mr. Canfield also collected water samples 3 springs providing water for 3 other cabins in the immediate area and fluids in the pit associated with Nonsuch Natural Gas's CSOC 697-14 #1 Well (05-045-07948). Volatile organic compounds (VOC) were detected in water samples from Mr. Prather's spring, pond, and faucet, including benzene which exceeded the WQCC standard of 5 µg/l.

Act, Order, Regulation, Permit Conditions Cited:

209, 324A.a, 324A.b, 902.a, 906.a, 906.b.(3), 907.a.(1), 907.a.(2)

Abatement or Corrective Action Required to be Performed by Operator

Provide written descriptions of: 1. any pits constructed or used on the wellpad, including size, volume, whether or not the pit was lined; 2. all fluids (water, drilling, completion, and frac fluids, flowback, etc.) placed in the pit, including volumes, dates, etc. Include haul tickets for all fluids brought from offsite to the pit(s); 3. whether condensate was observed in the pit during flowback or completion; and 4. tanks or other containers that were used at this site to manage fluids and any spills/releases that occurred. Submit: 1. Site Investigation & Remediation Work Plan (Form 27) for COGCC review, and 2. all analytical data collected to date. In addition consult with and mitigate impacts to Mr. Prather's springs, including 1. fencing impacted surface water to restrict access by livestock and wildlife, and 2. providing him with a supply of water for drinking and other household use and for watering livestock.

Abatement or Corrective Action Required to be Completed by: 7/7/2008*This section to be completed by Operator when alleged violation is corrected*

Company Rep:	Title:
Signature?	Date: 6/19/2008 6:09:50 PM

Company Comments:

COGCC Signature?	Date: 6/17/2008 4:50:00 PM
Resolution approved by:	Title:

Final Resolution

Date	Case Closed?	Letter Sent?	COGCC person
No Final data found.			

COGIS - NOAV Report**Operator Information**

DocNum:	200191141	Date Rec'd:	6/19/2008
Operator:	MARATHON OIL COMPANY	Oper. No.	53650
Address:	734 Horizon Ct. Suite 220 GRAND JUNCTION , CO 81506		
Company Rep.	CURTIS RYLAND		
Well Name/No.	CHEVRON-MARATHON 41A-22D		
Location	NWNW 23 T6S R97W 6		
Fac.ID:	291568	Fac.Type:	WELL
API number:	05-045 -14441	County	GARFIELD
COGCC Rep:	DEBBIE BALDWIN	Phone:	(303) 894-2100

Alleged Violation:**Date of Alleged Violation:** 5/30/2008**Approx. time of violation:**

Unauthorized discharge of E&P waste has occurred from oil and gas operations in the vicinity of Mr. Prather's spring, cabin, and pond and has impacted ground and surface water. On 5/30/08 Mr. Ned Prather visited his cabin located in SW 14, 6S, 97W, Garfield County. He drank water from his spring (DWR #233234), felt a burning sensation in his throat, became ill, and was taken to the hospital. On 6/3/08 Mr. Prather filed a complaint (200190483) with the COGCC. On 6/4/08 Chris Canfield met Mr. Prather and collected water samples from his spring box, the faucet in his cabin from which he drank, and his stock pond, which is fed by the same spring. Mr. Canfield also collected water samples 3 springs providing water for 3 other cabins in the immediate area and fluids in the pit associated with Nonsuch Natural Gas's CSOC 697-14 #1 Well (05-045-07948). Volatile organic compounds (VOC) were detected in water samples from Mr. Prather's spring, pond, and faucet, including benzene which exceeded the WQCC standard of 5 µg/l.

Act, Order, Regulation, Permit Conditions Cited:

209, 324A.a, 324A.b, 902.a, 906.a, 906.b.(3), 907.a.(1), 907.a.(2)

Abatement or Corrective Action Required to be Performed by Operator

Provide written descriptions of: 1. any pits constructed or used on the wellpad, including size, volume, whether or not the pit was lined; 2. all fluids (water, drilling, completion, and frac fluids, flowback, etc.) placed in the pit, including volumes, dates, etc. Include haul tickets for all fluids brought from offsite to the pit(s); 3. whether condensate was observed in the pit during flowback or completion; and 4. tanks or other containers that were used at this site to manage fluids and any spills/releases that occurred. Submit: 1. Site Investigation & Remediation Work Plan (Form 27) for COGCC review, and 2. all analytical data collected to date. In addition consult with and mitigate impacts to Mr. Prather's springs, including 1. fencing impacted surface water to restrict access by livestock and wildlife, and 2. providing him with a supply of water for drinking and other household use and for watering livestock.

