November 2, 2015

Assistant Director for Permitting
WV Department of Environmental Protection
Division of Air Quality
601 57th Street, SE
Charleston, WV 25304

RE: Antero Midstream LLC – Bluestone Compressor Station
West Virginia Department of Environmental Protection, Division of Air Quality,
General Air Permit Modification G35-A004A

To Whom it May Concern,

On behalf of Antero Midstream LLC (Antero), please find attached the permit modification application for permit number G35-A004A for Facility Number 033-00172 located in Harrison County, West Virginia. The facility was recently purchased by Antero and its name changed to Bluestone Compressor Station. Below is a list of requested modifications to the permitted facility included in the application:

1. The facility name to be changed from Salem Compressor Station to Bluestone Compressor Station (see attached Permit Transfer document).
2. The owner and operator of the facility to be transferred from Hall Drilling, LLC to Antero Midstream LLC (see attached Permit Transfer document).
3. Three (3) existing Caterpillar engines to be removed.
4. Two (2) existing dehydration units and three (3) reboilers to be removed.
5. A 25 million standard cubic feet per day (MMSCFD) dehydration unit expected to process no more than 6 MMSCFD with 0.5 MMBtu/hr reboiler to be added to the facility.
6. One (1) 210 barrel produced water tank and one (1) 50 barrel produced water tank to be added to the facility with an expected produced water production of 210 barrels per day.
7. One (1) horizontal filter separator to be added to the facility.

Enclosed is a hard-copy of the entire permit application plus two (2) electronic CDs of the permit application form and the required attachments. Per 45CSR13, a $4,000 application fee is also enclosed, which covers the Class II General Permit Registration $500 application fee and an additional $1,000 for NSPS requirements and $2,500 for MACT requirements.

A copy of the Air Quality Permit Notice for the advertisement is included as Attachment J. As the Notice is being submitted simultaneously with the application, the official affidavit of publication will be submitted to the Division of Air Quality separately once it is completed.

1801 California Street, Suite 1100 ❖ Denver, CO 80202 ❖ 303.237.6601 ❖ fax 303.237.6602

Please call if you have any questions or if I can be of further assistance. I can be reached at (719)632-3593 or by email at kmeszaros@kleinfelder.com .

Sincerely,
Kleinfelder

Kaitlin Meszaros
Air Quality Professional

Enclosure: Bluestone Compressor Station General Air Permit Modification

1801 California Street, Suite 1100 ❖ Denver, CO 80202 ❖ 303.237.6601 ❖ fax 303.237.6602

Antero Midstream LLC

Bluestone Compressor Station

General Permit Modification
West Virginia Department of Environmental Protection
Division of Air Quality
G35-A004A

Harrison County, West Virginia

November 2015

Prepared by:

1801 California Street, Suite 1100
Denver, CO 80202
(303) 237-6601
Fax (303) 237-6602
www.kleinfelder.com

DEN15O23608

Table of Contents

WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
601 57th Street, SE
Charleston, WV 25304
Phone: (304) 926-0475 • *www.dep.wv.gov/daq*

APPLICATION FOR GENERAL PERMIT REGISTRATION

CONSTRUCT, MODIFY, RELOCATE OR ADMINISTRATIVELY UPDATE

A STATIONARY SOURCE OF AIR POLLUTANTS

☐ CONSTRUCTION ☒ MODIFICATION ☐ RELOCATION ☐ CLASS I ADMINISTRATIVE UPDATE

☐ CLASS II ADMINISTRATIVE UPDATE

CHECK WHICH TYPE OF GENERAL PERMIT REGISTRATION YOU ARE APPLYING FOR:

☐ **G10-D –** Coal Preparation and Handling

☐ **G20-B –** Hot Mix Asphalt

☐ **G30-D –** Natural Gas Compressor Stations

☐ **G33-A –** Spark Ignition Internal Combustion Engines

☒ **G35-A –** Natural Gas Compressor Stations (Flare/Glycol Dehydration Unit)

☐ **G40-C –** Nonmetallic Minerals Processing

☐ **G50-B –** Concrete Batch

☐ **G60-C** - Class II Emergency Generator

☐ **G65-C –** Class I Emergency Generator

☐ **G70-A –** Class II Oil and Natural Gas Production Facility

SECTION I. GENERAL INFORMATION

1. Name of applicant (as registered with the WV Secretary of State's Office):
Antero Midstream LLC

2. Federal Employer ID No. **(FEIN):**
46-5517375

3. Applicant's mailing address:
____1615 Wynkoop Street_____
_____Denver, CO 80202_____

4. Applicant's physical address:
__From Bridgeport, WV head west on US-50 W. In 20 miles, turn right onto 50/28. Take the first right to stay on 50/28. The entrance to the facility will be 0.2 miles ahead on the right._____

5. If applicant is a subsidiary corporation, please provide the name of parent corporation:

6. **WV BUSINESS REGISTRATION.** Is the applicant a resident of the State of West Virginia? ☐ **YES** ☒ **NO**

- IF **YES,** provide a copy of the Certificate of **Incorporation/ Organization / Limited Partnership** (one page) including any name change amendments or other Business Registration Certificate as **Attachment A**.
- IF **NO,** provide a copy of the **Certificate of Authority / Authority of LLC / Registration** (one page) including any name change amendments or other Business Certificate as **Attachment A**.

SECTION II. FACILITY INFORMATION

7. Type of plant or facility (stationary source) to be constructed, modified, relocated or administratively updated (e.g., coal preparation plant, primary crusher, etc.): **Natural Gas Compressor Station**

8a. Standard Industrial Classification (SIC) code: **4922**

AND

8b. North American Industry System (NAICS) code: **486210**

9. DAQ Plant ID No. (for existing facilities only):
0 3 3 - 0 0 1 7 2

10. List all current 45CSR13 and other General Permit numbers associated with this process (for existing facilities only):
G35-A004A

A: PRIMARY OPERATING SITE INFORMATION

11A. Facility name of primary operating site:	12A. Address of primary operating site:
Bluestone Compressor Station	Mailing: **___Same as applicant address_____**
_____	Physical:**___US-50 Salem, WV 26426 Harrison County____**

13A**.** Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? Ξ **YES** ☐ **NO**

– IF **YES**, please explain: **__Antero Midstream LLC owns the land for the Bluestone Compressor Station_**

_____

– IF **NO**, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.

14A. – For **Modifications or Administrative Updates** at an existing facility, please provide directions to the present location of the facility from the nearest state road;

– For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a **MAP** as **Attachment F**.

_From Bridgeport, WV head west on US-50 W. In 20 miles, turn right onto 50/28. Take the first right to stay on 50/28. The entrance to the facility will be 0.2 miles ahead on the right.___

15A. Nearest city or town:	16A. County:	17A. UTM Coordinates:
Salem	**Harrison**	Northing (KM): **__4350.034_____** Easting (KM): **__534.947_____** Zone: **___17_____**

18A. Briefly describe the proposed new operation or change (s) to the facility:	19A. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits):
Modified construction – removal of three compressor engines, two dehydration units, and three reboilers, as well as the addition of one dehydration unit, one reboiler and two storage tanks	Latitude: **_39.29898_____** Longitude: **_-80.59471_____**

B: 1ST ALTERNATE OPERATING SITE INFORMATION (only available for G20, G40, & G50 General Permits)

11B. Name of 1st alternate operating site:	12B. Address of 1st alternate operating site:
_____	Mailing:_____ Physical:_____
_____	_____

13B**.** Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? ☐ **YES** ☐ **NO**

– IF **YES**, please explain: _____

_____

– IF **NO**, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.

14B. – For **Modifications or Administrative Updates** at an existing facility, please provide directions to the present location of the facility from the nearest state road;

– For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a **MAP** as **Attachment F**.

_____

_____

_____

15B. Nearest city or town:	16B. County:	17B. UTM Coordinates: Northing (KM): _____ Easting (KM): _____ Zone: _____
18B. Briefly describe the proposed new operation or change (s) to the facility:		19B. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: _____ Longitude: _____

C: 2ND ALTERNATE OPERATING SITE INFORMATION (only available for G20, G40, & G50 General Permits):

11C. Name of 2nd alternate operating site: _____ _____	12C. Address of 2nd alternate operating site: Mailing:_____ Physical:_____ _____

13C**.** Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? ☐ **YES** ☐ **NO**

– IF **YES**, please explain: _____

_____

– IF **NO**, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.

14C. – For **Modifications or Administrative Updates** at an existing facility, please provide directions to the present location of the facility from the nearest state road;

– For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a **MAP** as **Attachment F**.

_____

_____

_____

15C. Nearest city or town:	16C. County:	17C. UTM Coordinates: Northing (KM): _____ Easting (KM): _____ Zone: _____
18C. Briefly describe the proposed new operation or change (s) to the facility:		19C. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: _____ Longitude: _____

20. Provide the date of anticipated installation or change: _____/____/_____ ☐ If this is an **After-The-Fact** permit application, provide the date upon which the proposed change did happen: : **__5__/_10__/_2015_**	21. Date of anticipated Start-up if registration is granted: _____/_____/_____

22. Provide maximum projected **Operating Schedule** of activity/activities outlined in this application if other than 8760 hours/year. (Note: anything other than 24/7/52 may result in a restriction to the facility's operation).

Hours per day___**24**_____ Days per week ___**7**_____ Weeks per year ___**52**_____ Percentage of operation __**100%**_____

SECTION III. ATTACHMENTS AND SUPPORTING DOCUMENTS

23. Include a check payable to WVDEP – Division of Air Quality with the appropriate **application fee** (per 45CSR22 and 45CSR13).

24. Include a **Table of Contents** as the first page of your application package.

All of the required forms and additional information can be found under the Permitting Section (General Permits) of DAQ's website, or requested by phone.

25. Please check all attachments included with this permit application. Please refer to the appropriate reference document for an explanation of the attachments listed below.

- ☒ ATTACHMENT A : CURRENT BUSINESS CERTIFICATE
- ☒ ATTACHMENT B: PROCESS DESCRIPTION
- ☒ ATTACHMENT C: DESCRIPTION OF FUGITIVE EMISSIONS
- ☒ ATTACHMENT D: PROCESS FLOW DIAGRAM
- ☒ ATTACHMENT E: PLOT PLAN
- ☒ ATTACHMENT F: AREA MAP
- ☒ ATTACHMENT G: EQUIPMENT DATA SHEETS AND REGISTRATION SECTION APPLICABILITY FORM
- ☒ ATTACHMENT H: AIR POLLUTION CONTROL DEVICE SHEETS
- ☒ ATTACHMENT I: EMISSIONS CALCULATIONS
- ☒ ATTACHMENT J: CLASS I LEGAL ADVERTISEMENT
- ☐ ATTACHMENT K: ELECTRONIC SUBMITTAL
- ☒ ATTACHMENT L: GENERAL PERMIT REGISTRATION APPLICATION FEE
- ☐ ATTACHMENT M: SITING CRITERIA WAIVER
- ☒ ATTACHMENT N: MATERIAL SAFETY DATA SHEETS (MSDS)
- ☒ ATTACHMENT O: EMISSIONS SUMMARY SHEETS
- ☒ OTHER SUPPORTING DOCUMENTATION NOT DESCRIBED ABOVE (Equipment Drawings, Aggregation Discussion, etc.)

Please mail an original and two copies of the complete General Permit Registration Application with the signature(s) to the DAQ Permitting Section, at the address shown on the front page of this application. Please DO NOT fax permit applications. For questions regarding applications or West Virginia Air Pollution Rules and Regulations, please refer to the website shown on the front page of the application or call the phone number also provided on the front page of the application.

SECTION IV. CERTIFICATION OF INFORMATION

This General Permit Registration Application shall be signed below by a Responsible Official. A Responsible Official is a President, Vice President, Secretary, Treasurer, General Partner, General Manager, a member of a Board of Directors, or Owner, depending on business structure. A business may certify an Authorized Representative who shall have authority to bind the Corporation, Partnership, Limited Liability Company, Association, Joint Venture or Sole Proprietorship. Required records of daily throughput, hours of operation and maintenance, general correspondence, Emission Inventory, Certified Emission Statement, compliance certifications and all required notifications must be signed by a Responsible Official or an Authorized Representative. If a business wishes to certify an Authorized Representative, the official agreement below shall be checked off and the appropriate names and signatures entered. Any administratively incomplete or improperly signed or unsigned Registration Application will be returned to the applicant.

