Daub & Associates, Inc.

Appendix III

Sampling and Analysis Plan for the Barrett/Williams WGV Pad 21-23 Garfield County, CO

Form 27
Site Investigation and Remediation Workplan
Colorado Oil and Gas Conservation Commission
State of Colorado

Submitted to:
Williams Production RMT Company
1515 Arapahoe Street
Tower 3, Suite 1000
Denver, CO 80202

Submitted by:
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2241 S. Broadway
Grand Junction, Colorado
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October 2009

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PREFACE

This Sampling and Analysis Plan (SAP) for the WGV 21-23 Drilling Pad has been prepared in response to a Notice of Alleged Violation (NOAV) issued by the Colorado Oil and Gas Conservation Commission (COGCC) to Williams Production RMT Company (Williams) for contamination found in Prather Spring in Garfield County, Colorado. The WGV 21-23 Pad is located in Section 23, Township 6 South, Range 97 West, Garfield County, Colorado (Figure 1).

The WGV Pad was constructed in 2007 for the purpose of drilling two natural gas wells WGV 21-23-697 and WGV 22-23-697. The pad has the approximate dimensions of 250 x 350 ft. The drill pad was constructed with two pits: a reserve pit measuring approximately 160 x 55 x 10 ft and a produced water pit measuring approximately 100 x 50 x 15 ft (Figure 2). Each pit is underlain by a 12-mm thick polyethylene liner to prevent leakage of fluids to subsurface soils and groundwater. Currently, only the produced water pit remains open, the reserved pit was reclaimed.

The objective of the sampling program is to collect samples that are representative of current conditions directly beneath the former reserve pit and the production pit in order to assess whether fluids were released from these pits in sufficient quantities to have migrated to Prather Spring. The primary analytical objective is quantification of petroleum hydrocarbon and other organic contaminant concentrations, if present. Therefore, the sampling approach must evaluate whether petroleum hydrocarbons, volatile organic compounds (VOCs) and semi volatile organic compounds (SVOCs) indicative of a release are present in the underlying soils beneath the pits.

In order to conduct this investigation, the produced water pit will need to be taken out of service and closed. Both pits on the WGV 21-23 pad, the “Existing Production Pit” (EP Pit) and the “Former Reserve Pit” (FR Pit), will be sampled in accordance with this SAP. The pad area will be inspected, trenches dug into the FR pit, the water drained from the EP pit, solids and liner removed, underlying soils inspected and sampled, remediation of