Abatement or Corrective Action Required to be Completed by: 7/7/2008*This section to be completed by Operator when alleged violation is corrected*

Company Rep:	Title:
Signature?	Date: 6/19/2008 6:10:17 PM

Company Comments:

COGCC Signature?	Date: 6/17/2008 4:50:00 PM
Resolution approved by:	Title:

Final Resolution

Date	Case Closed?	Letter Sent?	COGCC person
No Final data found.			

COGIS - NOAV Report**Operator Information**

DocNum:	200191142	Date Rec'd:	6/19/2008
Operator:	MARATHON OIL COMPANY	Oper. No.	53650
Address:	734 HORIZON CT. SUITE 220 ATTN: CURTIS RYLAND GRAND JUNCTION , CO 81506		
Company Rep.	CURTIS RYLAND		
Well Name/No.	CHEVRON-MARATHON 11D-14D		
Location	NWNW 23 T6S R97W 6		
Fac.ID:	291570	Fac.Type:	WELL
API number:	05-045 -14440	County	GARFIELD
COGCC Rep:	DEBBIE BALDWIN	Phone:	(303) 894-2100

Alleged Violation:**Date of Alleged Violation:** 5/30/2008**Approx. time of violation:**

Unauthorized discharge of E&P waste has occurred from oil and gas operations in the vicinity of Mr. Prather's spring, cabin, and pond and has impacted ground and surface water. On 5/30/08 Mr. Ned Prather visited his cabin located in SW 14, 6S, 97W, Garfield County. He drank water from his spring (DWR #233234), felt a burning sensation in his throat, became ill, and was taken to the hospital. On 6/3/08 Mr. Prather filed a complaint (200190483) with the COGCC. On 6/4/08 Chris Canfield met Mr. Prather and collected water samples from his spring box, the faucet in his cabin from which he drank, and his stock pond, which is fed by the same spring. Mr. Canfield also collected water samples 3 springs providing water for 3 other cabins in the immediate area and fluids in the pit associated with Nonsuch Natural Gas's CSOC 697-14 #1 Well (05-045-07948). Volatile organic compounds (VOC) were detected in water samples from Mr. Prather's spring, pond, and faucet, including benzene which exceeded the WQCC standard of 5 µg/l.

Act, Order, Regulation, Permit Conditions Cited:

209, 324A.a, 324A.b, 902.a, 906.a, 906.b.(3), 907.a.(1), 907.a.(2)

Abatement or Corrective Action Required to be Performed by Operator

Provide written descriptions of: 1. any pits constructed or used on the wellpad, including size, volume, whether or not the pit was lined; 2. all fluids (water, drilling, completion, and frac fluids, flowback, etc.) placed in the pit, including volumes, dates, etc. Include haul tickets for all fluids brought from offsite to the pit(s); 3. whether condensate was observed in the pit during flowback or completion; and 4. tanks or other containers that were used at this site to manage fluids and any spills/releases that occurred. Submit: 1. Site Investigation & Remediation Work Plan (Form 27) for COGCC review, and 2. all analytical data collected to date. In addition consult with and mitigate impacts to Mr. Prather's springs, including 1. fencing impacted surface water to restrict access by livestock and wildlife, and 2. providing him with a supply of water for drinking and other household use and for watering livestock.

Abatement or Corrective Action Required to be Completed by: 7/7/2008*This section to be completed by Operator when alleged violation is corrected*

Company Rep:	Title:
Signature?	Date: 6/19/2008 6:10:44 PM

Company Comments:

COGCC Signature?	Date: 6/17/2008 4:50:00 PM
Resolution approved by:	Title:

Final Resolution

Date	Case Closed?	Letter Sent?	COGCC person
No Final data found.			