FOR A CORPORATION (domestic or foreign)

☒ I certify that I am a President, Vice President, Secretary, Treasurer or in charge of a principal business function of the corporation

FOR A PARTNERSHIP

☐ I certify that I am a General Partner

FOR A LIMITED LIABILITY COMPANY

☐ I certify that I am a General Partner or General Manager

FOR AN ASSOCIATION

☐ I certify that I am the President or a member of the Board of Directors

FOR A JOINT VENTURE

☐ I certify that I am the President, General Partner or General Manager

FOR A SOLE PROPRIETORSHIP

☐ I certify that I am the Owner and Proprietor

☐ *I hereby certify that* (please print or type) _____

is an Authorized Representative and in that capacity shall represent the interest of the business (e.g., Corporation, Partnership, Limited Liability Company, Association Joint Venture or Sole Proprietorship) and may obligate and legally bind the business. If the business changes its Authorized Representative, a Responsible Official shall notify the Director of the Office of Air Quality immediately, and/or,

I hereby certify that all information contained in this General Permit Registration Application and any supporting documents appended hereto is, to the best of my knowledge, true, accurate and complete, and that all reasonable efforts have been made to provide the most comprehensive information possible

Signature _____
(please use blue ink) Responsible Official Date

Name & Title Ward McNeilly, Vice President Reserves Planning & Midstream
(please print or type)

Signature _____
(please use blue ink) Authorized Representative (if applicable) Date

Applicant's Name Ward McNeilly

Phone & Fax (303)357-6822 (303)357-7315
Phone Fax

Email wmcneilly@anteroresources.com

Discussion of Nearby Facilities

Bluestone Compressor Station – Closest Antero Midstream LLC Facilities

1. Common Control: Only those facilities that are owned and managed by Antero were included in the aggregation discussion. This includes Antero Resources Corporation production facilities in addition to the Antero Midstream LLC midstream facilities.

2. SIC Code: The Bluestone Compressor Station operates under SIC code 4922 (pipeline transportation of natural gas. The closest facility owned by Antero Midstream LLC with this SIC code is a compressor station 4.5 miles southwest of Bluestone Compressor Station. All Antero Resources Corporation facilities operate under the SIC code of 1311 (crude oil and natural gas). The closest facility with this SIC code is approximately 2 miles to the southwest.

3. Contiguous or Adjacent: The land between the Bluestone Compressor Station and its nearest compressor station operating under the same SIC code is not owned or managed by Antero Midstream LLC. Therefore, the facilities are not considered to be adjacent or contiguous.

Based on this three-pronged evaluation, there are no other existing facilities that should aggregate emissions with Bluestone Compressor Station.

Attachment A.
Business Certificate

State of West Virginia

Certificate

I, Natalie E. Tennant, Secretary of State of the State of West Virginia, hereby certify that

ANTERO MIDSTREAM LLC

Control Number: 9A5E1

a limited liability company, organized under the laws of the State of Delaware

has filed its "Application for Certificate of Authority" in my office according to the provisions of West Virginia Code §31B-10-1002. I hereby declare the organization to be registered as a foreign limited liability company from its effective date of April 29, 2014, until a certificate of cancellation is filed with our office.

Therefore, I hereby issue this

CERTIFICATE OF AUTHORITY OF A FOREIGN LIMITED LIABILITY COMPANY

to the limited liability company authorizing it to transact business in West Virginia

Given under my hand and the Great Seal of the State of West Virginia on this day of April 29, 2014

Natalie E Tennant

Secretary of State

FILED

APR 29 2014

IN THE OFFICE OF
WV SECRETARY OF STATE

Submitted by:
CT Corporation Rep-Terry Stamper
Terry.Stamper@wolterskluwer.com
304-776-1152

1152

Natalie E. Tennant
Secretary of State
1900 Kanawha Blvd E
Bldg 1, Suite 157-K
Charleston, WV 25305

Penney Barker, Manager
Corporations Division
Tel: (304)558-8000
Fax: (304)558-8381
Website: www.wvsos.com
E-mail: business@wvsos.com

Office Hours: Monday – Friday
8:30 a.m. – 5:00 p.m. ET

Control # A45E1

FILE ONE ORIGINAL.
(Two if you want a filed stamped copy returned to you)
FEE: $150

WV APPLICATION FOR CERTIFICATE OF AUTHORITY OF LIMITED LIABILITY COMPANY

1. The **name** of the company as registered in its **home state** is: Antero Midstream LLC

   and the **state or country of organization** is: Delaware

☒ **CHECK HERE to indicate you have obtained and submitted with this application a CERTIFICATE OF EXISTENCE (GOOD STANDING), dated during the current tax year, from your home state of original incorporation as required to process your application. The certificate may be obtained by contacting the Secretary of State's Office in the home state of original incorporation.**

2. The **name** to be used in **West Virginia** will be: [The **name must contain one of the required terms** such as limited liability company" or abbreviations such as "LLC" or "PLLC". See instructions for complete list of acceptable terms and requirements for use of trade name.]
   ☒ **Home State name as listed above,** if available in WV (If name is not available, check DBA Name box below and follow special instructions in **Section 2.** attached.)
   ☐ **DBA name** _____ (See special instructions in **Section 2.** Regarding the **Letter of Resolution** attached to this application.)

3. The company will be a: [See instructions for limitations on professions which may form P.L.L.C. in WV. All members must have WV professional license. In most cases, a **Letter of Authorization/Approval from the appropriate State Licensing Board** is required to process the application.]
   ☒ regular **L.L.C.**
   ☐ **Professional L.L.C.** for the profession of _____

4. The street address of the **principal office** is:
   No. & Street: 1625 17th Street, Suite 300
   City/State/Zip: Denver, Colorado 80202

   and the mailing address (if different) is:
   Street/Box: _____
   City/State/Zip: _____

5. The **address** of the **designated office** of the company in WV, if any, will be:
   No. & Street: 5400 D Big Tyler Road
   City/State/Zip: Charleston, West Virginia 25313

6. **Agent of Process:** Properly designated person to whom notice of legal process may be sent, if any:
   Name: C T Corporation System
   Address: 5400 D Big Tyler Road
   City/State/Zip: Charleston, West Virginia 25313

RECEIVED

APR 29 2014

214913 3/2/2014 8:35:00

7. **E-mail address** where business correspondence may be received: jgiannaula@anteroresources.com

8. **Website address of the business,** if any: N/A

9. The company is:
   - [X] an **at-will** company, for an indefinite period
   - [ ] a **term** company, for the term of _____ years, which will expire on _____.

10. The company is:
   - [X] **member**-managed. [List the names and addresses of all members.]
   - [ ] **manager**-managed. [List the names and addresses of all managers.]

List the **Name(s) and Address(es) of the Member(s)/Manager(s)** of the company (attach additional pages if necessary).

Name	Street Address	City, State, Zip
Antero Resources Corporation	1625 17th Street, Suite 300	Denver, Colorado 80202

11. All or specified members of a limited liability company are liable in their capacity as members for all or specified debts, obligations or liabilities of the company.
   - [X] **No**--All debts, obligations and liabilities are those of the company.
   - [ ] **Yes**--Those persons who are liable in their capacity as members for all debts, obligations or liability of the company have consented in writing to the adoption of the provision or to be bound by the provision.

12. The **purpose** for which this limited liability company is formed are as follows:
(Describe the type(s) of business activity which will be conducted, for example, "real estate," "construction of residential and commercial buildings," "commercial printing," "professional practice of architecture.")

Midstream oil and gas operating company

13. Is the business a **Scrap Metal Dealer**?
   - [ ] **Yes** [If "Yes," you must complete the **Scrap Metal Dealer Registration Form** (Form SMD-1) and proceed to question 14.].
   - [X] **No** [Proceed to question 14.]

14. The number of pages attached and included in this application is: 3

15. The requested **effective date** is: [Requested date *may not be earlier than filing nor later than 90 days after filing in our office.*]
☒ the date & time of filing in the Secretary of State's Office
☐ the following date _____ and time _____

16. **Contact and Signature Information*** (See below ***Important Legal Notice Regarding Signature***):

a.	Alvyn A. Schopp	(313) 357-7310
	Contact Name	Phone Number
b.	Alvyn A. Schopp	Chief Administrative Officer and Regional Vice President
	Print or type name of signer	Title / Capacity of Signer
c.	_____	April 28, 2014
	Signature	**Date**

****Important Legal Notice Regarding Signature:* Per West Virginia Code §31B-2-209, Liability for false statement in filed record.** If a record authorized or required to be filed under this chapter contains a false statement, one who suffers loss by reliance on the statement may recover damages for the loss from a person who signed the record or caused another to sign it on the person's behalf and knew the statement to be false at the time the record was signed.

Delaware

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY "ANTERO MIDSTREAM LLC" IS DULY FORMED UNDER THE LAWS OF THE STATE OF DELAWARE AND IS IN GOOD STANDING AND HAS A LEGAL EXISTENCE SO FAR AS THE RECORDS OF THIS OFFICE SHOW, AS OF THE TWENTY-NINTH DAY OF APRIL, A.D. 2014.

AND I DO HEREBY FURTHER CERTIFY THAT THE ANNUAL TAXES HAVE NOT BEEN ASSESSED TO DATE.

Jeffrey W. Bullock, Secretary of State

5466900 8300

AUTHENTICATION: 1328067

140532521

DATE: 04-29-14

You may verify this certificate online at corp.delaware.gov/authver.shtml

Attachment B.
Process Description

Attachment B
Bluestone Compressor Station – Process Description

The Bluestone Compressor Station is located in Harrison County, West Virginia. The modified facility will consist of one (1) 1,380 brake horsepower (bhp) Caterpillar G3516B compressor engine with oxidation catalyst, one (1) 210 barrel (bbl) produced water tank, one (1) 50 bbl produced water tank, one (1) 25 million standard cubic feet per day (MMSCFD) capacity triethylene glycol (TEG) dehydration unit with a 0.5 MMBtu/hr reboiler, and one (1) horizontal filter separator.

Gas from surrounding pipelines and onsite well enters the facility through one (1) filter separator for the initial separation of production liquids and sales gas. There are no regular emissions associated with the separator other than fugitive component leaks discussed below. Gas from the filter separator is sent to the 1,380 bhp Caterpillar compressor engine (CE-4). The compressor engine is controlled by an oxidation catalyst (1C). Produced water from the filter separator and compressor engine is sent to the 210 bbl produced water tank (T01) and 50 bbl produced water tank (T02). Gas from the compressor engine is sent to the TEG dehydrator (DEHY-001).

The TEG dehydrator (DEHY-001) contains a flash gas tank and 0.5 MMBtu/hr reboiler (RB-1). The dehydrator has a design rate of 25 MMSCFD, but will only process a maximum of 6 MMSCFD. Within the dehydration unit, vent gas from the flash gas tank is routed to the reboiler and used as fuel with an assumed 95% efficiency for combusting the gas. Emissions from the reboiler are routed to the atmosphere. The still vent is equipped with a condenser. Produced water from the dehydrator is routed to the two (2) produced water tanks. The dry gas from the dehydration process is sent to plant discharge.

Produced water is trucked out via tank trucks as needed (LDOUT). The facility produced water production is 210 barrels per day. Fugitive emissions also occur from component leaks and from haul road dust from onsite truck traffic. The compressor engine will undergo venting episodes from regular maintenance including compressor blowdowns.

The N Ritter 1 is a dry gas well owned by Antero Resources Corporation on the same pad as the Bluestone Compressor Station. Though the well is not covered under the existing G35-A004A, there are no emissions associated with this well as it does not have any associated production equipment and its production is piped to commingle with other compressor station inlet flows.

Sources of emissions from the compressor station include:

- Compressor Engine: NOx, CO, VOC, SOx, PM_{10}, $PM_{2.5}$, HAPs, CO_2e
- Produced Water Storage Tanks: VOC, HAPs, CO_2e
- Dehydration Unit: VOC, HAPs, CO_2e
- Reboiler: NOx, CO, VOC, SOx, PM_{10}, $PM_{2.5}$, HAPs, CO_2e
- Truck Loading: VOC, HAPs, CO_2e
- Fugitive Component Leaks: VOC, HAPs, CO_2e
- Venting Episodes: VOC, HAPs, CO_2e
- Fugitive Dust: PM_{10}, $PM_{2.5}$

Attachment C.
Description of Fugitive Emissions

Attachment C
Bluestone Compressor Station – Description of Fugitive Emissions

The fugitive emissions that will occur at the Bluestone Compressor Station include:

1. Equipment leaks – components in gas service and light liquid service

Each piece of equipment onsite are fitted with components such as flanges, valves, and pressure relief valves to ensure a safe and efficient compression process. These components are designed to have a small amount of gas vent to the atmosphere. The component counts were estimated using component counts from a similar compressor station configuration. Weight fractions of specific pollutant components were retrieved from a site-specific gas analysis of a nearby well and from the ProMax output of the flashing gas evolved from the produced water.

