

December 10, 2015

Sundance Energy, Inc.  
633 17<sup>th</sup> Street  
Suite 1950  
Denver, Colorado 80202

Attention: Ms. Catherine A. Aniello

Subject: Sundance Beneficial Reuse Area (COGCC Location #429637)  
Arsenic Background Sampling  
Weld County, Colorado  
AGW Project Number: 152962.E2

Dear Ms. Aniello:

As requested, A. G. Wassenaar, Inc. (AGW) conducted background soil sampling to analyze for arsenic in the area surrounding the Sundance Beneficial Reuse area located in Weld County, Colorado. Background sampling was requested after initial sampling and analysis of the Sundance Beneficial Reuse area yielded arsenic levels higher than the COGCC standard of 0.39 mg/kg. A composite background sample was collected to compare the naturally-occurring level of arsenic in the soil against the arsenic level in the soil in the beneficial reuse area samples which had been integrated with bentonitic drilling fluids and drill cuttings from one or more Sundance site(s) through beneficial reuse of the drill cuttings. This letter summarizes the project activities and analytical results.

## **BACKGROUND**

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The subject site is located in an agricultural area in the Northeast 1/4 the Northwest 1/4 of Section 16, Township 4 North, Range 67 West. It is approximately 2,300 feet east-southeast of the intersection of Weld County Road (WCR)-17 and WCR-46. Based on U.S. Geological Survey (USGS) Topographic Map data, the ground surface at the site generally slopes to the southeast. Figure 1 in Attachment A illustrates the site location and topography. On September 22, 2015, an AGW geologist visited the site and collected a composite sample of the incorporated bentonitic soil which yielded an arsenic level of 6.9 mg/kg.

## **SOIL SAMPLING METHODS**

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To collect the background sample, an AGW technician revisited the site on November 23, 2015. The location of the beneficial reuse area was confirmed using section and range information, satellite photos, and global positioning system (GPS) coordinates provided by Sundance.

AGW collected one composite sample comprised of two discrete soil samples collected from different portions of the area surrounding the subject farm field. Each discrete sample was taken from a depth of 0 to 8 inches using a clean shovel and stainless steel sampling scoop. Prior to each use, the shovel, scoop, and a stainless steel bowl used to mix the discrete soils, were cleaned in a solution of Alconox® detergent

and tap water followed by a tap water and distilled water rinse. To control potential cross contamination, the AGW geologist also wore a new pair of disposable nitrile gloves.

To prepare the composite sample, designated SUN-BG-962, AGW mixed approximate equal portions of the discrete soil samples in the clean stainless steel bowl. The composite sample was then transferred into five new laboratory-supplied glass jars. The jars were immediately sealed, labeled, and placed into a cooler with ice (a preservative). On the day of collection, AGW delivered the sample to Accutest® Mountain States Laboratory, Inc. (Accutest®) in Wheat Ridge, Colorado for testing. During this project, AGW followed chain-of-custody procedures in general accordance with U.S. Environmental Protection Agency (EPA) guidelines.

AGW recorded the GPS coordinates for each discrete sample location using a Garmin® model eTrex Vista® Hcx hand held GPS unit incorporating the NAD83 geodetic reference format. The GPS coordinates and sample locations are illustrated on Figure 1 in Attachment A.

## ANALYTICAL RESULTS

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Accutest® analyzed the sample using EPA approved Methods for COGCC Table 910-1 arsenic. The analytical results are included below on Table 1. The laboratory reports are included in Attachment B.

**Table 1**  
**Sundance Beneficial Reuse Site**  
**Soil Sample Results**  
**November 23, 2015**

Analyte	Sundance Beneficial Reuse Site	Sundance Background	COGCC Standard**
Arsenic	6.9	6.6	0.39 mg/kg*

\* Units include: mg/kg; Milligrams per kilogram

\*\* Standards from Colorado Oil and Gas Conservation Commission Table 910-1, effective January 30, 2015.

To evaluate analytical results associated with oil and gas related sites in Colorado, AGW compares detected concentrations to the regulatory standards published on Table 910-1 of the COGCC Series 900 Rules.

Both the background sample and incorporated soil area sample are above the COGCC standard. The Sundance integrated soil field is 4.5% greater than its background, which is under the 10%-increase level to indicate required further action.