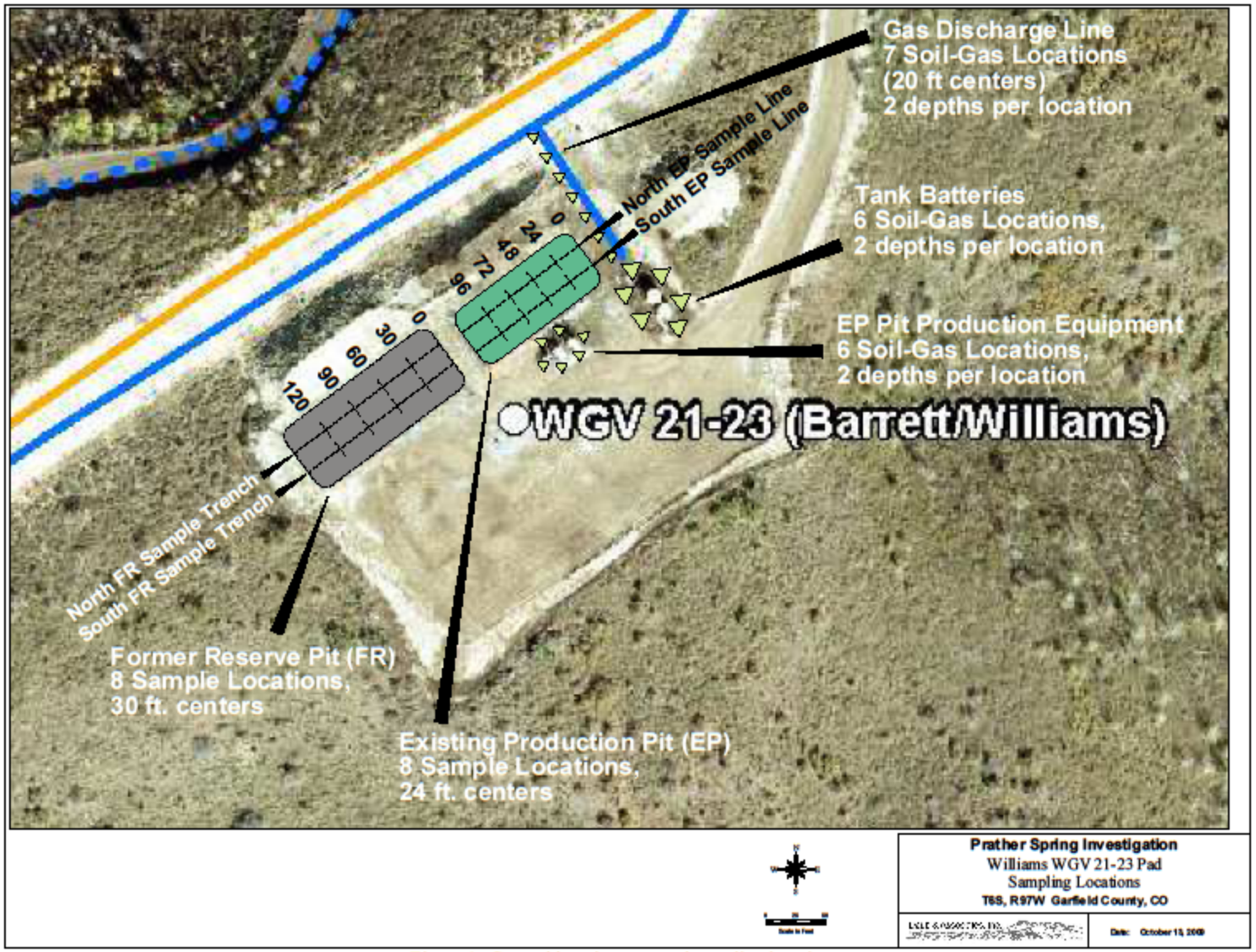

Figure 1. General location map and sampling locations.

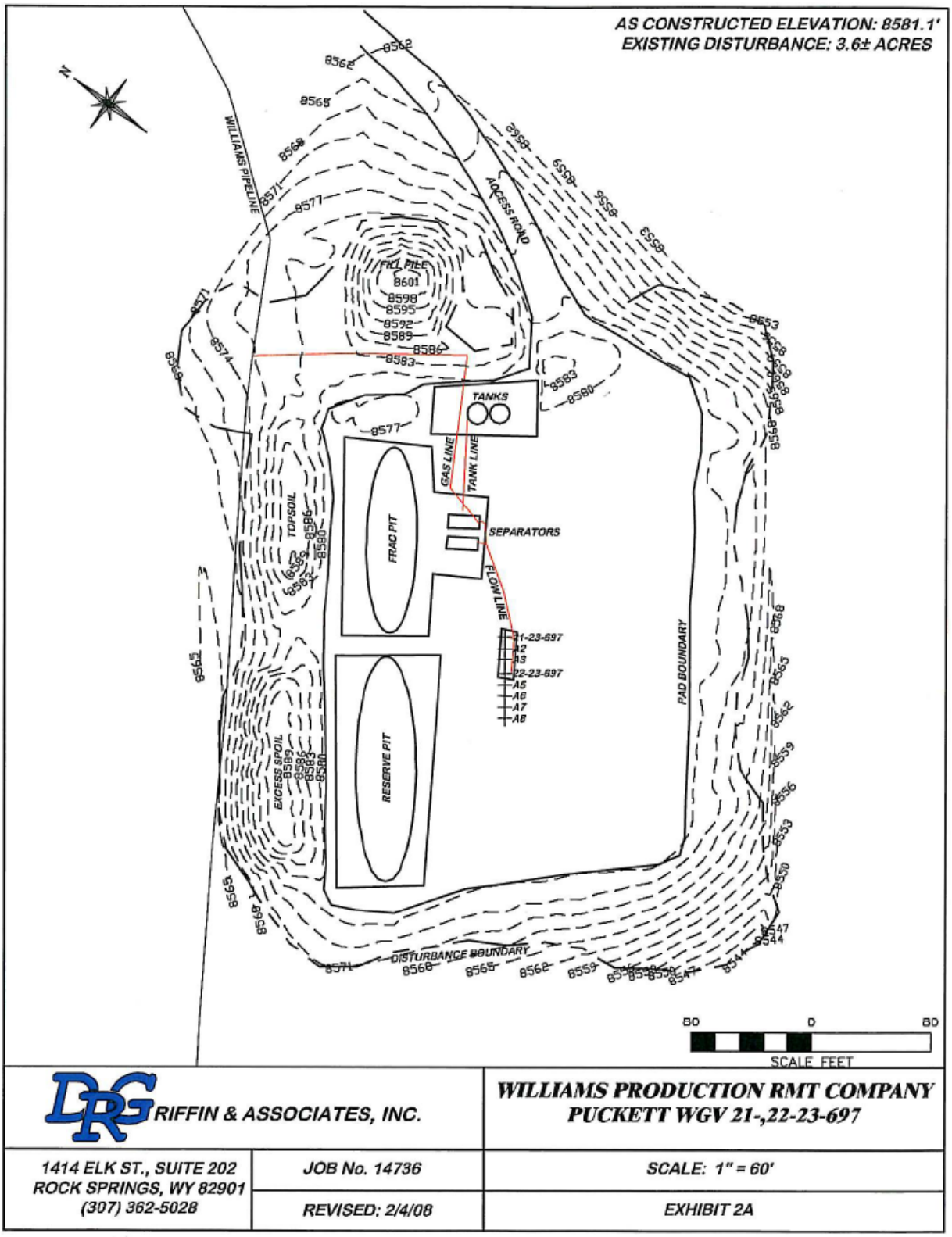

Figure 2. As-constructed drawing for the WGV Pad.

any impacted soils performed if necessary and all activities documented. Williams has tasked Daub & Associates, Inc. (Daub) with preparing this SAP and coordinating the sampling activities in accordance with the SAP.

