

# **Sampling and Analysis Plan Antero Resources McPherson A Pad Blowout**

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## **1.0 Introduction**

### **1.1 Project Background**

This Sampling and Analysis Plan (SAP) was prepared at the request of Antero Resources Piceance Corporation (Antero) to outline the approach for delineating potential soil and surface water contamination that may have migrated from the Antero McPherson A well pad. This investigation stems from a loss of well control which resulted in a blowout on the McPherson A well pad at approximately 12:10 pm on November 25, 2008. The well flowed uncontrolled from approximately 12:10 on November 25, 2008 until 15:40 November 27, 2008. During this time period an undetermined amount of natural gas and fluids, in the form of frac water, produced water, and possibly some condensate, was released from the well into the air. Due to the pressures involved the released fluids migrated through the air in the form of a fine mist which potentially could have drifted from the well pad onto surrounding properties.

HRL Compliance Solutions, Inc. (HCSI) made an initial site visit on December 1, 2008 to conduct an initial site investigation and to assess any potential effects, if any; the released fluids may have had on the surrounding properties. HCSI returned to the site on December 2, 2008 to collect soil samples on the north, south, east, and west sides of the well pad approximately 50 feet from the toe of the fill slopes of the pad. The samples were submitted and will be analyzed for the constituents established in Table 910-1 of the revised Colorado Oil and Gas Conservation Commission (COGCC) rules for oil and gas operations.

### **1.2 Project Scope and Objectives**

The main objective of this SAP is to identify and sample potentially affected properties within a half mile radius of the McPherson A well pad for both surface soil and surface water contamination. Meteorological data from the Rifle Municipal Airport was utilized to construct a wind rose diagram covering the periods from November 24, 2008 to November 29, 2008. The data indicates that the prominent wind direction during the entire period was from the south southwest and from the west. Based on this data it would appear that the properties with the greatest potential for impacts from this incident would be those to the northeast of the McPherson A well pad; therefore, HCSI is recommending that the sampling efforts be concentrated on these potentially affected properties. In addition, samples will be collected from the Shuster property due to the fact it located in closest proximity to the well pad.

During sample collection, HCSI will be working in direct consultation with Antero Environmental and Land staff to contact potentially affected landowners and sample their properties as authorized. Figure 1 refers to the potentially affected properties within a half mile radius of the McPherson A well pad.

## **2.0 Site Investigation Activities**

### **2.1 Surface Soil Sampling**

Surface soil samples will be collected from various locations on the landowner property. HCSI and Antero will assess the property and determine which locations may have the greatest potential for any soil impacts (i.e. roof drip lines, gardens, pastures etc.). Soil samples will be collected from several locations within the potentially impacted areas. The soil will then be mixed in a stainless steel pan to form a representative composite sample of the potentially impacted area. Additional samples may also be collected at specific locations as requested by the landowner.

The sample material will then be placed directly into laboratory specified sample containers and labeled in accordance with the COGCC revised Table 910-1 analytes. Placing samples directly into laboratory specified sample containers will ensure that there is little to no project derived waste. For transport, sample containers will be placed inside a cooler, and cooled to 4°C to preserve sample integrity. Samples will be submitted according to Evergreen Analytical Laboratory (EAL) Chain of Custody (COC) protocol. Table 1 summarizes EAL's sampling specifications including parameters, analytical methods, and sample handling information (i.e., bottles and holding times). Table 2 summarizes the sample nomenclature, property, sample collection location, and type.

### **2.2 Surface Water Sampling**

Surface Water, if present, will be sampled and analyzed for constituents outlined in the COGCC revised Table 910-1. As outlined in the surface soil sampling section 2.1, HCSI and Antero will assess the property and determine which surface water features have the potential for the greatest potential impacts from the blowout. In addition HCSI and Antero staff will collect additional samples from specific locations as requested by the landowner.

The sample material will then be placed directly into laboratory specified sample containers and labeled in accordance with the COGCC revised Table 910-1 analytes. Placing samples directly into laboratory specified sample containers will ensure that there is little to no project derived waste. For transport, sample containers will be placed inside a cooler, and cooled to 4°C to preserve sample integrity. Samples will be submitted according to Evergreen Analytical Laboratory (EAL) Chain of Custody (COC) protocol. Table 1 summarizes EAL's sampling specifications including parameters, analytical methods, and sample handling information (i.e., bottles and holding times).