COGIS - NOAV Report**Operator Information**

DocNum:	200193443	Date Rec'd:	8/7/2008
Operator:	MARATHON OIL COMPANY	Oper. No.	53650
Address:	734 HORIZON CT., SUITE 220 GRAND JUNCTION , CO 81506		
Company Rep.	BOB COLEMAN		
Well Name/No.	CHEVRON-MARATHON 11D-14D		
Location	NWNW 23 T6S R97W 6		
Fac.ID:	291570	Fac.Type:	WELL
API number:	05-045 -14440	County	GARFIELD
COGCC Rep:	CHRIS CANFIELD	Phone:	(970) 625-2497

Alleged Violation:**Date of Alleged Violation:** 7/17/2008**Approx. time of violation:**

Failure to notify the NRC, CDPHE-WQCD, & COGCC of the discovery of benzene in a spring (Prather Spring Investigation - Spring No. 2) supplying water to a stock pond. Additionally, the land owner (Ned Prather) was not notified of the release in a timely manner.

Act, Order, Regulation, Permit Conditions Cited:

906..b.(3) "spill/releases of any size which impact or threaten to impact any waters of the state, residence or occupied structure, livestock, or public byway, shall be reported to the Director as soon as practicable after the discovery."

Abatement or Corrective Action Required to be Performed by Operator

Consult immediately with Mr. Prather and take any necessary actions to protect his health and safety, the health of his live stock, and to mitigate impacts to his property. Provide the COGCC with full laboratory reports for the sample from Spring No. 2 in which benzene was first detected including associated chain-of-custody documentation. Provide the COGCC with a written explanation of why notification was not made in a timely manner. Provide the COGCC with a timeline depicting the sequence of events starting with the collection of the sample from Spring No. 2 in which benzene was first detected and continuing through the time the respondent received the analytical results for that sample.

Abatement or Corrective Action Required to be Completed by: 8/15/2008

This section to be completed by Operator when alleged violation is corrected

Company Rep:	Title:	
Signature?	Date:	8/7/2008 11:02:27 AM

Company Comments:

COGCC Signature?	Date: N/A
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Resolution approved by:	Title:
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Final Resolution

Date	Case Closed?	Letter Sent?	COGCC person
No Final data found.			

COGIS - NOAV Report**Operator Information**

DocNum:	200193444	Date Rec'd:	8/7/2008
Operator:	MARATHON OIL COMPANY	Oper. No.	53650
Address:	734 HORIZON COURT, SUITE 220 GRAND JUNCTION , CO 81506		
Company Rep.	BOB COLEMAN		
Well Name/No.	CHEVRON-MARATHON 11D-14D		
Location	NWNW 23 T6S R97W 6		
Fac.ID:	291570	Fac.Type:	WELL
API number:	05-045 -14440	County	GARFIELD
COGCC Rep:	CHRIS CANFIELD	Phone:	(970) 216-6832

Alleged Violation:**Date of Alleged Violation:** 7/17/2008**Approx. time of violation:**

Failure to notify the NRC, CDPHE-WQCD, & COGCC of the discovery of benzene in a spring (Prather Spring Investigation - Spring No. 2) supplying water to a stock pond. Additionally, the land owner (Ned Prather) was not notified of the release in a timely manner.

Act, Order, Regulation, Permit Conditions Cited:

906..b.(3) "spill/releases of any size which impact or threaten to impact any waters of the state, residence or occupied structure, livestock, or public byway, shall be reported to the Director as soon as practicable after the discovery."

Abatement or Corrective Action Required to be Performed by Operator

Consult immediately with Mr. Prather and take any necessary actions to protect his health and safety, the health of his live stock, and to mitigate impacts to his property. Provide the COGCC with full laboratory reports for the sample from Spring No. 2 in which benzene was first detected including associated chain-of-custody documentation. Provide the COGCC with a written explanation of why notification was not made in a timely manner. Provide the COGCC with a timeline depicting the sequence of events starting with the collection of the sample from Spring No. 2 in which benzene was first detected and continuing through the time the respondent received the analytical results for that sample.