PRE-SAMPLING PROCEDURES

The WGV Pad investigation activities will include four phases:

1. Preparation, safety training, site inspection, surveying and layout of sampling locations.
2. Fluid and solids removal of the EP pit, sampling and pit reclamation. (the order of EP reclamation, tank battery sampling and FR pit trenching may be altered based on input from the excavating subcontractor).
3. Trenching and sampling of the FR pit and the EP pit if hydrocarbons are detected in underlying soils.
4. Tank battery inspections, air monitoring, soil vapor testing, and soil sampling if necessary.

Phase 1

Safety training, work plan review, layout mapping, reconnaissance scan and field screening shall be performed prior to sampling as follows:

- The Williams Health and Safety Plan (HSP) shall be used for the duration of the sampling project and shall include but not be limited to specialized Trenching/Shoring training. Safety training shall be provided in accordance with the HSP by the Williams Health and Safety Officer (HSO) or an approved qualified person. Training shall be documented and shall be submitted to Daub upon request.
- Prior to SAP implementation, the FR pit corner locations shown in Figure 2 will be surveyed and staked by a professional surveying company.
- The designated footage of the trench and adjacent areas to be sampled shall be laid out using a measuring tape. Marker flags shall be placed to designate the beginning and end sample lines and all samples locations.
- Two individuals will walk the area of the EP Pit, around the tanks, along the road, and inspect and document the soil conditions. Photo Ionization Detector (PID)

measurements and a photographic record will be taken. Representative background PID readings, elevated PID readings and areas of organic soil staining will be recorded in the field log book and marked on the surface with designated flags for follow-up sampling.

Phase 2

The fluid and the solids in the EP Pit will be removed and temporarily managed on site until the proper disposition can be determined. Representative fluid samples shall be acquired in accordance with the Sampling Surface Water for Chemical Analysis Procedure (Appendix 1). Solids in the EP pit will be sampled in accordance the Sampling Surface Soil for Chemical Analysis Procedure (Appendix 1). EP pit solids will be disposed of in an acceptable off-site disposal facility. The pit liner will be removed and properly disposed of at an off-site disposal facility. Two sample lines, approximately 20 apart, will be marked on the exposed surface beneath the pit liner and labeled as the North EP Sample Line and South EP Sample Line as shown in Figure 1. Four samples will be marked on 24 foot centers along each sample line. Soil samples will be sampled in accordance with the Sampling Surface Soil for Chemical Analysis Procedure (Appendix 1). A mobile laboratory (i.e. Chem Solutions) will be present during all phases of field activities. In the event that areas of hydrocarbon contamination are detected during the closure of the EP pit, the mobile laboratory will be utilized to provide real-time analytical services, and will be used to guide remedial activities associated with any areas of contamination that may be encountered. Soil samples will be collected and submitted to the mobile laboratory for analysis for the purposes of delineating the lateral and vertical extent of any contaminated materials, as well as to verify that soil clean-up objectives have been met.

Sampling locations will be surveyed for location and elevation by a licensed professional surveyor. Any contaminated soil encountered beneath the EP pit in excess of COGCC Table 910-1 concentration standards will be removed and temporarily stockpiled in a bermed area, prior to arranging for proper disposal. After surveying, the pit will be reclaimed by back filling with clean soil.

Phase 3

Two trenches, approximately 20 feet apart and designated as North FR Trench and South FR Trench, will be cut into the FR pit to a depth one-foot below the bottom of the pit or about 11 feet below land surface (Figure 1). Four sample locations will be marked on 24 foot centers along each trench line. (Note: Figure 1 will be revised to reflect that the sample spacing for this pit has been changed to 24-foot spacing). Soil will be brought to the surface at each sample location using the backhoe bucket. The soil in the backhoe bucket will be scanned with a PID and sampled. Any contaminated soil encountered within the FR pit in excess of COGCC Table 910-1 concentration standards will be removed and temporarily stockpiled in a bermed area, prior to arranging for proper disposal.

Phase 4

The two tank batteries used for condensate and produced water storage will be inspected and soil vapor samples retrieved by Environmental Audit and Assessment, Inc. from six locations around the tank berm. Two soil vapor samples will be collected at each location from two discrete depths, 5 foot and 20 foot (or bedrock contact). Additionally, the area immediately surrounding the on-site pit production equipment will be inspected for evidence of contaminated soils, and soil vapor samples retrieved by Environmental Audit and Assessment, Inc. from six locations around the equipment. Two soil vapor samples will be collected at each location from two discrete depths, 5 foot and 20 foot (or bedrock contact). The gas discharge line from the production equipment will also be inspected and soil vapor samples retrieved by Environmental Audit and Assessment, Inc. from seven locations along the pipeline (20 foot centers). Two soil vapor samples will be collected at each location from two discrete depths, at the pipeline and 1 to 2 feet below the pipeline.

A mobile laboratory (i.e. Chem Solutions) will be present during all phases of field activities. In the event that areas of hydrocarbon contamination are detected during this phase of the investigation, the mobile laboratory will be utilized to provide real-time

analytical services, and will be used to guide remedial activities associated with any areas of contamination that may be encountered. Soil vapor samples will be collected and submitted to the mobile laboratory for analysis for the purposes of delineating the lateral and vertical extent of any contaminated materials.