2. Venting episodes – compressor blowdowns and start-up events

The onsite compressor will undergo scheduled blowdown events to ensure proper operation of the engine. The gas from these events is released to the atmosphere. No regular schedule is set for when these events will occur. Emissions from the blowdowns as well as starting the engine up after the blowdowns were calculated based on the frequency of events, the estimated gas that will be released, and the weight fractions of specific pollutant components of the site-specific gas.

3. Haul road emissions – truck traffic

The gravel access road allowing entry and exit onto the compressor station site is not paved. Truck travel on the gravel access road results in the dislodging of particulates from the road and lifting dust to the atmosphere. It is assumed no more than two produced water tanker trucks and two light-duty pickup trucks will drive onsite per day. The gravel access road distance is approximately 1,250 feet.

Equipment Leaks

LEAK SOURCE DATA SHEET

Source Category	Pollutant	Number of Source Components[1]	Number of Components Monitored by Frequency[2]	Average Time to Repair (days)[3]	Estimated Annual Emission Rate (lb/yr)[4]
Pumps[5]	light liquid VOC[6,7]				
	Non-VOC[9]				
Valves[10]	Gas VOC	105		1st attempt – 5 days Final repair – 15 days	807.9
	Light Liquid VOC	53		1st attempt – 5 days Final repair – 15 days	218.9
Safety Relief Valves[11]	Gas VOC				
	Non VOC				
Open-ended Lines[12]	Gas VOC				
	Light Liquid VOC				
Sampling Connections[13]	VOC				
	Non-VOC				
Connectors	Gas VOC				
	Light Liquid VOC				
Flanges	Gas VOC	75		1st attempt – 5 days Final repair – 15 days	50.0
	Light Liquid VOC	38		1st attempt – 5 days Final repair – 15 days	6.9
Other	Gas VOC	5		1st attempt – 5 days Final repair – 15 days	75.2
	Light Liquid VOC				
	Non-VOC				

[1 - 13] See notes on the following page.

Notes for Leak Source Data Sheet

1. For VOC sources include components on streams and equipment that contain greater than 10% w/w VOC, including feed streams, reaction/separation facilities, and product/by-product delivery lines. Do not include certain leakless equipment as defined below by category.

2. By monitoring frequency, give the number of sources routinely monitored for leaks, using a portable detection device that measures concentration in ppm. Do not include monitoring by visual or soap-bubble leak detection methods. "M/Q(M)/Q/SA/A/O" means the time period between inspections as follows:

   Monthly/Quarterly, with Monthly follow-up of repaired leakers/Quarterly/Semi-annual/Annually/Other (specify time period)

   If source category is not monitored, a single zero in the space will suffice. For example, if 50 gas-service valves are monitored quarterly, with monthly follow-up of those repaired, 75 are monitored semi-annually, and 50 are checked bimonthly (alternate months), with non checked at any other frequency, you would put in the category “valves, gas service:” 0/50/0/75/0/50 (bimonthly).

3. Give the average number of days, after a leak is discovered, that an attempt will be made to repair the leak.

4. Note the method used: MB - material balance; EE - engineering estimate; EPA - emission factors established by EPA (cite document used); O - other method, such as in-house emission factor (specify).

5. Do not include in the equipment count sealless pumps (canned motor or diaphragm) or those with enclosed venting to a control device. (Emissions from vented equipment should be included in the estimates given in the Emission Points Data Sheet.)

6. Volatile organic compounds (VOC) means the term as defined in 40 CFR □51.100 (s).

7. A light liquid is defined as a fluid with vapor pressure equal to or greater than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if 20% w/w or more of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20 °C, then the fluid is defined as a light liquid.

8. A heavy liquid is defined as a fluid with a vapor pressure less than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if less than 20% w/w of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20 °C, then the fluid is defined as a heavy liquid.

9. LIST CO, H_2S, mineral acids, NO, NO_2, SO_3, etc. DO NOT LIST CO_2, H_2, H_2O, N_2, O_2, and Noble Gases.

10. Include all process valves whether in-line or on an open-ended line such as sample, drain and purge valves. Do not include safety-relief valves, or leakless valves such as check, diaphragm, and bellows seal valves.

11. Do not include a safety-relief valve if there is a rupture disk in place upstream of the valve, or if the valve vents to a control device.

12 Open-ended lines include purge, drain and vent lines. Do not include sampling connections, or lines sealed by plugs, caps, blinds or second valves.

13. Do not include closed-purge sampling connections.

Venting Episodes

Attachment L
EMISSIONS UNIT DATA SHEET
GENERAL

To be used for affected sources other than asphalt plants, foundries, incinerators, indirect heat exchangers, and quarries.

Identification Number (as assigned on *Equipment List Form*): Fugitive so no number assigned

1. Name or type and model of proposed affected source:

   Fugitive emissions from venting episodes such as compressor blowdowns and startups.

2. On a separate sheet(s), furnish a sketch(es) of this affected source. If a modification is to be made to this source, clearly indicated the change(s). Provide a narrative description of all features of the affected source which may affect the production of air pollutants.

3. Name(s) and maximum amount of proposed process material(s) charged per hour:

4. Name(s) and maximum amount of proposed material(s) produced per hour:

   - compressor blowdown - 0.022 tons VOC per event, 0.0012 tons HAPs per event, 4.65 tons CO2e per event
   - compressor startup - 0.003 tons VOC per event, 0.0001 tons HAPs per event, 0.49 tons CO2e per event

5. Give chemical reactions, if applicable, that will be involved in the generation of air pollutants:

   None

* The identification number which appears here must correspond to the air pollution control device identification number appearing on the *List Form*.

6. Combustion Data (if applicable):

(a) Type and amount in appropriate units of fuel(s) to be burned:

(b) Chemical analysis of proposed fuel(s), excluding coal, including maximum percent sulfur and ash:

(c) Theoretical combustion air requirement (ACF/unit of fuel):

@ °F and psia.

(d) Percent excess air:

(e) Type and BTU/hr of burners and all other firing equipment planned to be used:

(f) If coal is proposed as a source of fuel, identify supplier and seams and give sizing of the coal as it will be fired:

(g) Proposed maximum design heat input: × 10^6 BTU/hr.

7. Projected operating schedule:

Hours/Day	not a regular schedule	Days/Week	not a regular schedule	Weeks/Year	not a regular schedule

8. Projected amount of pollutants that would be emitted from this affected source if no control devices were used:

@ venting events are uncontrolled °F and psia

a.	NO_X	lb/hr	grains/ACF
b.	SO_2	lb/hr	grains/ACF
c.	CO	lb/hr	grains/ACF
d.	PM_{10}	lb/hr	grains/ACF
e.	Hydrocarbons	lb/hr	grains/ACF
f.	VOCs	lb/hr	grains/ACF
g.	Pb	lb/hr	grains/ACF
h.	Specify other(s)		
		lb/hr	grains/ACF
		lb/hr	grains/ACF
		lb/hr	grains/ACF
		lb/hr	grains/ACF

NOTE: (1) An Air Pollution Control Device Sheet must be completed for any air pollution device(s) used to control emissions from this affected source.

(2) Complete the Emission Points Data Sheet.

9. Proposed Monitoring, Recordkeeping, Reporting, and Testing
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
Engine maintenance and run time will be monitored.	Engine maintenance and run time will be recorded.
REPORTING	**TESTING**
Reports will be submitted as requested by WVDAQ.	None.

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

N/A

Haul Road Dust

Attachment L
FUGITIVE EMISSIONS FROM UNPAVED HAULROADS

UNPAVED HAULROADS (including all equipment traffic involved in process, haul trucks, endloaders, etc.)

		PM	PM-10
k =	Particle size multiplier	0.80	0.36
s =	Silt content of road surface material (%)	4.8	4.8
p =	Number of days per year with precipitation >0.01 in.	160	160

Item Number	Description	Number of Wheels	Mean Vehicle Weight (tons)	Mean Vehicle Speed (mph)	Miles per Trip	Maximum Trips per Hour	Maximum Trips per Year	Control Device ID Number	Control Efficiency (%)
1	Produced Water Tank Truck	4	21.5	--	0.47	1	730	NA	NA
2	Pick-up Trucks	4	21.5	--	0.47	1	730	NA	NA
3									
4									
5									
6									
7									
8									

Source: *AP-42 Fifth Edition – 13.2.2 Unpaved Roads*

$E = k \times 5.9 \times (s \div 12) \times (S \div 30) \times (W \div 3)^{0.7} \times (w \div 4)^{0.5} \times ((365 - p) \div 365) =$ lb/Vehicle Mile Traveled (VMT)

Where:

		PM	PM-10
k =	Particle size multiplier	0.80	0.36
s =	Silt content of road surface material (%)	4.8	4.8
S =	Mean vehicle speed (mph)	---	---
W =	Mean vehicle weight (tons)	21.5	21.5
w =	Mean number of wheels per vehicle	4	4
p =	Number of days per year with precipitation >0.01 in.	160	160

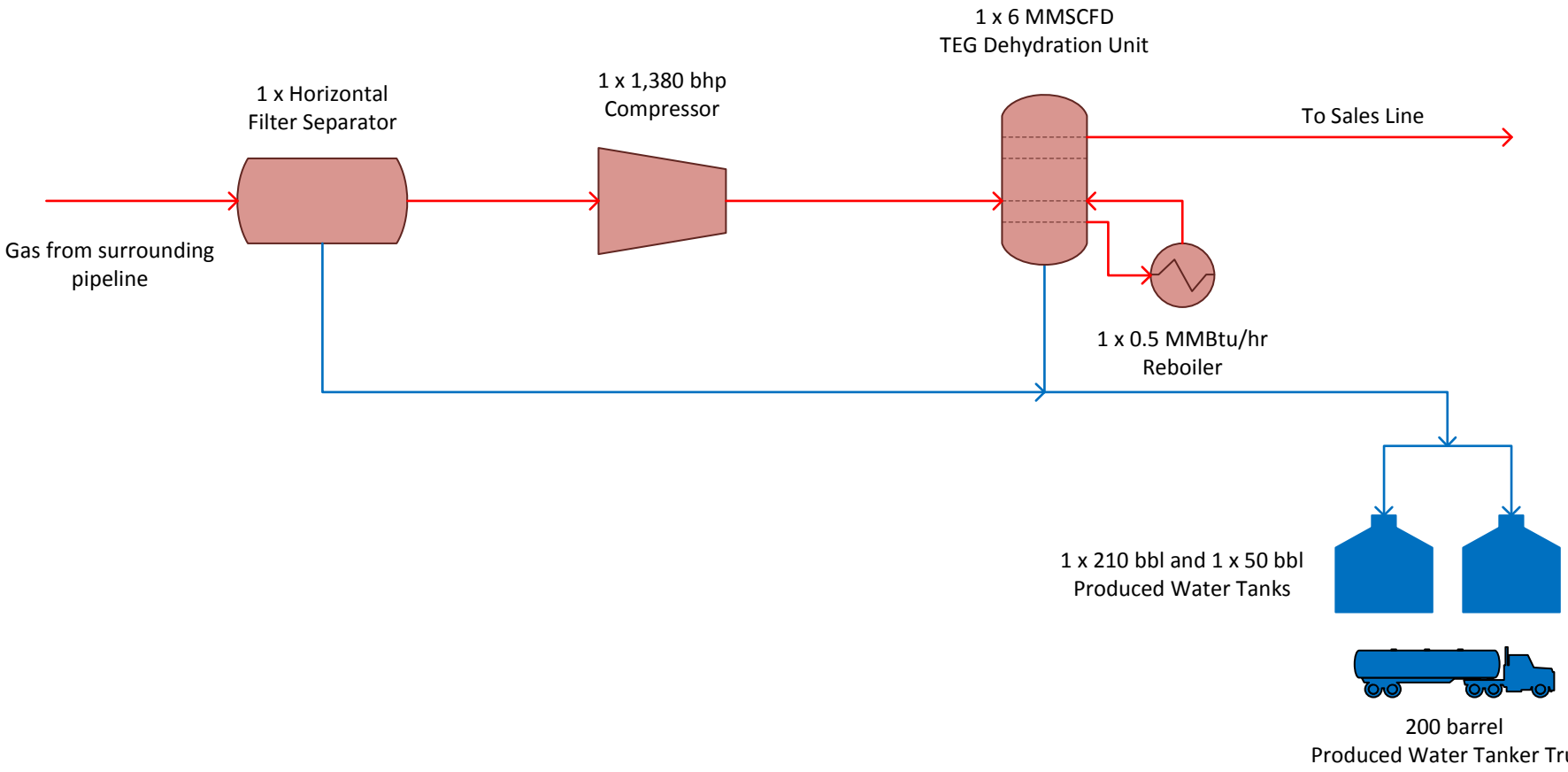
For lb/hr: [lb ÷ VMT] × [VMT ÷ trip] × [Trips ÷ Hour] = lb/hr