Abatement or Corrective Action Required to be Completed by: 8/15/2008

This section to be completed by Operator when alleged violation is corrected

Company Rep:	Title:	
Signature?	Date:	8/7/2008 11:17:49 AM

Company Comments:

COGCC Signature?	Date: N/A
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Resolution approved by:	Title:
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Final Resolution

Date	Case Closed?	Letter Sent?	COGCC person
No Final data found.			

COGIS - NOAV Report**Operator Information**

DocNum:	200193445	Date Rec'd:	8/7/2008
Operator:	MARATHON OIL COMPANY	Oper. No.	53650
Address:	734 HORIZON COURT, SUITE 220 GRAND JUNCTION , CO 81506		
Company Rep.	BOB COLEMAN		
Well Name/No.	CHEVRON-MARATHON 41A-22D		
Location	NWNW 23 T6S R97W 6		
Fac.ID:	291568	Fac.Type:	WELL
API number:	05-045 -14441	County	GARFIELD
COGCC Rep:	CHRIS CANFIELD	Phone:	(970) 216-6832

Alleged Violation:**Date of Alleged Violation:** 7/17/2008**Approx. time of violation:**

Failure to notify the NRC, CDPHE-WQCD, & COGCC of the discovery of benzene in a spring (Prather Spring Investigation - Spring No. 2) supplying water to a stock pond. Additionally, the land owner (Ned Prather) was not notified of the release in a timely manner.

Act, Order, Regulation, Permit Conditions Cited:

906..b.(3) "spill/releases of any size which impact or threaten to impact any waters of the state, residence or occupied structure, livestock, or public byway, shall be reported to the Director as soon as practicable after the discovery."

Abatement or Corrective Action Required to be Performed by Operator

Consult immediately with Mr. Prather and take any necessary actions to protect his health and safety, the health of his live stock, and to mitigate impacts to his property. Provide the COGCC with full laboratory reports for the sample from Spring No. 2 in which benzene was first detected including associated chain-of-custody documentation. Provide the COGCC with a written explanation of why notification was not made in a timely manner. Provide the COGCC with a timeline depicting the sequence of events starting with the collection of the sample from Spring No. 2 in which benzene was first detected and continuing through the time the respondent received the analytical results for that sample.

Abatement or Corrective Action Required to be Completed by: 8/15/2008

This section to be completed by Operator when alleged violation is corrected

Company Rep:	Title:	
Signature?	Date:	8/7/2008 11:23:47 AM

Company Comments:

COGCC Signature?	Date: N/A
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Resolution approved by:	Title:
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Final Resolution

Date	Case Closed?	Letter Sent?	COGCC person
No Final data found.			

COGIS - NOAV Report**Operator Information**

DocNum:	200193447	Date Rec'd:	8/7/2008
Operator:	PETROLEUM DEVELOPMENT CORP	Oper. No.	69175
Address:	1775 SHERMAN STREET, SUITE 3000 DENVER , CO 80203		
Company Rep.	JOHN NUSSBAUMER		
Well Name/No.	CHEVRON-MARATHON 11D-14D		
Location	NWNW 23 T6S R97W 6		
Fac.ID:	291570	Fac.Type:	WELL
API number:	05-045 -14440	County	GARFIELD
COGCC Rep:	CHRIS CANFIELD	Phone:	(970) 216-6832

Alleged Violation:**Date of Alleged Violation:** 7/17/2008**Approx. time of violation:**

Failure to notify the NRC, CDPHE-WQCD, & COGCC of the discovery of benzene in a spring (Prather Spring Investigation - Spring No. 2) supplying water to a stock pond. Additionally, the land owner (Ned Prather) was not notified of the release in a timely manner.

Act, Order, Regulation, Permit Conditions Cited:

906..b.(3) "spill/releases of any size which impact or threaten to impact any waters of the state, residence or occupied structure, livestock, or public byway, shall be reported to the Director as soon as practicable after the discovery."

Abatement or Corrective Action Required to be Performed by Operator

Consult immediately with Mr. Prather and take any necessary actions to protect his health and safety, the health of his live stock, and to mitigate impacts to his property. Provide the COGCC with full laboratory reports for the sample from Spring No. 2 in which benzene was first detected including associated chain-of-custody documentation. Provide the COGCC with a written explanation of why notification was not made in a timely manner. Provide the COGCC with a timeline depicting the sequence of events starting with the collection of the sample from Spring No. 2 in which benzene was first detected and continuing through the time the respondent received the analytical results for that sample.