## **2.3 Field Documentation**

All activities conducted in the field will be thoroughly documented so that all samples collected will be defensible. Documentation in the field will include written and photographs documenting activities taking place. This will take place at each location sampled. Copies of all field documentation, including photos, will be provided to Antero and any other interested party or parties as authorized by Antero.

## **2.4 Surveying**

Each sampling location, soil and surface water, will be surveyed with a hand held Trimble GPS unit that meets specification required by the COGCC, specifically in accordance with COGCC Rule 215. This unit will be furnished by HCSI.

## **2.5 Meteorological Data and Wind Rose Analysis**

Antero used the Rifle Airport meteorological data to generate a wind rose during the period that the McPherson A well was venting. Because of its proximity to the McPherson A Pad, the Rifle Airport meteorological is presumed to be representative of the meteorological conditions during this incident.

The wind rose provides a very succinct view of how the wind speed and direction were distributed at the McPherson A Pad for the duration of this event. Presented in a circular format, the wind rose indicates the frequency of time over the period of interest that the wind was blowing from a particular direction. The length of each “spoke” around the circle is related to the frequency of time that the wind blows from a particular direction. Thus, referencing the attached wind rose indicates that the most common wind directions during this episode were out of the WNW and the SSW, with tight clusters around each spoke. Wind speeds were light with the predominant wind speed category in the 4-7 knot range and a large percentage of near calm winds (< 3 knots). Again, the wind rose from the Rifle airport during the McPherson A well venting episode should mimic closely the onsite actual wind speed and direction at the pad.

## **3.0 Analytical Laboratory, Methods, and Data Management**

Samples collected during this investigation will be shipped to Evergreen Analytical Laboratory, Inc. in Wheat Ridge, CO.

Laboratory contact information is as follows:

Evergreen Analytical Laboratory, Inc.  
4036 Youngfield Street

Wheat Ridge, Colorado 80033  
1-877-737-4521  
303-425-6021 Phone  
303-425-6854 Fax

Attn: Shea Griner  
Email: [shea@evergreenanalytical.com](mailto:shea@evergreenanalytical.com)

### **3.1 Data Deliverables**

Analytical data generated during this project will be sent within two weeks of the sample collection date to HCSI in electronic PDF and EDD format. A hard copy will be mailed to HCSI and will contain the results including a Level 2 QA package as part of the hard copy. A copy of the EDD data will be provided to Antero in the form of an Excel file.

### **3.2 Data Management**

Analytical results from this project will be incorporated into a data base management system. Field measurements and coordinates from the two locations will also be included and used to generate a final report to Antero. A copy of this report will also be made available to any other party or parties as authorized by Antero.

## **4.0 Schedule**

The surface soil and water and sampling activities for this investigation have been tentively scheduled for January 13, 2009. The sample date is dependent of whether landowner approval and access has been granted and on whether the ground has sufficient thawed to allow for the collection of soil and water samples.

**Figure 1. Potentially impacted properties within a  $\frac{1}{2}$  mile radius of the McPherson A well pad.**

Table 1- COGCC Table 910-1 revised analysis for soil and groundwater

Analyte Class	Analysis	Method	COGCC Table 910-1 Concentration Standard	Holding Time	Container	
Organics Soil	TVPH (GRO)	SW8015 mod	500 mg/kg	14 days	4 oz. wide mouth jar	
	TEPH (DRO)					
	Acenaphthene	SW8270	1,000 mg/kg		4 oz. wide mouth jar	
	Anthracene		.22 mg/kg			
	Benzo (A) anthracene					
	Benzo (B) flouranthene					
	Benzo (K) fluoranthene					
	Benzo (A) pyrene		.022 mg/kg			
	Chrysene		22 mg/kg			
	Dibenzo (A,H) anthracene		.022 mg/kg			
	Fluoranthene		1,000 mg/kg			
	Fluorne		.22 mg/kg			
	Indeno (1,2,3,C,D) pyrene					
	Naphthalene					23 mg/kg
	Pyrene					1,000 mg/kg
	Organics Ground Water		Benzene			SW8021
Toluene		85 mg/kg				
Ethylbenzene		100 mg/kg				
Xylenes (total)		175 mg/kg				
Inorganics Soil	Electrical Conductivity	USDA Hdbk	<4 mmhos/cm or 2x background	28 days	1 gal. ziplock bag	
	Sodium Adsorption Ratio		<12	180 days		
	pH	SW9045	6-9	< 24 hrs.		
Inorganics in Ground Water	Total Dissolved Solids (TDS)	SM 2540 B/C/D	<1.25 x background	7 days	500ml Poly	
	Chlorides	EPA 300		28 days	125 ml Poly	
	Sulfates					