For TPY: [lb ÷ VMT] × [VMT ÷ trip] × [Trips ÷ Hour] × [Ton ÷ 2000 lb] = Tons/year

SUMMARY OF UNPAVED HAULROAD EMISSIONS

Item No.	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
1	0.14	0.61	0.14	0.61	0.04	0.16	0.04	0.16
2	0.14	0.61	0.14	0.61	0.04	0.16	0.04	0.16
3								
4								
5								
6								
7								
8								
TOTALS								

Attachment D.
Process Flow Diagram



Process Flow Diagram
Antero Midstream LLC
Bluestone Compressor Station
Harrison County, West Virginia

Attachment E.
Plot Plan

RB-1
Dehy-001

534.9472 km E
4350.0335 km N
Elevation: 1265 ft

Separator

CE 04

T01

T02

LDOUT
Tank Truck Route

Access Road

0 25 50 100 Feet

Legend

- Wellhead
- Access Road
- Well Pad/Property Boundary/Fence

N

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www.kleinfelder.com

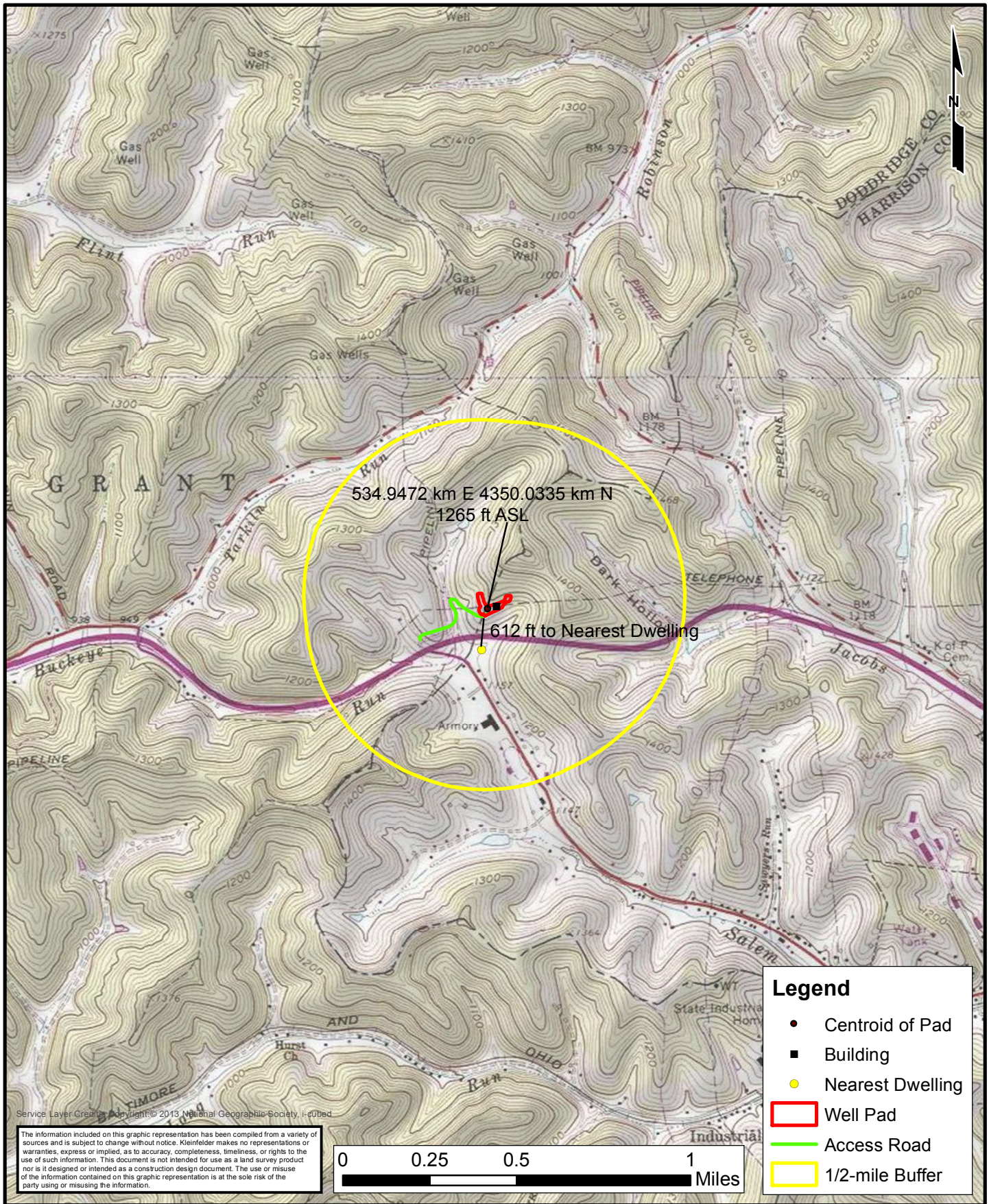
PROJECT NO.	20161518
DRAWN:	7/21/2015
DRAWN BY:	B. McDavid
CHECKED BY:	K. Meszaros
FILE NAME:	BluestoneCompressorStation.mxd

Antero Midstream LLC

Bluestone Compressor Station
Harrison County, Virginia
Plot Plan

FIGURE
1

Attachment F.
Area Map



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PROJECT NO.	20161518
DRAWN:	7/21/2015
DRAWN BY:	B. McDavid
CHECKED BY:	K. Meszaros
FILE NAME:	Bluestone_ProjectLocation.mxd

Antero Midstream LLC

Bluestone Compressor Station
Harrison County, West Virginia
Project Area Map

FIGURE
1

Attachment G.
Emission Unit Data Sheets

Registration Section Applicability Form

General Permit G35-A Registration
Section Applicability Form

General Permit G35-A was developed to allow qualified registrants to seek registration for a variety of sources. These sources include internal combustion engines, boilers, reboilers, line heaters, tanks, emergency generators, dehydration units not subject to MACT standards, dehydration units not subject to MACT standards and being controlled by a flare control device, dehydration units not subject to MACT standards and being controlled by recycling the dehydration unit back to flame zone of reboiler, dehydration units not subject to MACT standards being controlled by a thermal oxidizer, and permit exemptions including the less than 1 ton/year benzene exemption, the 40CFR63 Subpart HH - Annual Average Flow of Gas Exemption (3 mmscf/day), and the 40CFR63 Subpart HHH - Annual Average Flow of Gas Exemption (10 mmscf/day). All registered facilities will be subject to Sections 1.0, 1.1, 2.0, 3.0, and 4.0.

General Permit G35-A allows the registrant to choose which sections of the permit that they wish to seek registration under. Therefore, please mark which sections that you are applying for registration under. Please keep in mind, that if this registration is approved, the issued registration will state which sections will apply to your affected facility.

Section 5	Reciprocating Internal Combustion Engines (R.I.C.E.)*	☒
Section 6	Boilers, Reboilers, and Line Heaters	☒
Section 7	Tanks	☒
Section 8	Emergency Generators	☐
Section 9	Dehydration Units Not Subject to MACT Standards	☐
Section 10	Dehydration Units Not Subject to MACT Standards and being controlled by a flare control device	☐
Section 11	Dehydration Units Not Subject to MACT Standards being controlled by recycling the dehydration unit back to the flame zone of the reboiler	☒
Section 12	Dehydration Units Not Subject to MACT Standards and being controlled by a thermal oxidizer	☐
Section 13	Permit Exemption (Less than 1 ton/year of benzene exemption)	☒
Section 14	Permit Exemption (40CFR63 Subpart HH – Annual average flow of gas exemption (3 mmscf/day))	☐
Section 15	Permit Exemption (40CFR63 Subpart HHH – Annual average flow of gas exemption (10 mmscf/day))	☐
Section 16	Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (40CFR60 Subpart JJJJ)	☒

*** Affected facilities that are subject to Section 5 may also be subject to Section 16. Therefore, if the applicant is seeking registration under both sections, please select both.**

Emission Units Table

Emission Units Table

(includes all emission units and air pollution control devices that will be part of this permit application review, regardless of permitting status)

Emission Unit ID[1]	Emission Point ID[2]	Emission Unit Description	Year Installed/ Modified	Design Capacity	Type[3] and Date of Change	Control Device[4]
CE-4	1E	Compressor Engine	2010	1,380 bhp	Modification	1C
T01	2E	Produced Water Storage Tank #1	2015	210 bbl	New	None
T02	3E	Produced Water Storage Tank #2	2015	50 bbl	New	None
DEHY-001	4E	TEG Dehydration Unit	2015	25 MMSCFD	New	RB-1 (2C)
RB-1	5E/2C	Reboiler	2015	0.5 MMBtu/hr	New	None
CE-1		Caterpillar G3516LE Compressor Engine	2015	1,265 bhp	Removal	None
CE-2		Caterpillar G3516LE Compressor Engine	2015	1,085 bhp	Removal	None
CE-3		Caterpillar G3516 Compressor Engine	2015	1,265 bhp	Removal	None
RBV-1		Hanover Glycol Dehydration Unit Reboiler	2015	10 MMSCFD	Removal	None
RBV-2		Exterran Glycol Dehydration Unit Reboiler	2015	0.2 MMBtu/hr	Removal	None
RSV-2		Exterran Glycol Dehydration Unit Still Vent	2015	10 MMSCFD	Removal	None
RBV-3		Exterran Glycol Dehydration Unit Reboiler	2015	0.5 MMBtu/hr	Removal	None
RSV-3		Exterran Glycol Dehydration Unit Still Vent	2015	20 MMSCFD	Removal	None
LDOUT	6E	Produced Water Truck Loadout	2015	210 bbl/day	New	None

[1] For Emission Units (or Sources) use the following numbering system:1S, 2S, 3S,... or other appropriate designation.
[2] For Emission Points use the following numbering system:1E, 2E, 3E, ... or other appropriate designation.
[3] New, modification, removal
[4] For Control Devices use the following numbering system: 1C, 2C, 3C,... or other appropriate designation.

Compressor Engine

NATURAL GAS COMPRESSOR/GENERATOR ENGINE DATA SHEET

Source Identification Number[1]		CE-4					
Engine Manufacturer and Model		Caterpillar G3516B					
Manufacturer's Rated bhp/rpm		1,380 bhp/ 1,400 rpm					
Source Status[2]		MS					
Date Installed/Modified/Removed[3]		2010					
Engine Manufactured/Reconstruction Date[4]		2010					
Is this a Certified Stationary Spark Ignition Engine according to 40CFR60 Subpart JJJJ? (Yes or No)[5]		No					
Engine, Fuel and Combustion Data	Engine Type[6]	LB4S					
	APCD Type[7]	SCR					
	Fuel Type[8]	PQ					
	H_2S (gr/100 scf)	0					
	Operating bhp/rpm	1,380 bhp/ 1,400 rpm					
	BSFC (Btu/bhp-hr)	7,301					
	Fuel throughput (ft^3/hr)	8,851					
	Fuel throughput ($MMft^3$/yr)	77.54					
	Operation (hrs/yr)	8,760					
Reference[9]	Potential Emissions[10]	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
	NO_X	1.52	6.66				
	CO	0.74	3.24				
	VOC	0.73	3.20				
	SO_2	0.006	0.03				
	PM_{10}	0.10	0.44				
	Formaldehyde	0.13	0.56				

1. Enter the appropriate Source Identification Number for each natural gas-fueled reciprocating internal combustion compressor/generator engine located at the compressor station. Multiple compressor engines should be designated CE-1, CE-2, CE-3 etc. Generator engines should be designated GE-1, GE-2, GE-3 etc. If more than three (3) engines exist, please use additional sheets.