Abatement or Corrective Action Required to be Completed by: 8/15/2008

This section to be completed by Operator when alleged violation is corrected

Company Rep:	Title:	
Signature?	Date:	8/7/2008 11:39:15 AM

Company Comments:

COGCC Signature?	Date: N/A
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Resolution approved by:	Title:
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Final Resolution

Date	Case Closed?	Letter Sent?	COGCC person
No Final data found.			

COGIS - NOAV Report**Operator Information**

DocNum:	200193448	Date Rec'd:	8/7/2008
Operator:	PETROLEUM DEVELOPMENT CORP	Oper. No.	69175
Address:	1775 SHERMAN STREET, SUITE 3000 DENVER , CO 80203		
Company Rep.	JOHN NUSSBAUMER		
Well Name/No.	CHEVRON-MARATHON 41A-22D		
Location	NWNW 23 T6S R97W 6		
Fac.ID:	291568	Fac.Type:	WELL
API number:	05-045 -14441	County	GARFIELD
COGCC Rep:	CHRIS CANFIELD	Phone:	(970) 216-6832

Alleged Violation:**Date of Alleged Violation:** 7/17/2008**Approx. time of violation:**

Failure to notify the NRC, CDPHE-WQCD, & COGCC of the discovery of benzene in a spring (Prather Spring Investigation - Spring No. 2) supplying water to a stock pond. Additionally, the land owner (Ned Prather) was not notified of the release in a timely manner.

Act, Order, Regulation, Permit Conditions Cited:

906..b.(3) "spill/releases of any size which impact or threaten to impact any waters of the state, residence or occupied structure, livestock, or public byway, shall be reported to the Director as soon as practicable after the discovery."

Abatement or Corrective Action Required to be Performed by Operator

Consult immediately with Mr. Prather and take any necessary actions to protect his health and safety, the health of his live stock, and to mitigate impacts to his property. Provide the COGCC with full laboratory reports for the sample from Spring No. 2 in which benzene was first detected including associated chain-of-custody documentation. Provide the COGCC with a written explanation of why notification was not made in a timely manner. Provide the COGCC with a timeline depicting the sequence of events starting with the collection of the sample from Spring No. 2 in which benzene was first detected and continuing through the time the respondent received the analytical results for that sample.

Abatement or Corrective Action Required to be Completed by: 8/15/2008

This section to be completed by Operator when alleged violation is corrected

Company Rep:	Title:	
Signature?	Date:	8/7/2008 11:49:19 AM

Company Comments:

COGCC Signature?	Date: N/A
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Resolution approved by:	Title:
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Final Resolution

Date	Case Closed?	Letter Sent?	COGCC person
No Final data found.			

State of Colorado
Oil and Gas Conservation Commission

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



FOR OGCC USE ONLY
06/19/2008
200191132

*** NOTICE OF ALLEGED VIOLATION ***

OGCC Operator Number: 10163
Name of Operator: NONSUCH NATURAL GAS INC
Address: P O BOX 110066 ATTN: DAVID LEE
City: NAPELS State: FL Zip: 34108
Company Representative: DAVID LEE

Date Notice Issued:
06/19/2008

Well Name: CSOC 697-14 Well Number: 1 Facility Number: 261391
Location (Qtr, Sec, Twp, Rng, Meridian): SWSW 14 6S 97W 6 County: GARFIELD
API Number: 05 045 07948 00 Lease Number:

COGCC Representative: BALDWIN DEBBIE Phone Number: 303 894-2100

THE FOLLOWING ALLEGED VIOLATION WAS FOUND BY THE COGCC REPRESENTATIVE FOR THE SITE LISTED

Date of Alleged Violation: 05/30/2008

Approximate Time of Violation:

Description of Alleged Violation:

Unauthorized discharge of E&P waste has occurred from oil and gas operations in the vicinity of Mr. Prather's spring, cabin, and pond and has impacted ground and surface water.