Table 1- COGCC Table 910-1 revised analysis for soil and groundwater (cont.)

Analyte Class	Analysis	Method	COGCC Action Level	Holding Time	Container
Total Metals	Arsenic	SW 6010, 6020, 7470	.39 mg/kg	28 days for Hg & 180 days for remaining	4 oz. wide mouth jar
	Barium		15,000 mg/kg		
	Boron (Hot Water Soluble)		2 mg/l		
	Cadmium		70 mg/kg		
	Chromium (III)		120,000 mg/kg		
	Chromium (IV)		23 mg/kg		
	Copper		3,100 mg/kg		
	Lead (inorganic)		400 mg/kg		
	Mercury		23 mg/kg		
	Nickel (soluble salts)		1,600 mg/kg		
	Selenium		390 mg/kg		
	Silver		390 mg/kg		

Table 1- Soil Sample Location, Collections, Handling and Analysis Summary continued

Note: Preservation standards for organics and inorganics in soil are < 4°C as per EAL protocol



Table 2. Sample nomenclature and collection locations

Sample I.D.	Property Owner	Sample Location	Type
B1	Kimberly Barta	Southwest Property Corner	Soil
B2	Kimberly Barta	Structure Drip Line (Roof)	Soil
D1	Dennis F. & Julie M. Davidson	Western Property Boundary	Soil
D2	Dennis F. & Julie M. Davidson	Structure Drip Line (Roof)	Soil
P1	Jeffery L., SR.. & Debra K. Payne	Western Property Boundary	Soil
P2	Jeffery L., SR.. & Debra K. Payne	Structure Drip Line (Roof)	Soil
K1	Antoinette Kurelich	Western Property Boundary	Soil
K2	Antoinette Kurelich	Structure Drip Line (Roof)	Soil
G1	Kurt & Tammara Grimm	Western Property Boundary	Soil
G2	Kurt & Tammara Grimm	Structure Drip Line (Roof)	Soil
G3	Michael C. & Ruth A. Grimm	Western Property Boundary	Soil
G4	Michael C. & Ruth A. Grimm	Structure Drip Line (Roof)	Soil
DCP1	Dry Creek Properties, LLC	Northwest Property Corner	Soil
U1	Halina Urbank Trustee of Living Trust	Northern Property Boundary	Soil
U2	Halina Urbank Trustee of Living Trust	Northern Property Boundary	Soil
L1	Geneevieve C. Limbach As Trustee of The	Northeast Property Corner	Soil
S1	Patrick L. & Toni M. Shuster	Southern Property Boundary	Soil
S2	Patrick L. & Toni M. Shuster	Structure Drip Line (Roof)	Soil
HDK1	H.D. & Leslie Marie Kanciua	Northern Portion of Property	Soil
HDK2	H.D. & Leslie Marie Kanciua	Structure Drip Line (Roof)	Soil
GRC1	Gypsum Ranch Co., LLC	Southern Property Boundary	Soil
E1	Gary L. & Joan N. Eppestad	Central Portion of Property	Soil

Notes:

1. Sample locations denote the proposed location of the sample to be collected. The sample will be collected as a composite sample at each location. For example; the G1 location is located on the western edge of the Grimm property boundary. A composite sample will be collected along the entire western boundary of the property. The G2 location is located near one of the structures on the property. A composite sample will be collected around the entire roof drip line.
2. Surface water locations are not denoted on the map due to the fact they are hard to locate on the aerial photograph. If a surface water feature is encountered it will be assessed and sampled if warranted or if the landowner requests that it be sampled.
3. Additional soil samples may be collected if requested by the landowner. If additional soil samples are collected they will be mapped with a Trimble GPS unit and will be added to the map.