2. Enter the Source Status using the following codes:

NS	Construction of New Source (installation)	ES	Existing Source
MS	Modification of Existing Source	RS	Removal of Source

3. Enter the date (or anticipated date) of the engine's installation (construction of source), modification or removal.

4. Enter the date that the engine was manufactured, modified or reconstructed.

5. Is the engine a certified stationary spark ignition internal combustion engine according to 40CFR60 Subpart JJJJ. If so, the engine and control device must be operated and maintained in accordance with the manufacturer's emission-related written instructions. You must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required. If the certified engine is not operated and maintained in accordance with the manufacturer's emission-related written instructions, the engine will be considered a non-certified engine and you must demonstrate compliance according to 40CFR§60.4243a(2)(i) through (iii), as appropriate.

   Provide a manufacturer's data sheet for all engines being registered.

6. Enter the Engine Type designation(s) using the following codes:

LB2S	Lean Burn Two Stroke	RB4S	Rich Burn Four Stroke
LB4S	Lean Burn Four Stroke		

7. Enter the Air Pollution Control Device (APCD) type designation(s) using the following codes:

A/F	Air/Fuel Ratio	IR	Ignition Retard
HEIS	High Energy Ignition System	SIPC	Screw-in Precombustion Chambers
PSC	Prestratified Charge	LEC	Low Emission Combustion
NSCR	Rich Burn & Non-Selective Catalytic Reduction	SCR	Lean Burn & Selective Catalytic Reduction

8. Enter the Fuel Type using the following codes:

PQ	Pipeline Quality Natural Gas	RG	Raw Natural Gas

9. Enter the Potential Emissions Data Reference designation using the following codes. Attach all referenced data to this *Compressor/Generator Data Sheet(s)*.

MD	Manufacturer's Data	AP	AP-42	
GR	GRI-HAPCalc™	OT	Other _____	(please list)

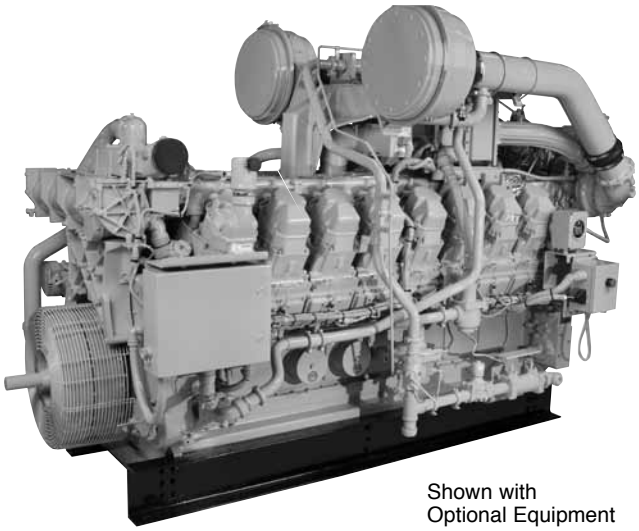
10. Enter each engine's Potential to Emit (PTE) for the listed regulated pollutants in pounds per hour and tons per year. PTE shall be calculated at manufacturer's rated brake horsepower and may reflect reduction efficiencies of listed Air Pollution Control Devices. Emergency generator engines may use 500 hours of operation when calculating PTE. PTE data from this data sheet shall be incorporated in the *Emissions Summary Sheet*.

CATERPILLAR®

G3516B LE Gas Petroleum Engine

1029 bkW (1380 bhp)
1400 rpm

0.5 g/bhp-hr NOx or 1.0 g/bhp-hr NOx (NTE)



Shown with Optional Equipment

CAT® ENGINE SPECIFICATIONS

V-16, 4-Stroke-Cycle

Bore	170 mm (6.7 in.)
Stroke	190 mm (7.5 in.)
Displacement	69.3 L (4230 cu. in.)
Aspiration	Turbocharged-2 Stage Aftercooled
Digital Engine Management	
Governor and Protection	Electronic (ADEM™ A3)
Combustion	Low Emission (Lean Burn)
Engine Weight, net dry (approx)	8401 kg (18,520 lb)
Power Density	8.2 kg/kW (13.4 lb/hp)
Power per Displacement	19.9 bhp/L
Total Cooling System Capacity	221.5 L (58.5 gal)
Jacket Water	204.4 L (54 gal)
SCAC	17 L (4.5 gal)
Lube Oil System (refill)	424 L (112 gal)
Oil Change Interval	1000 hour
Rotation (from flywheel end)	Counterclockwise
Flywheel and Flywheel Housing	SAE No. 00
Flywheel Teeth	183

FEATURES

Engine Design
- Built on G3500 LE proven reliability and durability
- Ability to burn a wide spectrum of gaseous fuels
- Robust diesel strength design prolongs life and lowers owning and operating costs
- Broad operating speed range at lower site air densities (high altitude/hot ambient temperatures)
- Higher power density improves fleet management
- Quality engine diagnostics
- Detonation-sensitive timing control for individual cylinders

Ultra Lean Burn Technology (ULB)
ULB technology uses an advanced control system, a better turbo match, improved air and fuel mixing, and a more sophisticated combustion recipe to provide:
- Lowest engine-out emissions
- Highest fuel efficiency
- Improved altitude and speed turndown
- Stable load acceptance and load rejection

Emissions
- Meets U.S. EPA Spark Ignited Stationary NSPS emissions for 2010
- Lean air/fuel mixture provides best available emissions and fuel efficiency for engines of this bore size

Advanced Digital Engine Management
ADEM A3 engine management system integrates speed control, air/fuel ratio control, and ignition/detonation controls into a complete engine management system. ADEM A3 has improved: user interface, display system, shutdown controls, and system diagnostics.

Full Range of Attachments
Large variety of factory-installed engine attachments reduces packaging time.

Testing
Every engine is full-load tested to ensure proper engine performance.

Gas Engine Rating Pro
GERP is a PC-based program designed to provide site performance capabilities for Cat® natural gas engines for the gas compression industry. GERP provides engine data for your site's altitude, ambient temperature, fuel, engine coolant heat rejection, performance data, installation drawings, spec sheets, and pump curves.

Product Support Offered Through Global Cat Dealer Network
More than 2,200 dealer outlets

Cat factory-trained dealer technicians service every aspect of your petroleum engine

Cat parts and labor warranty

Preventive maintenance agreements available for repair-before-failure options

S•O•S℠ program matches your oil and coolant samples against Caterpillar set standards to determine:
- Internal engine component condition
- Presence of unwanted fluids
- Presence of combustion by-products
- Site-specific oil change interval

Over 80 Years of Engine Manufacturing Experience
Over 60 years of natural gas engine production

Ownership of these manufacturing processes enables Caterpillar to produce high quality, dependable products
- Cast engine blocks, heads, cylinder liners, and flywheel housings
- Machine critical components
- Assemble complete engine

Web Site
For all your petroleum power requirements, visit www.catoilandgas.cat.com.

STANDARD EQUIPMENT

Air Inlet System
Axial flow air cleaners
Service indicator
Cleanable

Cooling System
Two-stage charge air cooling:
First stage — JW + OC + 1st stage AC
Second stage — 2nd stage AC
Engine cooling and charge air cooling thermostats

Exhaust System
Dry exhaust manifolds and turbocharger housings

Flywheels and Housings
SAE 00 flywheel
SAE 00 flywheel housing
SAE standard rotation

Fuel System
Electronic fuel metering valve
Requires 7-50 psig gas supply
Gas pressure regulator
Gas shutoff valve

Instrumentation
Remote-mounted Advisor control panel
Interconnect harness

Lube System
Top-mounted crankcase breathers
Oil cooler
Oil filter and oil sampling valve
Drain valve
Turbo oil accumulator
API B16.3 approved gas/air-driven pre-lube system

Torsional Vibration Analysis
Caterpillar provided
Required through first quarter 2010

Mounting
Rails

Control Panels
4" LCD Advisor display panel
Shipped loose

Starting System
90 psi TDI starter
150 psi TDI starter

Power Take-Offs
Front housing, two sided
Front lower LH accessory drive

Protection System — Display/Alarm/Shutdown
Low oil pressure
Oil filter differential pressure
High fuel or oil temperature
Engine oil to engine coolant
Differential temperature
High coolant temperature
Engine speed
Engine load
Battery voltage
Detonation
Manifold air temperature
Coolant JW inlet/outlet pressure
Left turbo inlet temperature
Right turbo inlet temperature
Cylinder port temperature

Protection System — Display Only
Service hours
Oxygen level

General
Paint — Cat yellow
Dual 23" vibration damper with guard
CSA Certification, Class 1 Division 2 Groups C and D

OPTIONAL EQUIPMENT

Air Inlet System
Rectangular air inlet adapter
Circular air inlet adapter

Charging System
Battery Charger 20 amp

Connections
Mechanical joint assembly
Inlet connection

Exhaust System
Flexible fittings available at first production build
Elbows and mufflers

Instrumentation
Optional interconnect harness

Lube System
Shipped with lube oil

Mounting System
Rails

Power Take-Offs
Front stub shaft

Literature
Options available

Packing

TECHNICAL DATA

G3516B LE Gas Petroleum Engine — 1400 rpm***

Fuel System		0.5 g NOx NTE Rating DM8800-03	1.0 g NOx NTE Rating DM8850-02
Engine Power			
@ 100% Load	bkW (bhp)	1029 (1380)	1029 (1380)
Engine Speed	rpm	**1400**	**1400**
Max Altitude @ Rated Torque and 38°C (100°F)	m (ft)	1219.2 (4000)	1828.8 (6000)
Speed Turndown @ Max Altitude, Rated Torque, and 38°C (100°F)	%	25	25
Aftercooler Temperature			
Stage 1 (JW)	°C (°F)	98.9 (210)	98.9 (210)
Stage 2 (SCAC)	°C (°F)	54 (130)	54 (130)
Emissions*			
NOx	g/bkW-hr (g/bhp-hr)	0.67 (0.50)	1.34 (1.00)
CO	g/bkW-hr (g/bhp-hr)	3.26 (2.43)	3.75 (2.80)
CO_2	g/bkW-hr (g/bhp-hr)	635 (474)	603 (449)
VOC**	g/bkW-hr (g/bhp-hr)	0.64 (0.48)	0.51 (0.38)
Fuel Consumption***			
@ 100% Load	MJ/bkW-hr (Btu/bhp-hr)	10.33 (7301)	9.97 (7050)
Heat Balance			
Heat Rejection to Jacket Water @ 100% Load			
JW	bkW (Btu/mn)	412.37 (23,451)	418.9 (23,820)
OC	bkW (Btu/mn)	78.2 (4449)	78.2 (4449)
Heat Rejection to Aftercooler @ 100% Load			
1st Stage AC	bkW (Btu/mn)	94.23 (5359)	78.55 (4467)
2nd Stage AC	bkW (Btu/mn)	176.7 (10,047)	157.9 (8984)
Heat Rejection to Exhaust @ 100% Load LHV to 25° C (77° F)	bkW (Btu/mn)	1098 (62,428)	1021.9 (58,113)
Heat Rejection to Atmosphere @ 100% Load	bkW (Btu/mn)	107.34 (6110)	107.34 (6110)
Exhaust System			
Exhaust Gas Flow Rate @ 100% Load	m^3/min (cfm)	258.4 (9126)	246.8 (8716)
Exhaust Stack Temperature @ 100% Load	°C (°F)	533.33 (992)	532.22 (990)
Intake System			
Air Inlet Flow Rate @ 100% Load	m^3/min (scfm)	88.52 (3126)	84.70 (2991)
Gas Pressure	kPag (psig)	48-345 (7-50)	48-345 (7-50)