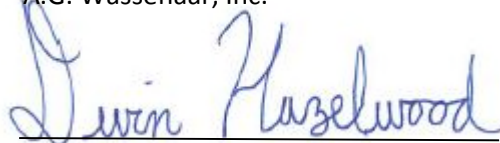
## CONCLUSIONS AND RECOMMENDATIONS

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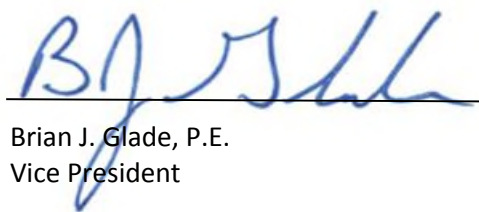
AGW collected a composite soil sample from the Sundance Beneficial Reuse area in September, 2015 and tested it for several analytes including the Table 910-1 Metals. When the resulting arsenic level was higher than the COGCC standard, AGW returned to the site and tested the soil from the unincorporated area surrounding the beneficial reuse area. The background soil arsenic level is 4.5% lower than the incorporated soil arsenic level.

Thank you for the opportunity to assist you with this project. If you have any questions or require further information, please call us at (303) 759-8373.

Sincerely,  
A.G. Wassenaar, Inc.



Devin E. Hazelwood, E.I.T.  
Environmental Engineer



Brian J. Glade, P.E.  
Vice President

DEH/BJG/dd

Attachments

**ATTACHMENT A**

**FIGURES**





### LEGEND

- - DISCREET SOIL SAMPLES FOR ORIGINAL SOIL COMPOSITION SAMPLE September 22, 2015
- - DISCREET SOIL SAMPLES FOR BACKGROUND SOIL COMPOSITION SAMPLE November 23, 2015

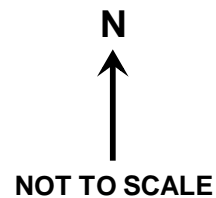
#### ORIGINAL SAMPLE GPS LOCATIONS:

- 1: N40.31888° W104.89948°
- 2: N40.31947° W104.89696°
- 3: N40.31812° W104.89927°
- 4: N40.31818° W104.89691°

#### BACKGROUND SAMPLE GPS LOCATIONS:

- 1: N40.317067° W104.898933°
- 2: N40.317° W104.8986°

ALL LOCATIONS ARE APPROXIMATE.



**A.G. WASSENAAR** | INC.

GEOTECHNICAL • ENVIRONMENTAL  
CONSULTANTS

**SUNDANCE ENERGY  
SUNDANCE REUSE SITE  
WELD COUNTY, COLORADO**

**FIGURE 1  
SITE FEATURES &  
SAMPLE LOCATIONS  
November 23, 2015  
PROJECT: 152962.E2**

**ATTACHMENT B**

**LABORATORY REPORT**







12/01/15

## Technical Report for

**A.G. Wassenaar, Inc.**

**Sundance**

**152962.E2**

**Accutest Job Number: D77588**

**Sampling Date: 11/23/15**

### Report to:

**A.G. Wassenaar, Inc.  
2180 S Ivanhoe Street Suite 5  
Denver, CO 80222  
hazelwoodd@agwco.com**

**ATTN: Devin Hazelwood**

**Total number of pages in report: 16**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

A handwritten signature in black ink, appearing to read 'Scott Heideman'.

**Scott Heideman  
Laboratory Director**

**Client Service contact: Renea Lewis 303-425-6021**

Certifications: CO (CO00049), ID, NE (CO00049), ND (R-027), NJ (CO 0007), OK (D9942), UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY CO (CO00049), EPA 524.2 Provisional

This report shall not be reproduced, except in its entirety, without the written approval of Accutest Laboratories.  
Test results relate only to samples analyzed.

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Sample Summary

A.G. Wassenaar, Inc.

Job No: D77588

Sundance  
Project No: 152962.E2

Sample Number	Collected		Received	Matrix		Client Sample ID
	Date	Time By		Code	Type	
D77588-1	11/23/15	12:06 DH	11/23/15	SO	Soil	SUN-BG-962

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

## CASE NARRATIVE / CONFORMANCE SUMMARY

**Client:** A.G. Wassenaar, Inc.

**Job No** D77588

**Site:** Sundance

**Report Date** 12/1/2015 11:52:55 A

On 11/23/2015, 1 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 2.4 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D77588 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

### Metals By Method SW846 6020A

**Matrix:** SO

**Batch ID:** MP17534

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D77571-1MS, D77571-1MSD, D77571-1SDL were used as the QC samples for the metals analysis.
- The matrix spike duplicate (MSD) recovery(s) of Arsenic are outside control limits. Probable cause due to matrix interference.