All soil vapor samples will be collected in accordance with the Sampling and Analysis of Soil Gases Procedure in Appendix 1. One soil vapor duplicate and one tubing blank will also be collected. The WGV Pad and access road will be inspected for evidence of spills or waste dumping; any soil suspected of contamination shall be sampled. Any soil encountered in excess of COGCC Table 910-1 concentration standards will be removed for disposal and temporarily stockpiled in a bermed area prior to arranging for proper disposal.

SAMPLING PROCEDURES

Because of the nature of volatile organic compounds (VOCs), it is important that the sampling occur soon after the media is exposed to air. VOCs will start to dissipate as soon as soil is removed, therefore the more elapsed time between exposure to air and sampling, the less representative the samples will be of actual in-situ VOC levels.

Four representative soil samples will be collected on 30 foot centers from the bottom of the North and South Trenches in the FR Pit for a total of eight as shown in Figure 1. Eight representative soil samples will be collected from the bottom of the EP Pit on approximately 24 foot centers along two parallel sample lines spaced approximately 20 feet apart and designated as North EP Sample Line and South EP Sample Line.

Only areas of suspected soil contamination shall be sampled around the tanks and along the road. The spacing of sample locations in the area of the tank battery and along the road will be at the discretion of the sample technician. If the results of the soil vapor anaylsis indicate that elevated concentrations of hydrocarbons are present, a soil sample

shall be collected at that location and submitted to the mobile laboratory for analyses as specified in Table 1.

A flag will be labeled with the sample number and used to mark each sample location. A digital camera shall be used to photograph the sample location and associated surface lithology. The sample number shall be visible in each photograph. The date, individual's name, sample location, sample number, photo number, lithology description and significant comments shall be recorded in the field notebook.

Additional samples may be collected at the discretion of the sample technician, i.e. where staining and/or elevated PID measurements, strong hydrocarbon odors or organic stains are detected. Any impacted areas will be excavated until non-stained soils and normal PID readings are encountered. And then samples of suspected "clean" soil collected to confirm the extent of areas of impacted soil.

For each sample location, the sample name shall include the sequential footage (using the beginning point as zero) and the sample depth (using the surface as zero). One duplicate sample shall be taken per pit and identified with the designation *DUP*. All samples to be submitted for laboratory testing will be placed in laboratory-supplied containers (Table 1) and stored in a cooler at the proper temperature prior to shipping.

Portions of each sample should be placed in sealable plastic bags or glass jars for field headspace testing using a PID. The PID used for field headspace testing should be capable of detecting VOCs at approximate concentrations of 1 part per million (1 ppm). Field headspace measurements will be made after samples have been in closed plastic bags for approximately 10 minutes. Sample numbers, retention times and instrument readings should be recorded in the field logbook.

1. In addition to the soil samples, two fluid samples will be collected according to the procedure for Sampling Surface Water for Chemical Analysis Procedure (Appendix 1) during de-watering of the EP Pit. Water samples shall be analyzed for: VOA Headspace List by Method 8260B

2. BNA Headspace List by Method 8270C
3. BTEX by Method 8021B
4. Anions (Cl, Br, NO_2, NO_3, o-Phosphate, SO_4) by Method 300.0 IC
5. Dissolved Metals (Ca, Fe, Mg, Mn, K, Na) by Method 6010B
6. Dissolved Metals (Se) by Method 6020
7. Fluoride by Method 300.0A
8. Alkalinity Series (Carbonate, Bicarbonate, Hydroxide, and Total Alkalinity) by Method 2320B
9. Total Dissolved Solids by Method 2540C
10. Specific Conductance by Method 2510B
11. pH by Method E150.

Samples for off-site analytical testing will be shipped under chain-of-custody procedures to:

Accutest Laboratories
4405 Vineland Road, C-15
Orlando, FL 32811
407-425-6700 Phone
407-425-0707 Fax

Samples sent to the off site laboratory will be analyzed using a gas chromatograph (GC) for total volatile and extractable petroleum hydrocarbons (TVPH and TEPH) using USEPA SW846 Modified Method 8015M, and for aromatic and halogenated volatiles using USEPA SW846 Method 8260B and for SVOCs using USEPA SW846 Method 8270 (Table 1).[1]

Duplicate samples will be shipped under chain-of-custody procedures to a designated separate laboratory. These duplicate sample analyses will provide quality assessment/quality control (QA/QC), and may facilitate further evaluation of hydrocarbon contamination undetected in the field.

The duplicate samples will be sent to aseparate laboratory for confirmatory analyses at

[1] Note: Holding times will vary depending on threshold limits, data evaluation and method used.

the address below:

Sample Management
Accutest Labs of New England
495 Technology Center West, Bldg 1
Marlborough, MA 01752
Office: 1-508-481-6200 X212
Fax: 1-508-481-7753