*at 100% load and speed, all values are listed as not to exceed

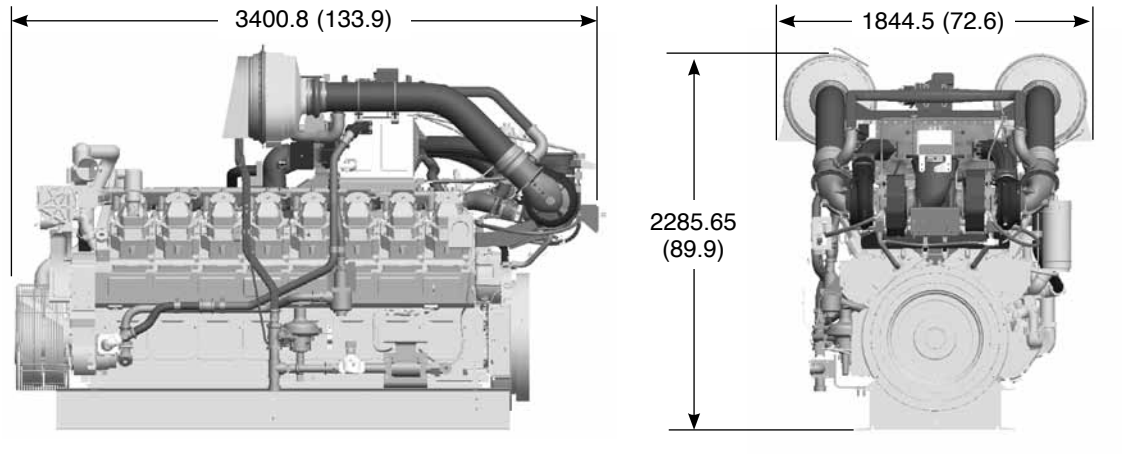
**Volatile organic compounds as defined in U.S. EPA 40 CFR 60, subpart JJJJ

***ISO 3046/1

G3516B LE GAS PETROLEUM ENGINE

1029 bkW (1380 bhp)

DIMENSIONS



DIMENSIONS		
Length	mm (in.)	3400.8 (133.9)
Width	mm (in.)	1844.55 (72.6)
Height	mm (in.)	2285.65 (89.9)
Shipping Weight	kg (lb)	8401 (18,520)

Note: General configuration not to be used for installation.

Dimensions are in mm (inches).

RATING DEFINITIONS AND CONDITIONS

Engine performance is obtained in accordance with SAE J1995, ISO3046/1, BS5514/1, and DIN6271/1 standards.

Transient response data is acquired from an engine/generator combination at normal operating temperature and in accordance with ISO3046/1 standard ambient conditions. Also in accordance with SAE J1995, BS5514/1, and DIN6271/1 standard reference conditions.

Conditions: Power for gas engines is based on fuel having an LHV of 33.74 kJ/L (905 Btu/cu ft) at 101 kPa (29.91 in. Hg) and 15° C (59° F). Fuel rate is based on a cubic meter at 100 kPa (29.61 in. Hg) and 15.6° C (60.1° F). Air flow is based on a cubic foot at 100 kPa (29.61 in. Hg) and 25° C (77° F). Exhaust flow is based on a cubic foot at 100 kPa (29.61 in. Hg) and stack temperature.

Performance Numbers: DM8800-03, DM8850-02
LEHW0037-00 (11-09)
Supersedes LEHW0002-02

Storage Tanks

STORAGE VESSEL EMISSION UNIT DATA SHEET

Provide the following information for each new or modified bulk liquid storage tank.

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name **Water Storage Tanks**	2. Tank Name **Produced Water Storage Tank #1**
3. Emission Unit ID number **T01**	4. Emission Point ID number **2E**
5. Date Installed or Modified *(for existing tanks)* **5/2015**	6. Type of change: ☒ New construction ☐ New stored material ☐ Other
7A. Description of Tank Modification *(if applicable)*	
7B. Will more than one material be stored in this tank? *If so, a separate form must be completed for each material.* ☐ Yes ☒ No	
7C. Provide any limitations on source operation affecting emissions. (production variation, etc.) **None**	

II. TANK INFORMATION (required)

8. Design Capacity *(specify barrels or gallons).* Use the internal cross-sectional area multiplied by internal height. **210 barrels**	
9A. Tank Internal Diameter (ft.) **10**	9B. Tank Internal Height (ft.) **15**
10A. Maximum Liquid Height (ft.) **14**	10B. Average Liquid Height (ft.) **7.5**
11A. Maximum Vapor Space Height (ft.) **1**	11B. Average Vapor Space Height (ft.) **7.5**
12. Nominal Capacity *(specify barrels or gallons)*. This is also known as "working volume. **200 barrels**	
13A. Maximum annual throughput (gal/yr) **3,066,000**	13B. Maximum daily throughput (gal/day) **8,400**
14. Number of tank turnovers per year **365**	15. Maximum tank fill rate (gal/min) **TBD**
16. Tank fill method ☐ Submerged ☒ Splash ☐ Bottom Loading	
17. Is the tank system a variable vapor space system? ☐ Yes ☒ No If yes, (A) What is the volume expansion capacity of the system (gal)? (B) What are the number of transfers into the system per year?	
18. Type of tank (check all that apply): ☒ Fixed Roof _**X**_ vertical ___ horizontal ___ flat roof ___ cone roof _**X**_ dome roof ___ other (describe) ☐ External Floating Roof ___ pontoon roof ___ double deck roof ☐ Domed External (or Covered) Floating Roof ☐ Internal Floating Roof ___ vertical column support ___ self-supporting ☐ Variable Vapor Space ___ lifter roof ___ diaphragm ☐ Pressurized ___ spherical ___ cylindrical ☐ Underground ☐ Other (describe)	

III. TANK CONSTRUCTION AND OPERATION INFORMATION *(check which one applies)*

☐ Refer to enclosed TANKS Summary Sheets
☒ Refer to the responses to items 19 – 26 in section VII

IV. SITE INFORMATION *(check which one applies)*

☐ Refer to enclosed TANKS Summary Sheets
☒ Refer to the responses to items 27 – 33 in section VII

V. LIQUID INFORMATION *(check which one applies)*

☐ Refer to enclosed TANKS Summary Sheets
☒ Refer to the responses to items 34 – 39 in section VII

VI. EMISSIONS AND CONTROL DEVICE DATA (required)

40. Emission Control Devices (check as many as apply):

☒ Does Not Apply
☐ Carbon Adsorption[1]
☐ Vent to Vapor Combustion Device[1] (vapor combustors, flares, thermal oxidizers)
☐ Condenser[1]
☐ Other[1] (describe)
☐ Rupture Disc (psig)
☐ Inert Gas Blanket of _____
☐ Conservation Vent (psig
Vacuum Setting Pressure Setting
☐ Emergency Relief Valve (psig)

[1] Complete appropriate Air Pollution Control Device Sheet

41. Expected Emission Rate (submit Test Data or Calculations here or elsewhere in the application).

Material Name and CAS No.	Flashing Loss		Breathing Loss		Working Loss		Total Emissions Loss		Estimation Method[1]
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	
VOC	0.44	1.91	1.5E-6	6.4E-6	6.2E-6	2.7E-5	0.44	1.91	O – ProMax Simulation

[1] EPA = EPA Emission Factor, MB = Material Balance, SS = Similar Source, ST = Similar Source Test, Throughput Data, O = Other (specify)

Remember to attach emissions calculations, including TANKS Summary Sheets and other modeling summary sheets if applicable.

SECTION VII (required if did not provide TANKS Summary Sheets)

TANK CONSTRUCTION AND OPERATION INFORMATION

19. Tank Shell Construction:
☒ Riveted ☐ Gunite lined ☐ Epoxy-coated rivets ☐ Other (describe)

20A. Shell Color: **Green**	20B. Roof Color: **Green**	20C. Year Last Painted: **NA**

21. Shell Condition (if metal and unlined):
☒ No Rust ☐ Light Rust ☐ Dense Rust ☐ Not applicable

22A. Is the tank heated? ☐ Yes ☒ No	22B. If yes, operating temperature:	22C. If yes, how is heat provided to tank?

23. Operating Pressure Range (psig): **-0.03 to 0.03 psig**

24. Is the tank a **Vertical Fixed Roof Tank**? ☒ Yes ☐ No	24A. If yes, for dome roof provide radius (ft): **5 feet**	24B. If yes, for cone roof, provide slop (ft/ft):

25. Complete item 25 for **Floating Roof Tanks** ☐ Does not apply ☒

25A. Year Internal Floaters Installed:

25B. Primary Seal Type *(check one):* ☐ Metallic (mechanical) shoe seal ☐ Liquid mounted resilient seal ☐ Vapor mounted resilient seal ☐ Other (describe):

25C. Is the Floating Roof equipped with a secondary seal? ☐ Yes ☐ No

25D. If yes, how is the secondary seal mounted? *(check one)* ☐ Shoe ☐ Rim ☐ Other (describe):			
25E. Is the floating roof equipped with a weather shield? ☐ Yes ☐ No			
25F. Describe deck fittings:			
26. Complete the following section for **Internal Floating Roof Tanks** ☒ Does not apply			
26A. Deck Type: ☐ Bolted ☐ Welded		26B. For bolted decks, provide deck construction:	
26C. Deck seam. Continuous sheet construction: ☐ 5 ft. wide ☐ 6 ft. wide ☐ 7 ft. wide ☐ 5 x 7.5 ft. wide ☐ 5 x 12 ft. wide ☐ other (describe)			
26D. Deck seam length (ft.):	26E. Area of deck (ft^2):	26F. For column supported tanks, # of columns:	26G. For column supported tanks, diameter of column:
SITE INFORMATION:			
27. Provide the city and state on which the data in this section are based: **Charleston, West Virginia**			
28. Daily Avg. Ambient Temperature (°F): **54.98**		29. Annual Avg. Maximum Temperature (°F): **65.75**	
30. Annual Avg. Minimum Temperature (°F): **44.22**		31. Avg. Wind Speed (mph): **6.05**	
32. Annual Avg. Solar Insulation Factor (BTU/ft^2-day): **1,250.6**		33. Atmospheric Pressure (psia): **14.25**	
LIQUID INFORMATION:			
34. Avg. daily temperature range of bulk liquid (°F): **65.1**	34A. Minimum (°F): **60.0**	34B. Maximum (°F): **75.9**	
35. Avg. operating pressure range of tank (psig): **0**	35A. Minimum (psig): **-0.03**	35B. Maximum (psig): **0.03**	
36A. Minimum liquid surface temperature (°F): **60.0**		36B. Corresponding vapor pressure (psia): **0.29**	
37A. Avg. liquid surface temperature (°F): **65.1**		37B. Corresponding vapor pressure (psia): **0.32**	
38A. Maximum liquid surface temperature (°F): **75.9**		38B. Corresponding vapor pressure (psia): **0.40**	
39. Provide the following for each liquid or gas to be stored in the tank. Add additional pages if necessary.			

39A. Material name and composition:	**Produced Water**		
39B. CAS number:			
39C. Liquid density (lb/gal):			
39D. Liquid molecular weight (lb/lb-mole):	**18.02**		
39E. Vapor molecular weight (lb/lb-mole):	**18.46**		
39F. Maximum true vapor pressure (psia):	**0.40**		
39G. Maxim Reid vapor pressure (psia):	**8.2**		
39H. Months Storage per year. From: To:	**January** **December**		

STORAGE VESSEL EMISSION UNIT DATA SHEET

Provide the following information for each new or modified bulk liquid storage tank.