On 5/30/08 Mr. Ned Prather visited his cabin located in SW 14, 6S, 97W, Garfield County. He drank water from his spring (DWR #2323234), felt a burning sensation in his throat, became ill, and was taken to the hospital. On 6/3/08 Mr. Prather filed a complaint (200190483) with the COGCC. On 6/4/08 Chris Canfield met Mr. Prather and collected water samples from his spring box, the faucet in his cabin from which he drank, and his stock pond, which is fed by the same spring. Mr. Canfield also collected water samples from 3 springs that provide water for 3 other cabins in the immediate area and fluids in the pit associated with Nonsuch Natural Gas's CSOC 697-14 #1 Well (05-045-07948). Volatile organic compounds (VOC) including benzene were detected in water samples from Mr. Prather's spring, pond, and faucet, including benzene which exceeded the WQCC standard of 5 µg/l.

Act, Order, Regulation, Permit Conditions Cited:

209, 324A.a, 324A.b, 902.a, 906.a, 906.b.(3), 907.a.(1), 907.a.(2)

Abatement or Corrective Action Required to be Performed by Operator*:

1. any pits constructed or used on the wellpad, including size, volume, whether or not the pit was lined;
2. all fluids (water, drilling, completion, and frac fluids, flowback, etc.) placed in the pit, including volumes, dates, etc. Include haul tickets for all fluids brought from offsite to the pit(s);
3. whether condensate was observed in the pit during flowback or completion; and
4. tanks or other containers that were used at this site to manage fluids and any spills/releases that occurred. Submit: 1. Site Investigation & Remediation Work Plan (Form 27) for COGCC review, and 2. all analytical data collected to date. In addition consult with and mitigate impacts to Mr. Prather's springs, including 1. fencing impacted surface water to restrict access by livestock and wildlife, and 2. providing him with a supply of water for drinking and other household use and for watering livestock.

Abatement or Corrective Action to be Completed by (date): 07/07/2008

* Proper and timely abatement does not necessarily preclude the assessment of penalties and an Order Finding Violation.

TO BE COMPLETED BY OPERATOR - When alleged violation is corrected, sign this notice and return to above address:

Company Representative Name: _____

Title: _____

Signature: _____

Date: _____

Company Comments: _____

*** THIS NOTICE CONSTITUTES A SEPARATE NOTICE OF ALLEGED VIOLATION FOR EACH VIOLATION LISTED ***

WARNING

Abatement and reporting time frames for Notices of Alleged Violation begin upon receipt of the Notice or five days after the date it is mailed, whichever is earlier. Each violation must be abated within the prescribed time upon receipt of this Notice, reported to the Colorado Oil and Gas Conservation Commission at the address shown above, and postmarked no later than the next business day after the prescribed time for abatement. Should abatement or corrective action fail to occur, the Director may make application to the Commission for an Order Finding Violation. Proper and timely abatement does not necessarily preclude the assessment of penalties and an Order Finding Violation.

PENALTY PROPOSED BY THE DIRECTOR PER RULE 523

The Director may propose a penalty as listed in the table below, not to exceed a maximum of \$1,000.00 per day per violation. Such proposed penalty amount will be limited to \$10,000.00 per violation if the violation does not result in significant waste of oil and gas resources, damage to correlative rights, or a significant adverse impact on public health, safety, or welfare. Such proposed penalty amount may be increased if aggravating factors indicate the violation: was intentional or reckless; had, or threatened to have, a significant negative impact on public health, safety, or welfare; resulted in significant waste of oil and gas resources; had a significant negative impact on correlative rights of other parties; resulted in, or threatened to result in, significant loss or damage to public or private property; involved recalcitrance or recidivism upon the part of the violator; involved intentional false reporting or record keeping; resulted in economic benefit to the violator. Such proposed penalty amount may be decreased if mitigating factors indicate the violator: self-reported; promptly, effectively and prudently responded to the violation; cooperated with the Commission or other agencies with respect to the violation; could not reasonably control, or be responsible for, the cause of the violation; made a good faith effort to comply with applicable requirements with Commission rules, regulations, and orders. The Commission has final authority over the penalty amount assessed. The Commission or other agencies with respect to the violation; could not reasonably control, or be responsible for, the cause of the violation; made a good faith effort to comply with applicable requirements prior to the Commission learning of the violation; had any economic benefit reduced or eliminated due to the cost of correcting the violation; has demonstrated a history of compliance with Commission rules, regulations, and orders. The Commission has final authority over the penalty amount assessed. The Commission or other agencies with respect to the violation; could not reasonably control, or be responsible for, the cause of the violation; made a good faith effort to comply with applicable requirements with Commission rules, regulations and orders. The Commission has final authority over the penalty amount assessed. The Commission or other agencies with respect to the violation; could not reasonably control, or be responsible for, the cause of the violation; made a good faith effort to comply with applicable requirements prior to the Commission learning of the violation; had any economic benefit reduced or eliminated due to the cost of correcting the violation; has demonstrated a history of compliance with Commission rules, regulations, and orders. The Commission has final authority over the penalty amount assessed.