Analysis (method)	Sample Matrix	Bottle Requirements	Preservation Requirements	Holding Time
VOC (8260)	Water	(3) 40 ml vials	HCl	7 days
SVOC (8270)	Water	(2) 1000 ml amber glass	<6 deg. C	7 days
Anions (300) Nitrates (E353.2)	Water	(1) 500 ml plastic	<6 deg. C	48 hours
Metals (SW6010)	Water	(1) 500 ml plastic	HNO3	28 days
TEPH (mod 8015M)	Soil	(1) 4 oz or 8 oz jar	<6 deg. C	14 days
TVPH (mod 8015M)	Soil	(1) 4 oz or 8 oz jar	<6 deg. C	14 days
VOC (8260B)	Soil	(1) 4 oz or 8 oz jar	<6 deg. C	14 days
SVOC (8270C)	Soil	(1) 4 oz or 8 oz jar	<6 deg. C	14 days

Table 1. Analytical Methods and Sample Requirements

FIELD LABORATORY

As an alternative to sending all soil samples off site, soil samples may be screened on site for VOCs with a field laboratory. Should contamination be discovered, then the field laboratory may be used to analyze soil vapor and soil samples to aid in the evaluation of the extent of contamination. The field laboratory will utilize and follow: ***Standard Operating Procedure (CS 109) Air Analysis by Method 8260B, Volatile Organic Compounds by Gas Chromotography/Mass Spectrometry (GCMS);*** and ***Standard***

Operating Procedure (CS 107) Method 8260B, BTEXN/GRO/DRO and Oxygenates by Gas Chromotography/Mass Spectrometry (GC/MS). These Chem Solutions SOPs will be provided to COGCC upon request.

At least 20 percent of the samples screened at the field laboratory will be sent to an off-site laboratory to verify the results. The samples selected to be sent off site will include samples from contaminated areas (if found) and samples from clean areas outside any zones of contamination discovered. In addition to reporting the results, the field laboratory will document and summarize quality control measures such as initial calibration, continuing calibration checks, matrix spikes, and blanks.

POST SAMPLING PROCEDURES

The laboratories shall provide the analytical data results in both electronic and hard copy format

Daub will prepare a final report on *Sampling and Analysis of the Williams WGV Pad, Garfield County, Colorado.* The report shall include documentation of field activities (written and photographic evidence of SAP implementation), and analytical results with verification. The report will be submitted to Williams within four weeks after all of the analytical results (initial analyses and split sample analyses if necessary) have been received. Williams will be responsible for submitting the final report to the COGCC.

Appendix 1

Standard Procedures

Programs and Procedures
Daub & Associates, Inc.
2241 So. Broadway
Grand Junction, CO 81507
970-254-1224

SAMPLING SURFACE SOIL FOR CHEMICAL ANALYSIS PROCEDURES

1. Introduction and Purpose

The objective of Daub & Associates, Inc. (Daub) *Programs and Procedures Manual* is to implement technical procedures in a safe and appropriate manner by using our best experience and industry standards. This technical procedure establishes uniform field soil sampling methods for samples submitted for chemical analysis. The methods described by this procedure shall be used by all Daub associates/employees.

2. Responsibilities

Daub management is responsible for establishing technical field sampling procedures, submitting procedural modifications as required, and providing the resources and support to implement the procedures. Management shall designate the project Task Leader. The Task Leader is responsible for monitoring the soil sampling activities to ensure that proper procedures, requirements and documentation are performed in accordance with this procedure, client project plans and applicable regulations. Associates/employees performing as Sample Technicians are responsible for conducting the soil sampling activities in accordance with this procedure. Any method deviation or procedural change shall be approved by management, Task Leader or qualified designee.
Employees/associates shall be trained in sampling procedures prior to performing soil sampling activities and the training shall be documented.

3. Definitions

The following terms are used in surface soil sampling for chemical analysis.

- Surface soil: uppermost consolidated soil on the land surface, exposed excavation or boring within ten (10) feet of the ground surface (a.k.a. surface layer).
- Sampling interval: stratigraphic depth represented by the soil sample.
- Headspace: empty volume in a sample container between the soil and the cap or seal.
- Chemical analysis: the laboratory testing by separating the sample into components (chemicals) to determine the type and amount of its constituents.

4. Equipment

The Standard Field Equipment List is found as an attachment to the Guidelines for Well Site (Field) Geologists procedure. All associates/employees working as Sample Technicians or Task Leaders shall be familiar with the Standard Field Equipment List and use the appropriate equipment for the job. Examples of standard field equipment are maps, clipboards, indelible ink markers/pens, rock hammers, engineer rule, PPE (personal protective equipment), field logbook and report forms.

Specialized equipment used for sampling surface soil for chemical analysis is as follows:

- GPS or Brunton Compass
- Fiberglass measuring tapes (increments in tenths of a ft.)
- Flagging material of various colors and flag stakes
- Disposable sampling equipment appropriate for soils (hand scoops, hand augers/dredges, small core samplers, or sampling tubes); when the soil samples are to be analyzed for VOCs, the sampling equipment shall be designed to minimize exposure to the atmosphere
- Appropriate sample bottles for the type and size of sample, or sample containers supplied by the laboratory
- Chain of Custody forms, seals and sample labels

- Appropriate decontamination solutions (i.e. distilled/de-ionized water and phosphate free detergent) and decontamination equipment (i.e. drip pans, brushes and sprayers)
- Drums or containers for storing decontamination/decanter waste solutions
- Thermometer to monitor retention temperatures
- Photo Ionization Detector (PID) and appropriate quality check (calibration) equipment/standards
- Digital and/or video camera(s)

5. Soil Sampling Procedure

The sample locations shall be mapped to the level of detail required by the sampling plan or agency guidelines. The base map shall be made available prior to the sampling activities. Each specific sample location shall be identified on the base map and on the land surface by a flag labeled with the sample number. The location shall be found by using a GPS unit or triangulated by compass readings. Locations may be surveyed by a licensed surveyor when required by the sampling plan.