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name **Water Storage Tanks**	2. Tank Name **Produced Water Storage Tank #2**
3. Emission Unit ID number **T02**	4. Emission Point ID number **3E**
5. Date Installed or Modified *(for existing tanks)* **5/2015**	6. Type of change: ☒ New construction ☐ New stored material ☐ Other
7A. Description of Tank Modification *(if applicable)*	
7B. Will more than one material be stored in this tank? *If so, a separate form must be completed for each material.* ☐ Yes ☒ No	
7C. Provide any limitations on source operation affecting emissions. (production variation, etc.) **None**	

II. TANK INFORMATION (required)

8. Design Capacity *(specify barrels or gallons).* Use the internal cross-sectional area multiplied by internal height. **50 barrels**	
9A. Tank Internal Diameter (ft.) **8**	9B. Tank Internal Height (ft.) **6**
10A. Maximum Liquid Height (ft.) **5**	10B. Average Liquid Height (ft.) **3**
11A. Maximum Vapor Space Height (ft.) **1**	11B. Average Vapor Space Height (ft.) **3**
12. Nominal Capacity *(specify barrels or gallons).* This is also known as "working volume. **45 barrels**	
13A. Maximum annual throughput (gal/yr) **153,300**	13B. Maximum daily throughput (gal/day) **420**
14. Number of tank turnovers per year **81**	15. Maximum tank fill rate (gal/min) **TBD**
16. Tank fill method ☐ Submerged ☒ Splash ☐ Bottom Loading	
17. Is the tank system a variable vapor space system? ☐ Yes ☒ No If yes, (A) What is the volume expansion capacity of the system (gal)? (B) What are the number of transfers into the system per year?	
18. Type of tank (check all that apply): ☒ Fixed Roof **_X_** vertical ___ horizontal ___ flat roof ___ cone roof **_X_** dome roof ___ other (describe) ☐ External Floating Roof ___ pontoon roof ___ double deck roof ☐ Domed External (or Covered) Floating Roof ☐ Internal Floating Roof ___ vertical column support ___ self-supporting ☐ Variable Vapor Space ___ lifter roof ___ diaphragm ☐ Pressurized ___ spherical ___ cylindrical ☐ Underground ☐ Other (describe)	

III. TANK CONSTRUCTION AND OPERATION INFORMATION *(check which one applies)*

☐ Refer to enclosed TANKS Summary Sheets
☒ Refer to the responses to items 19 – 26 in section VII

IV. SITE INFORMATION *(check which one applies)*

☐ Refer to enclosed TANKS Summary Sheets
☒ Refer to the responses to items 27 – 33 in section VII

V. LIQUID INFORMATION *(check which one applies)*

☐ Refer to enclosed TANKS Summary Sheets
☒ Refer to the responses to items 34 – 39 in section VII

VI. EMISSIONS AND CONTROL DEVICE DATA (required)

40. Emission Control Devices (check as many as apply):

☒ Does Not Apply
☐ Carbon Adsorption[1]
☐ Vent to Vapor Combustion Device[1] (vapor combustors, flares, thermal oxidizers)
☐ Condenser[1]
☐ Other[1] (describe)
☐ Rupture Disc (psig)
☐ Inert Gas Blanket of _____
☐ Conservation Vent (psig
Vacuum Setting Pressure Setting
☐ Emergency Relief Valve (psig)

[1] Complete appropriate Air Pollution Control Device Sheet

41. Expected Emission Rate (submit Test Data or Calculations here or elsewhere in the application).

Material Name and CAS No.	Flashing Loss		Breathing Loss		Working Loss		Total Emissions Loss		Estimation Method[1]
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	
VOC	0.11	0.47	5.7E-7	2.5E-6	7.4E-7	3.3E-6	0.11	0.47	O – ProMax Simulation

[1] EPA = EPA Emission Factor, MB = Material Balance, SS = Similar Source, ST = Similar Source Test, Throughput Data, O = Other (specify)

Remember to attach emissions calculations, including TANKS Summary Sheets and other modeling summary sheets if applicable.

SECTION VII (required if did not provide TANKS Summary Sheets)

TANK CONSTRUCTION AND OPERATION INFORMATION

19. Tank Shell Construction:
☒ Riveted ☐ Gunite lined ☐ Epoxy-coated rivets ☐ Other (describe)

20A. Shell Color: **Green**	20B. Roof Color: **Green**	20C. Year Last Painted: **NA**

21. Shell Condition (if metal and unlined):
☒ No Rust ☐ Light Rust ☐ Dense Rust ☐ Not applicable

22A. Is the tank heated? ☐ Yes ☒ No	22B. If yes, operating temperature:	22C. If yes, how is heat provided to tank?

23. Operating Pressure Range (psig): **-0.03 to 0.03 psig**

24. Is the tank a **Vertical Fixed Roof Tank**? ☒ Yes ☐ No	24A. If yes, for dome roof provide radius (ft): **4 feet**	24B. If yes, for cone roof, provide slop (ft/ft):

25. Complete item 25 for **Floating Roof Tanks** ☐ Does not apply ☒

25A. Year Internal Floaters Installed:

25B. Primary Seal Type *(check one):* ☐ Metallic (mechanical) shoe seal ☐ Liquid mounted resilient seal

☐ Vapor mounted resilient seal ☐ Other (describe):			
25C. Is the Floating Roof equipped with a secondary seal? ☐ Yes ☐ No			
25D. If yes, how is the secondary seal mounted? *(check one)* ☐ Shoe ☐ Rim ☐ Other (describe):			
25E. Is the floating roof equipped with a weather shield? ☐ Yes ☐ No			
25F. Describe deck fittings:			
26. Complete the following section for **Internal Floating Roof Tanks** ☒ Does not apply			
26A. Deck Type: ☐ Bolted ☐ Welded		26B. For bolted decks, provide deck construction:	
26C. Deck seam. Continuous sheet construction: ☐ 5 ft. wide ☐ 6 ft. wide ☐ 7 ft. wide ☐ 5 x 7.5 ft. wide ☐ 5 x 12 ft. wide ☐ other (describe)			
26D. Deck seam length (ft.):	26E. Area of deck (ft^2):	26F. For column supported tanks, # of columns:	26G. For column supported tanks, diameter of column:
SITE INFORMATION:			
27. Provide the city and state on which the data in this section are based: **Charleston, West Virginia**			
28. Daily Avg. Ambient Temperature (°F): **54.98**		29. Annual Avg. Maximum Temperature (°F): **65.75**	
30. Annual Avg. Minimum Temperature (°F): **44.22**		31. Avg. Wind Speed (mph): **6.05**	
32. Annual Avg. Solar Insulation Factor (BTU/ft^2-day): **1,250.6**		33. Atmospheric Pressure (psia): **14.25**	
LIQUID INFORMATION:			
34. Avg. daily temperature range of bulk liquid (°F): **65.1**	34A. Minimum (°F): **60.0**	34B. Maximum (°F): **75.9**	
35. Avg. operating pressure range of tank (psig): **0**	35A. Minimum (psig): **-0.03**	35B. Maximum (psig): **0.03**	
36A. Minimum liquid surface temperature (°F): **60.0**		36B. Corresponding vapor pressure (psia): **0.29**	
37A. Avg. liquid surface temperature (°F): **65.1**		37B. Corresponding vapor pressure (psia): **0.32**	
38A. Maximum liquid surface temperature (°F): **75.9**		38B. Corresponding vapor pressure (psia): **0.40**	
39. Provide the following for each liquid or gas to be stored in the tank. Add additional pages if necessary.			

39A. Material name and composition:	**Produced Water**		
39B. CAS number:			
39C. Liquid density (lb/gal):			
39D. Liquid molecular weight (lb/lb-mole):	**18.02**		
39E. Vapor molecular weight (lb/lb-mole):	**18.46**		
39F. Maximum true vapor pressure (psia):	**0.40**		
39G. Maxim Reid vapor pressure (psia):	**8.2**		
39H. Months Storage per year. From: To:	**January** **December**		

Dehydration Unit

NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET

General Glycol Dehydration Unit Data		Manufacturer and Model		The Hanover Company	
		Max Dry Gas Flow Rate (mmscf/day)		6.0	
		Design Heat Input (mmBtu/hr)		0.5	
		Design Type (DEG or TEG)		TEG	
		Source Status[2]		NS	
		Date Installed/Modified/Removed[3]		5/2015	
		Regenerator Still Vent APCD[4]		NA	
		Fuel HV (Btu/scf)		1,138	
		H_2S Content (gr/100 scf)		0	
		Operation (hrs/yr)		8,760	
Source ID #[1]	Vent	Reference[5]	Potential Emissions[6]	lbs/hr	tons/yr
5E	Reboiler Vent	AP-42	NO_X	0.06	0.27
		AP-42	CO	0.05	0.23
		AP-42/ GRI-GLYCalc™	VOC	0.04	0.19
		AP-42	SO_2	0.0004	0.002
		AP-42	PM_{10}	0.005	0.02
		GRI-GLYCalc™	Benzene	0.0006	0.003
		GRI-GLYCalc™	Ethylbenzene	0.0005	0.002
		GRI-GLYCalc™	Toluene	0.003	0.01
		GRI-GLYCalc™	Xylenes	0.005	0.02
		GRI-GLYCalc™	n-Hexane	0.002	0.01
4E	Glycol Regenerator Still Vent	GRI-GLYCalc™	VOC	1.91	8.36
		GRI-GLYCalc™	Benzene	0.06	0.27
		GRI-GLYCalc™	Ethylbenzene	0.09	0.38
		GRI-GLYCalc™	Toluene	0.39	1.72
		GRI-GLYCalc™	Xylenes	1.17	5.11
		GRI-GLYCalc™	n-Hexane	0.009	0.04

1. Enter the appropriate Source Identification Numbers for the glycol dehydration unit Reboiler Vent and glycol Regenerator Still Vent. The glycol dehydration unit Reboiler Vent and glycol Regenerator Still Vent should be designated RBV-1 and RSV-1, respectively. If the compressor station incorporates multiple glycol dehydration units, a *Glycol Dehydration Unit Data Sheet* shall be completed for each, using Source Identification #s RBV-2 and RSV-2, RBV-3 and RSV-3, etc.

2. Enter the Source Status using the following codes:

   NS Construction of New Source ES Existing Source

MS	Modification of Existing Source	RS	Removal of Source

3. Enter the date (or anticipated date) of the glycol dehydration unit's installation (construction of source), modification or removal.

4. Enter the Air Pollution Control Device (APCD) type designation using the following codes:

NA	None	CD	Condenser
FL	Flare	CC	Condenser/Combustion Combination
TO	Thermal Oxidizer		

5. Enter the Potential Emissions Data Reference designation using the following codes:

MD	Manufacturer's Data	AP	AP-42	
GR	GRI-GLYCalc™	OT	Other _____	(please list)

6. Enter the Reboiler Vent and glycol Regenerator Still Vent Potential to Emit (PTE) for the listed regulated pollutants in lbs per hour and tons per year. The glycol Regenerator Still Vent potential emissions may be determined using the most recent version of the thermodynamic software model GRI-GLYCalc™ (Radian International LLC & Gas Research Institute). Attach all referenced Potential Emissions Data (or calculations) and the GRI-GLYCalc *Aggregate Calculations Report* to this *Glycol Dehydration Unit Data Sheet(s)*. This PTE data shall be incorporated in the *Emissions Summary Sheet*.

Include a copy of the GRI-GLYCalc™ analysis. This includes a printout of the aggregate calculations report, which shall include emissions reports, equipment reports, and stream reports.

***An explanation of input parameters and examples, when using GRI-GLYCalc™ is available on our website.**

West Virginia Department of Environmental Protection

DIVISION OF AIR QUALITY : (304) 926-0475
WEB PAGE: http:\\www.wvdep.org

Division of Air Quality

40 CFR Part 63; Subpart HH & HHH Registration Form

Complete this form for any oil and natural gas production or natural gas transmission and storage facility that uses an affected unit under HH/HHH, whether subject or not.