### Wet Chemistry By Method SM2540G-2011 M

**Matrix:** SO

**Batch ID:** GN32523

- The data for SM2540G-2011 M meets quality control requirements.

AMS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting AMS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

AMS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by AMS indicated via signature on the report cover.

Summary of Hits

Job Number: D77588  
Account: A.G. Wassenaar, Inc.  
Project: Sundance  
Collected: 11/23/15



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
D77588-1	SUN-BG-962					
Arsenic		6.6	0.11		mg/kg	SW846 6020A

## Sample Results

## Report of Analysis

Report of Analysis

Client Sample ID:	SUN-BG-962	Date Sampled:	11/23/15
Lab Sample ID:	D77588-1	Date Received:	11/23/15
Matrix:	SO - Soil	Percent Solids:	83.1
Project:	Sundance		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	6.6	0.11	mg/kg	5	11/24/15	11/25/15 NT	SW846 6020A <sup>1</sup>	SW846 3050B <sup>2</sup>

(1) Instrument QC Batch: MA6789  
(2) Prep QC Batch: MP17534

RL = Reporting Limit

## Misc. Forms

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### Custody Documents and Other Forms

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**Includes the following where applicable:**

- Chain of Custody





## Accutest Laboratories Sample Receipt Summary

**Accutest Job Number:** D77588      **Client:** AG WASS      **Project:** 152962.E2  
**Date / Time Received:** 11/23/2015 1:19:00 PM      **Delivery Method:** \_\_\_\_\_      **Airbill #'s:** hd  
**Cooler Temps (Initial/Adjusted):** #1: (2.4/2.4):

**Cooler Security**
**Y or N**

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

**Cooler Temperature**
**Y or N**

- |   |           |
|---|-----------|
| 1. Temp criteria achieved: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N | IR Gun;   |
| 2. Cooler temp verification:  | Ice (Bag) |
| 3. Cooler media:  | 1         |
| 4. No. Coolers:   |           |

**Quality Control Preservation**
**Y or N**
**N/A**

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

Comments

**Sample Integrity - Documentation**
**Y or N**

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

**Sample Integrity - Condition**
**Y or N**

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

**Sample Integrity - Instructions**
**Y or N**
**N/A**

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

## Metals Analysis

### QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D77588  
Account: AGWCODN - A.G. Wassenaar, Inc.  
Project: Sundance

QC Batch ID: MP17534  
Matrix Type: SOLID

Methods: SW846 6020A  
Units: mg/kg

Prep Date: 11/24/15

Metal	RL	IDL	MDL	MB	
				raw	final
Arsenic	0.10	.0085	.024	-0.0067	<0.10

Associated samples MP17534: D77588-1

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

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D77588  
 Account: AGWCODN - A.G. Wassenaar, Inc.  
 Project: Sundance

QC Batch ID: MP17534  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: mg/kg

Prep Date: 11/24/15

Metal	D77571-1		Spikelot		QC	
	Original	MS	ICPALL2	% Rec	Limits	
Arsenic	20.7	160	118	118.4	75-125	

Associated samples MP17534: D77588-1

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits  
 (N) Matrix Spike Rec. outside of QC limits  
 (anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D77588  
 Account: AGWCODN - A.G. Wassenaar, Inc.  
 Project: Sundance

QC Batch ID: MP17534  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: mg/kg

Prep Date: 11/24/15

Metal	D77571-1 Original	MSD	Spikelot ICPALL2	% Rec	MSD RPD	QC Limit
Arsenic	20.7	171	119	126.5N(a)	6.6	20

Associated samples MP17534: D77588-1

Results < IDL are shown as zero for calculation purposes

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

(anr) Analyte not requested

(a) Spike recovery indicates possible matrix interference and/or sample nonhomogeneity.

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D77588  
 Account: AGWCODN - A.G. Wassenaar, Inc.  
 Project: Sundance

QC Batch ID: MP17534  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: mg/kg

Prep Date: 11/24/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Arsenic	111	100	111.0	80-120

Associated samples MP17534: D77588-1

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

SERIAL DILUTION RESULTS SUMMARY

Login Number: D77588  
 Account: AGWCODN - A.G. Wassenaar, Inc.  
 Project: Sundance

QC Batch ID: MP17534  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: ug/l

Prep Date: 11/24/15

Metal	D77571-1			QC Limits
	Original	SDL 5:25	%DIF	

Arsenic	174	164	5.9	0-10
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Associated samples MP17534: D77588-1

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

6.1.4  
6