The land surface where the samples are to be extracted shall be cleared prior to sampling (i.e. vegetation/obstacle removal). If the samples are to represent a predetermined depth, the overlying soils shall be removed by shovels, post-hole diggers, augers or excavating equipment. Samples shall be removed with vertical tubes/pipes, dredges, hand samplers/augers or core samplers. Sediment samples shall be allowed to settle prior to containerization and the extra water decanted. Samples to be analyzed for VOCs shall be containerized immediately upon retrieval so as to not compromise the integrity of the sample.

The sample retrieval method shall be specific, repetitive and conducted in the manner required by the plan, client or regulatory agency. Representative archival samples shall be retrieved upon request, in accordance with standard methods and stored in designated locations.

Note: For field headspace testing using a PID, portions of each sample shall be placed in sealable plastic bags or glass jars. The PID used for field headspace testing shall be capable of detecting VOCs at approximate concentrations of 1 part per million (1 ppm). Field headspace measurements will be made after samples have been in closed plastic bags for approximately 10 minutes. Sample numbers, retention times and instrument readings shall be recorded in the field notebook. A daily standard check (calibration) of the PID shall be performed by the sample technician and the measurements recorded in the field logbook. Damaged or nonfunctional equipment shall be taken out of service and tagged.

Samples to be shipped to a laboratory for chemical analysis shall be collected, containerized and stored in accordance with laboratory guidelines and requirements (i.e. glass bottles stored in a cooler with ice below a maximum temperature). A Chain-of-Custody form shall accompany all shipped samples. The sampling technician is responsible for familiarity of the laboratory requirements and completion of the Chain-of-Custody form.

All surface soil sampling information shall be recorded and documented in the field logbook and shall include, but is not limited to, the following:

- Project Title
- Date and time (in military time)
- Individual sampling technicians' names and name of Task Leader
- Area location in Section, Township and Range format
- Sample location coordinates
- Sample numbers and description of numbering scheme
- Photo number and type and number of camera used
- Lithology description (moisture content, fracturing, soil type, texture, cement type)
- Significant comments i.e. weather conditions, extenuating circumstances and visitors
- Sample shipping information.

6. Decontamination

Disposable sampling equipment shall be used to obtain samples whenever possible. Disposable equipment shall be bagged and disposed of properly in accordance with local, State and Federal regulations. All non-disposable sampling equipment shall be decontaminated before and after sampling activities. The equipment shall be washed with a non-phosphate detergent, and rinsed initially with tap water followed by a distilled/de-ionized water rinse. Dedicated brushes may be used to loosen coarse material and debris. Decontaminated equipment shall be stored to prevent cross-contamination. Decontamination solutions shall be securely containerized and disposed of in accordance with local, State and Federal regulations.

Programs and Procedures
Daub & Associates, Inc.
2241 So. Broadway
Grand Junction, CO 81507
970-254-1224

SAMPLING SURFACE WATER FOR CHEMICAL ANALYSIS PROCEDURE

1. Introduction and Purpose

The objective of Daub & Associates, Inc. (Daub) *Programs and Procedures Manual* is to implement technical procedures in a safe and appropriate manner by using our best experience and industry standards. This technical procedure establishes uniform field water sampling methods for samples submitted for chemical analysis. The methods described by this procedure shall be used by all Daub associates/employees.

2. Responsibilities

Daub management is responsible for establishing technical field sampling procedures, submitting procedural modifications as required, and providing the resources and support to implement the procedures. Management shall designate the project Task Leader. The Task Leader is responsible for monitoring the water sampling activities to ensure that proper procedures, requirements and documentation are performed in accordance with this procedure, client project plans and applicable regulations. Associates/employees performing as Sample Technicians are responsible for conducting the water sampling activities in accordance with this procedure. Any method deviation or procedural change shall be approved by management, Task Leader or qualified designee.
Employees/associates shall be trained in sampling procedures prior to performing water sampling activities and the training shall be documented.

3. Definitions

The following terms are used in surface water sampling for chemical analysis.

- Surface water: water on the land surface, or exposed in an excavation.
- Sampling interval: depth represented by the water sample.
- Headspace: empty volume in a sample container between the water and the cap or seal.
- Chemical analysis: the laboratory testing by separating the sample into components (chemicals) to determine the type and amount of its constituents.

4. Equipment

Surface water grab samples will be collected from water bodies and wetlands. In cases where the depth of the surface water body prevents sampling from the banks of the water body, sampling from a boat may be required. Some wetlands may not have a sufficient depth of water from which to collect a sample.

The Standard Field Equipment List is found as an attachment to the Guidelines for Well Site (Field) Geologists procedure. All associates/employees working as Sample Technicians or Task Leaders shall be familiar with the Standard Field Equipment List and use the appropriate equipment for the job. Examples of standard field equipment are maps, clipboards, indelible ink markers/pens, rock hammers, engineer rule, PPE (personal protective equipment), field logbook and report forms.