BASE FINE \$250.00 PER DAY PER VIOLATION:	RULES 210, 307, 311, 312, 313, 314A, 315, 403, 405, 603, 604
BASE FINE \$500.00 PER DAY PER VIOLATION:	RULES 205, 206, 207, 208, 302, 306, 308, 310, 316A, 321, 322, 328, 329, 330, 331, 332, 401
BASE FINE \$750.00 PER DAY PER VIOLATION:	RULES 605, 606A, 606B, 609
BASE FINE \$1,000.00 PER DAY PER VIOLATION:	RULES 209, 301, 303, 305, 306, 316B, 317, 317A, 318, 319, 320, 323, 324, 325, 326, 327, 333, 404, 602, 603, 604, 703, 704, 705, 706, 707, 708, 709, 711, 802, 801, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 1002, 1003, 1004, 1101, 1102, 1103

In accordance with Rule 523.a.(4), fines for violations for which no base fine is listed shall be determined by the Commission at its discretion.

Signature of COGCC Representative: _____

Debbie Baldwin

Date: 06/19/2008

Time: 4:57 PM

Resolution Approved by: _____

Date: _____



FOR OGCC USE ONLY
06/19/2008
200191139

***** NOTICE OF ALLEGED VIOLATION *****

OGCC Operator Number: 96850
Name of Operator: WILLIAMS PRODUCTION RMT COMPANY
Address: 1515 ARAPAHOE ST STE 1000 ATTN: MIKE PAULES
City: DENVER State: CO Zip: 80202
Company Representative: MIKE PAULES

Date Notice Issued:
06/19/2008

Well Name: CRYSTAL CREEK A-2 Well Number: MV 1-23 Facility Number: 210718
Location (Qtr/Tr, Sec, Twp, Rng, Meridian): NWNW 23 6S 97W 6 County: GARFIELD
API Number: 05 045 06476 00 Lease Number: 12703

COGCC Representative: BALDWIN DEBBIE Phone Number: 303 894-2100

THE FOLLOWING ALLEGED VIOLATION WAS FOUND BY THE COGCC REPRESENTATIVE FOR THE SITE LISTED

Date of Alleged Violation: **05/30/2008**

Approximate Time of Violation:

Description of Alleged Violation:

Unauthorized discharge of E&P waste has occurred from oil and gas operations in the vicinity of Mr. Prather's spring, cabin, and pond and has impacted ground and surface water.

On 5/30/08 Mr. Ned Prather visited his cabin located in SW 14, 6S, 97W, Garfield County. He drank water from his spring (DWR #233234), felt a burning sensation in his throat, became ill, and was taken to the hospital. On 6/3/08 Mr. Prather filed a complaint (200190483) with the COGCC. On 6/4/08 Chris Canfield met Mr. Prather and collected water samples from his spring box, the faucet in his cabin from which he drank, and his stock pond, which is fed by the same spring. Mr. Canfield also collected water samples 3 springs providing water for 3 other cabins in the immediate area and fluids in the pit associated with Nonsuch Natural Gas's CSOC 697-14 #1 Well (05-045-07948). Volatile organic compounds (VOC) including benzene were detected in water samples from Mr. Prather's spring, pond, and faucet, including benzene which exceeded the WQCC standard of 5 µg/l.