Specialized equipment used for sampling surface water for chemical analysis is as follows:

- Rubber boots and/or rubberized waders.
- A boat to sample from, if required.
- Personal protective clothing and equipment as required in the site-specific HASP.
- Decontamination equipment and supplies.
- Temperature probe or thermometers, specific conductance meter, pH meter, dissolved oxygen meter, and turbidimeter as required.
- Appropriate sample containers (some will be pre-preserved) and labels.
- Bound field logbook.

- Hard plastic cooler with ice.
- Filters as required.

5. Water Sampling Procedure

The sample locations shall be mapped to the level of detail required by the sampling plan or agency guidelines. The base map shall be made available prior to the sampling activities. Each specific sample location shall be identified on the base map. The location shall be found by using a GPS unit or triangulated by compass readings. Locations may be surveyed by a licensed surveyor when required by the sampling plan.

The following steps will be taken when collecting samples of surface water for VOC and TAL inorganics analyses:

1. Slowly submerge unpreserved one-liter amber glass-capped bottle (SVOA) completely into the water. Open and fill bottle from below the water surface. If wading is required, approach the sample site from downstream and do not enter the actual sample area. Do not disturb bottom sediments. Open-end of the bottle should be pointed at approximately 90° to the upstream direction, in undisturbed gently flowing water. This procedure will be performed to minimize the effects due to high turbulence and aeration, or if surface scum is prevalent.

2. Collect a sufficient volume of water to fill all sample containers.

3. For VOC analyses, slowly pour surface water sample into pre-preserved 40 ml VOA vials taking care not to let it over flow and lose preservative. Place cap with Teflon septum on each vial as filled. Turn the vial upside down and check for air bubbles. Tap the bottom of the VOA vials to dislodge any bubbles that may have formed around the cap or sides. If bubbles are present, discard vial and re-sample using new VOA vial.

4. For TAL metals, slowly pour surface water sample into pre-preserved 500 ml plastic container to sufficiently fill the container. Surface water samples may be collected as totals (unfiltered) or dissolved (filtered).

5. Seal sample container.

6. Place labeled sample container(s) into a sample cooler with ice.

7. Record samples (e.g., sample ID, location, method, etc.) in the field logbook.

8. Collect an additional grab sample in an unpreserved sample container and measure and record field parameters in the log book or on sampling sheets. Measured field parameters include pH, temperature, specific conductance, turbidity and Eh.

The following steps will be followed when collecting surface water samples for SVOCs and PCBs.

1. Slowly submerge capped sample containers completely into the water. Open and fill containers from below the water surface. If wading is required, approach the sample site from downstream and do not enter the actual sample area. Do not disturb underlying sediments. Open end of the containers should be pointed at approximately 90° to the upstream direction in undisturbed, gently flowing water. This procedure will be performed to minimize the effects due to high turbulence and aeration, or if surface scum is prevalent.

2. Collect a sufficient volume of water to fill all sample containers.

3. Seal sample container.

4. Place labeled sample container(s) into a sample cooler containing ice and temperature blank.

5. Record samples (e.g., sample ID, location, method, etc.) in the field logbook.

6. Collect an additional grab sample in an unpreserved sample vial and measure and record field parameters in the log book or on sampling sheets. Measured field parameters include pH, temperature, specific conductance, turbidity and Eh.

Samples to be shipped to a laboratory for chemical analysis shall be collected, containerized and stored in accordance with laboratory guidelines and requirements (i.e. glass bottles stored in a cooler with ice below a maximum temperature). A Chain-of-Custody form shall accompany all shipped samples. The sampling technician is responsible for familiarity of the laboratory requirements and completion of the Chain-of-Custody form.

All surface water sampling information shall be recorded and documented in the field logbook and shall include, but is not limited to, the following:

- Project Title
- Date and time (in military time)
- Individual sampling technicians' names and name of Task Leader
- Area location in Section, Township and Range format
- Sample location coordinates
- Sample numbers and description of numbering scheme
- Photo number and type and number of camera used
- Significant comments i.e. weather conditions, extenuating circumstances and visitors
- Sample shipping information.

6. Decontamination

Disposable sampling equipment shall be used to obtain samples whenever possible. Disposable equipment shall be bagged and disposed of properly in accordance with local, State and Federal regulations. All non-disposable sampling equipment shall be decontaminated before and after sampling activities. The equipment shall be washed with a non-phosphate detergent, and rinsed initially with tap water followed by a distilled/de-ionized water rinse. Dedicated brushes may be used to loosen coarse material and debris. Decontaminated equipment shall be stored to prevent cross-contamination. Decontamination solutions shall be securely containerized and disposed of in accordance with local, State and Federal regulations.

Environmental, Audit & Assessment, Inc.
225 North 5th Street,
Suite #8
Grand Junction, CO 81501
970-245-5997

SAMPLING AND ANALYSIS OF SOIL GASES PROCEDURE

SCOPE OF WORK

The scope of work provided in this SAP is based on Environmental, Audit & Assessment, Inc. standard operating procedures for sampling and analysis of soil gases. Each phase of soil-gas sampling will include the following steps:

- Clear location of underground lines prior to installing probe
- Install probe to target depth(s);
- Develop probe by removing three volumes of soil vapor;
- Conduct flow and vacuum checks at different flow rates to support soil-air permeability calculations ;
- Conduct a leak tracer test;
- Allow probe to equilibrate;
- Conduct field screening with field meters;
- Purge and sample probes;
- Collect field quality control samples; and
- Either ship samples off site or analyze vapor samples on site for selected analytes.

SOIL VAPOR SAMPLING PROGRAM

Probes will be installed with the help of a drill rig. Immediately following installation and sealing of the probe, each probe will be developed by vapor extraction. EAA will then conduct a flow/vacuum check, leak tracer screening, and O2, CO2, CH4 screening on the following day, if requested by the client. Samples will then be collected in Tedlar bags for analysis of VOCs and SVOCs. The field laboratory will utilize and follow: ***Standard Operating Procedure (CS 109) Air Analysis by Method 8260B, Volatile Organic Compounds by Gas Chromotography/Mass Spectrometry (GCMS).*** This Chem Solutions SOP will be provided to COGCC upon request.Soil Vapor Probes

Probes will be installed in open boreholes and will consist of ¼-in Teflon tubing, with a 6-in vapor tip at the bottom. The probe filter pack will be clean silica sand installed approximately six inches beneath the probe and extend six inches above the top of the probe. A one foot bentonite grout seal will be placed above the filter pack. Additional granular bentonite, hydrated with deionized water, will complete the hole to approximately two feet below surface. Probes will be sealed with a thick bentonite grout placed to ground surface. A ¼-inch Teflon tube will be connected to each implant, with a sampling valve at the surface. A locking well cover is then cemented in to prevent vandalism or tampering.

If nested well are requested, the granular bentonite will be placed in the hole and extend approximately six inches below the depth of the next shallower sample depth. At this point, a silica sand pack will be installed as described above.

PROBE DEVELOPMENT AND CONDITIONING

Following probe installation, three probe volumes of air will be removed from each probe at a flow rate of between 100 and 200 ml/min. Probes will be allowed to equilibrate for a day before sampling. All purge volumes, sampling times and rates will be recorded in a field book.

LEAK TRACER TEST FLOW AND VACUUM CHECK AND O2/CO2/CH4 SCREENING

If requested, the sampling train for leak tracer, flow and vacuum and $O_2/CO_2/CH_4$ screening will consist of:

- Valve;
- Vacuum gauge (0-5 inches water);
- Rotometer (0-1 L/min);
- Vacuum box with 1-litre SKC Tedlar bag; and
- SKC Pump.

The following will be performed.

- Place a plastic shroud over the probe.
- Before starting test, adjust pump to 100 to 200 ml/min.
- Calculate volume of tubing and implant.
- Connect the sampling train, turn pump on and open valve.
- Check that pump flow rate is 100-200 ml/min.
- Record flow rate and vacuum, and reduce flow rate if vacuum exceeds 5 inch water vacuum.

- Purge 3 to 5 volumes.
- Change orientation of tubing such that Tedlar bag begins to fill.
- Measure $O_2/CO_2/CH_4$ using Landtec GEM-2000 and total hydrocarbons using PID with 10.6 eV lamp.
- Fill second bag and measure helium concentrations if helium tracer test is conducted.
- If helium concentrations exceed 1% fix the probe and/or valve.
- At the end of the test conduct a shut-in test by closing the valve and pulling the tubing from the vacuum chamber, which seals off the quick-connect.

Record the decrease in vacuum over time.

The installed probes will be leak tracer tested using helium (He) at a ratio of no less than 1 in 10 probes (10% verification). Ultra-pure helium will be slowly released below a shroud; pressurization of gas in the shroud is to be avoided (one end of the shroud can be lifted to let air escape). When helium concentrations are about 100% the sampling will begin as described above. The helium concentrations will be measured using a helium detector with detection limit of 10 ppm or less. At selected locations, repeat the helium tracer test to see if the helium concentrations change. A vacuum-flow step test will be conducted at selected locations where flow is varied and vacuum is recorded for each flow rate.

SAMPLING AND ANALYSIS

Three probe volumes will be purged prior to sampling. Samples will be collected in 1-liter Tedlar bags. The vapor sample will fill the Tedlar bag, and the bag will be sealed and stored in a cool environment. Samples will be shipped in coolers to the laboratory or analyzed at the on-site laboratory, as appropriate. Quality control testing will consist of collection of one field duplicate for every 10 samples using a splitter, if requested.

OTHER CONSIDERATIONS

SAP implementation and reporting will be based on the following additional considerations.

A Health and Safety Plan addressing job specific hazards will be used in support of SAP implementation.

When feasible, disposable sampling equipment will be used to collect samples. To avoid cross contamination, non-dedicated sampling equipment will be thoroughly cleaned prior to initiation of sampling activities, and as otherwise necessary based on standard operating procedures.

Documentation of the field activities will consist of written and photographic evidence of SAP implementation, and will be included in the final report. This report will include the analytical results.

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ChemSolutions SOP's will be followed for all field analytical work including:

FIELD LABORATORY ANALYTICAL PROCEDURES:

CS107 – Soil Analysis, Method 8260B

CS109 - Air Analysis, Method 8260B