Act, Order, Regulation, Permit Conditions Cited:

209, 324A.a, 324A.b, 902.a, 906.a, 906.b.(3), 907.a.(1), 907.a.(2)

Abatement or Corrective Action Required to be Performed by Operator:

1. any pits constructed or used on the wellpad, including size, volume, whether or not the pit was lined;
2. all fluids (water, drilling, completion, and frac fluids, flowback, etc.) placed in the pit, including volumes, dates, etc. Include haul tickets for all fluids brought from offsite to the pit(s);
3. whether condensate was observed in the pit during flowback or completion; and
4. tanks or other containers that were used at this site to manage fluids and any spills/releases that occurred. Submit: 1. Site Investigation & Remediation Work Plan (Form 27) for COGCC review, and 2. all analytical data collected to date. In addition consult with and mitigate impacts to Mr. Prather's springs, including 1. fencing impacted surface water to restrict access by livestock and wildlife, and 2. providing him with a supply of water for drinking and other household use and for watering livestock.

Abatement or Corrective Action to be Completed by (date): **07/07/2008**

* Proper and timely abatement does not necessarily preclude the assessment of penalties and an Order Finding Violation.

TO BE COMPLETED BY OPERATOR - When alleged violation is corrected, sign this notice and return to above address:

Company Representative Name: _____

Title: _____

Signature: _____

Date: _____

Company Comments: _____

***** THIS NOTICE CONSTITUTES A SEPARATE NOTICE OF ALLEGED VIOLATION FOR EACH VIOLATION LISTED *****

WARNING

The Director may propose a penalty as listed in the table below, not to exceed a maximum of \$1,000.00 per day per violation. Such proposed penalty amount will be limited to \$10,000.00 per violation if the violation does not result in significant waste of oil and gas resources, damage to correlative rights, or a significant adverse impact on public health, safety, or welfare. Such proposed penalty amount may be increased if aggravating factors indicate the violation: was intentional or reckless; had, or threatened to have, a significant negative impact on public health, safety, or welfare; resulted in significant waste of oil and gas resources; had a significant negative impact on correlative rights of other parties; resulted in or threatened to result in, significant loss or damage to public or private property; involved recalcitrance or recidivism upon the part of the violator; involved intentional false reporting or record keeping; resulted in economic benefit to the violator. Such proposed penalty amount may be decreased if mitigating factors indicate the violator: self-reported; promptly, effectively and prudently responded to the violation; cooperated with the Commission or other agencies with respect to the violation; could not reasonably control, or be responsible for, the cause of the violation; made a good faith effort to comply with applicable requirements prior to the Commission learning of the violation; had any economic benefit reduced or eliminated due the cost of correcting the violation; has demonstrated a history of compliance with Commission rules, regulations and orders. The Commission has final authority over the penalty amount assessed. The Commission or other agencies with respect to the violation: could not reasonably control, or be responsible for, the cause of the violation; made a good faith effort to comply with applicable requirements prior to the Commission learning of the violation; had any economic benefit reduced or eliminated due to the cost of correcting the violation; has demonstrated a history of compliance with Commission rules, regulations, and orders. The Commission has final authority over the penalty amount assessed.

PENALTY PROPOSED BY THE DIRECTOR PER RULE 523

BASE FINE \$250.00 PER DAY PER VIOLATION: RULES 210, 307, 311, 312, 313, 314A, 315, 403, 405, 603, 804
 BASE FINE \$500.00 PER DAY PER VIOLATION: RULES 205, 206, 207, 208, 302, 308, 309, 310, 316A, 321, 322, 328, 329, 330, 331, 332, 401
 BASE FINE \$750.00 PER DAY PER VIOLATION: RULES 605, 606A, 606B, 607
 BASE FINE \$1,000.00 PER DAY PER VIOLATION: RULES 209, 301, 303, 305, 306, 316B, 317, 317A, 318, 319, 320, 323, 324, 325, 326, 327, 333, 404, 602, 603, 604, 703, 704, 705,
 706, 707, 708, 709, 711, 802, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 1002, 1003, 1004, 1101, 1102, 1103
 In accordance with Rule 523.a.(4), fines for violations for which no base fine is listed shall be determined by the Commission at its discretion.

Signature of COGCC Representative: *Debbie Baldwin*

Date: *6/19/08*

Time: *4:50 PM*

Resolution Approved by: _____

Date: _____