Section A: Facility Description		
Affected facility actual annual average natural gas throughput (scf/day): **6,000,000**		
Affected facility actual annual average hydrocarbon liquid throughput: (bbl/day): **210**		
The affected facility processes, upgrades, or stores hydrocarbon liquids prior to custody transfer.	(Yes)	No
The affected facility processes, upgrades, or stores natural gas prior to the point at which natural gas (NG) enters the NG transmission and storage source category or is delivered to the end user.	(Yes)	No
The affected facility is: ☒ prior to a NG processing plant ☐ a NG processing plant ☐ prior to the point of custody transfer and there is no NG processing plant		
The affected facility transports or stores natural gas prior to entering the pipeline to a local distribution company or to a final end user (if there is no local distribution company).	(Yes)	No
The affected facility exclusively processes, stores, or transfers black oil.	Yes	(No)
Initial producing gas-to-oil ratio (GOR): _____scf/bbl API gravity: _____degrees		

Section B: Dehydration Unit (if applicable) [1]		
Description: **Bluestone Compressor Station Dehydrator (DEHY-001)**		
Date of Installation: **5/2015**	Annual Operating Hours: **8,760**	Burner rating (MMbtu/hr): **0.5**
Exhaust Stack Height (ft): **10**	Stack Diameter (ft): **3**	Stack Temp. (ºF): **375**
Glycol Type: ☒ TEG ☐ EG ☐ Other:		
Glycol Pump Type: ☐ Electric ☒ Gas If gas, what is the volume ratio? __**0.029**____ACFM/gpm		
Condenser installed? ☐ Yes ☒ No Exit Temp. _____ ºF Condenser Pressure _____psig		
Incinerator/flare installed? ☐ Yes ☒ No Destruction Eff. _____%		
Other controls installed? ☐ Yes ☒ No Describe:		
Wet Gas[2]: Gas Temp.: **_70__**ºF Gas Pressure **__875__** psig (Upstream of Contact Tower) Saturated Gas? ☒ Yes ☐ No If no, water content _____ lb/MMSCF		
Dry Gas: Gas Flowrate(MMSCFD) Actual **___6____** Design **___25____** (Downstream of Contact Tower) Water Content **__7____** lb/MMSCF		
Lean Glycol: Circulation rate (gpm) Actual[3] **__0.32____** Maximum[4] **__0.32_____** Pump make/model: **Kimray 21015PV**		
Glycol Flash Tank (if applicable): Temp.: **__250___**ºF Pressure **__120____** psig Vented? Yes ☐ No ☒ If no, describe vapor control: **Flash tank gas is used in reboiler as fuel**		
Stripping Gas (if applicable): Source of gas: **NA** Rate _____ scfm		

Please attach the following required dehydration unit information:

1. System map indicating the chain of custody information. See Page 43 of this document for an example of a gas flow schematic. It is not intended that the applicant provide this level of detail for all sources. The level of detail that is necessary is to establish where the custody transfer points are located. This can be accomplished by submitting a process flow diagram indicating custody transfer points and the natural gas flow. However, the DAQ reserves the right to request more detailed information in order to make the necessary decisions.
2. Extended gas analysis from the Wet Gas Stream including mole percents of C_1-C_8, benzene, ethylbenzene, toluene, xylene and n-Hexane, using Gas Processors Association (GPA) 2286 (or similar). A sample should be taken from the inlet gas line, downstream from any inlet separator, and using a manifold to remove entrained liquids from the sample and a probe to collect the sample from the center of the gas line. GPA standard 2166 reference method or a modified version of EPA Method TO-14, (or similar) should be used.
3. GRI-GLYCalc Ver. 3.0 aggregate report based on maximum Lean Glycol circulation rate and maximum throughput.
4. Detailed calculations of gas or hydrocarbon flow rate.

Section C: Facility NESHAPS Subpart HH/HHH status

Affected facility status: (choose only one)

- ☒ Subject to Subpart HH **- applies, but is exempt through <1 tpy benzene exemption**
- ☐ Subject to Subpart HHH
- ☒ Not Subject because:
  - ☒ < 10/25 TPY
  - ☐ Affected facility exclusively handles black oil
  - ☐ The facility wide actual annual average NG throughput is < 650 thousand scf/day and facility wide actual annual average hydrocarbon liquid is < 250 bpd
  - ☐ No affected source is present

DRAWING NO.
D-488750011 1of5

GLYCOL REBOILER	STILL COLUMN	GLY/GLY EXCH	FUEL GAS K.O. POT	GLY/GAS/DIST SEP'R	CHARCOAL FILTER	GLY SOCK FILTER	GLYCOL PUMP	GLY. ABSORBER/SCRUBBER	GLYCOL/GAS EXCH.
500M BTU/HR ATMOS @ 375F 36" OD x 10'-0" F/E	12 3/4" OD x 8'-0" F/F W/REFLUX	PANEL COILS (5 PARALLEL) 22" X 47"	10" OD x 1'-7 1/4" S/S 250 PSIG @ 120F	24" OD X 4'-0" S/S 125 PSIG @ 250°	THE HANOVER COMPANY 10 3/4" OD X 2'-8" NOM.	THE HANOVER COMPANY 8 5/8" OD X 2'-0" NOM.	(2) KIMRAY 21015PV		PIPE IN PIPE

GLYCOL REBOILER
VAPOR OUT
TI
P
2"x1"
1 1/2"H
D
SPARGER CONN
3/4"x1/2"
FA
TC
TSH
TI
C
LG
1"A2S
A
F.C.
1"x3/4"
TCV
3/4"A2S
PI
3/4"x1/4"
1/2"x1/4"
PCV
1"x1"
SET @ 125 PSIG
PSV
1"x1/4"
1"x1/2"
1"D2SW
1"A2S
B
CHARCOAL FILTER
1"x1"
SET @ 14 PSIG
PSV
1"D2SW
1"D4S
GLY/GLY EXCH
(TYP. FOR 5 PANELS)
GLY SOCK FILTER
1/2"A2S
GLYCOL PUMPS
GLY. ABSORBER/SCRUBBER
GAS OUTLET
K
GAS INLET
J
M
LC
LG
LCV
COND. OUTLET
1" NPT
L
1"D2S
1"
1"x1/4"
FUEL GAS KO POT
1"X1/4"
1/2"A2S
N
GLY/GAS/DIST SEPR
THROTTLE
SNAP
DIST. OUTLET
1" NPT
E
SET @ 35#
H
GAS OUTLET
1" NPT
BPV

A	REBOILER DRAIN
B	STORAGE DRAIN
C	SKIMMER
D	REBOILER FILL
E	SEP'R CONDENSATE OUTLET
H	SEP'R BACK PRESS. GAS OUTLET
J	ABS/SCR INLET
K	ABS/SCR GAS OUTLET
L	ABS/SCR CONDENSATE OUTLET
M	ABS/SCR DRAIN
N	FUEL GAS SCRUBBER DRAIN
P	STILL COLUMN VAPOR OUTLET

ONSHORE DESIGN

THE HANOVER COMPANY
ROUTE 2 BOX 179
ALLEYTON, TEXAS 78935

NO	REVISION	DATE	BY	CK

CUSTOMER: STOCK
TITLE: P&ID 500M REG W/24" OD X 4'-0" DIST SEP'R (HIGH RECONCENTRATION UNIT)

DRAWN	SCALE	DATE	UNIT NO.	REVISION
RON		01-21-99		0
S.O. NO.	APPROVED	NO. REQ'D.	DRAWING NO.	
			D-488750011 1of5	

RNEUENDO: DWF 01/21/1999 08:50 - J:\HS-STD\GDUASS*\500M\9750011a.dwg

Reboiler

NATURAL GAS FIRED FUEL BURNING UNITS
EMISSION DATA SHEET

Complete the information on this data for each Gas Producing Unit(s), Heater Treater(s), and in-line heater(s) at the production pad. Reboiler information should be entered on the Glycol Dehydration Emission Unit Data Sheet.

Emission Unit ID #[1]	Emission Point ID#[2]	Emission Unit Description (Manufacturer / Model #)	Year Installed/ Modified	Type[3] and Date of Change	Control Device[4]	Design Heat Input (mmBtu/hr)[5]	Fuel Heating Value (Btu/scf)[6]
RB-1	5E	Hanover Reboiler	5/2015	New	None	0.5	1,138

[1] Enter the appropriate Emission Unit (or Sources) identification numbers for each fuel burning unit located at the production pad. Gas Producing Unit Burners should be designated GPU-1, GPU-2, etc. Heater Treaters should be designated HT-1, HT-2, etc. Heaters or Line Heaters should be designated LH-1, LH-2, etc. For sources, use 1S, 2S, 3S…or other appropriate designation. Enter glycol dehydration unit Reboiler Vent data on the *Glycol Dehydration Unit Data Sheet*.

[2] Enter the appropriate Emission Point identification numbers for each fuel burning unit located at the production pad. Gas Producing Unit Burners should be designated GPU-1, GPU-2, etc. Heater Treaters should be designated HT-1, HT-2, etc. Heaters or Line Heaters should be designated LH-1, LH-2, etc. For emission points, use 1E, 2E, 3E…or other appropriate designation.

[3] New, modification, removal

[4] Complete appropriate air pollution control device sheet for any control device.

[5] Enter design heat input capacity in mmBtu/hr.

[6] Enter the fuel heating value in Btu/standard cubic foot.

Tank Truck Loading

TANK TRUCK LOADING
EMISSION UNIT DATA SHEET

Furnish the following information for each new or modified bulk liquid transfer area or loading rack at the natural gas production pad. This form is to be used for bulk liquid transfer operations to tank trucks.

1. Emission Unit ID: **LDOUT**	2. Emission Point ID: **6E**	3. Year Installed/ Modified: **2015**
4. Emission Unit Description: **Produced water loadout rack**		
5. Loading Area Data:		
5A. Number of pumps: **TBD**	5B. Number of liquids loaded: **1**	5C. Maximum number of tank trucks loading at one time: **1**
6. Describe cleaning location, compounds and procedure for tank trucks: **To be determined**		
7. Are tank trucks pressure tested for leaks at this or any other location? ☐ Yes ☒ No If YES, describe:		

8. Projected Maximum Operating Schedule (for rack or transfer point as a whole):

Maximum	Jan. - Mar.	Apr. - June	July - Sept.	Oct. - Dec.
hours/day	**10**	**10**	**10**	**10**
days/week	**5**	**5**	**5**	**5**

9. Bulk Liquid Data *(add pages as necessary):*

Liquid Name	**Produced Water**		
Max. daily throughput (1000 gal/day)	**8.82**		
Max. annual throughput (1000 gal/yr)	**3,219**		
Loading Method [1]	**BF**		
Max. Fill Rate (gal/min)	**168**		
Average Fill Time (min/loading)	**50**		
Max. Bulk Liquid Temperature (°F)	**65.1**		
True Vapor Pressure [2]	**0.32**		
Cargo Vessel Condition[3]	**U**		
Control Equipment or Method [4]	**None**		
Minimum collection efficiency (%)	**0**		
Minimum control efficiency (%)	**0**		

** Continued on next page*

Maximum Emission Rate	Loading (lb/hr)	**0.71**		
	Annual (ton/yr)	**0.14**		
Estimation Method [5] **AP-42 and ProMax outputs**				

Notes:

[1] BF = Bottom Fill SP = Splash Fill SUB = Submerged Fill

[2] At maximum bulk liquid temperature

[3] B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe)

[4] List as many as apply (complete and submit appropriate *Air Pollution Control Device Sheets as Attachment "H"*):
CA = Carbon Adsorption
VB = Dedicated Vapor Balance (closed system)
ECD = Enclosed Combustion Device
F = Flare
TO = Thermal Oxidation or Incineration

[5] EPA = EPA Emission Factor as stated in AP-42
MB = Material Balance
TM = Test Measurement based upon test data submittal
O = other (describe)

10. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING *Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment operation/air pollution control device.*

Monitor monthly and rolling twelve-month average of liquids loaded out.

RECORDKEEPING *Please describe the proposed recordkeeping that will accompany the monitoring.*

Record monthly and rolling twelve-month average of liquids loaded out.

REPORTING *Please describe the proposed frequency of reporting of the recordkeeping.*

Reporting will occur as directed by WVDAQ.

TESTING *Please describe any proposed emissions testing for this process equipment/air pollution control device.*

None.

11. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty:
NA

Attachment H.
Air Pollution Control Device Data Sheets

Oxidation Catalyst

Attachment M
Air Pollution Control Device Sheet
(OTHER COLLECTORS)

Control Device ID No. (must match Emission Units Table): 1C

Equipment Information

1. Manufacturer: EMIT Technologies Model No. ELS-3050-1414F-3CE0241	2. Control Device Name: 1C - Catalyst for CE-4 Type: Oxidation Catalyst
3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.	
4. On a separate sheet(s) supply all data and calculations used in selecting or designing this collection device.	
5. Provide a scale diagram of the control device showing internal construction.	
6. Submit a schematic and diagram with dimensions and flow rates.	
7. Guaranteed minimum collection efficiency for each pollutant collected: N/A – no capture of pollutants	
8. Attached efficiency curve and/or other efficiency information.	
9. Design inlet volume: 9,126 ACFM	10. Capacity:
11. Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any. N/A	
12. Attach any additional data including auxiliary equipment and operation details to thoroughly evaluate the control equipment.	
13. Description of method of handling the collected material(s) for reuse of disposal. Replace Catalyst elements when necessary	

Gas Stream Characteristics

14. Are halogenated organics present?	☐ Yes	☒ No
Are particulates present?	☒ Yes	☐ No
Are metals present?	☐ Yes	☒ No

15. Inlet Emission stream parameters:	Maximum	Typical
Pressure (mmHg):	Not specified	
Heat Content (BTU/scf):	1,400	1,138
Oxygen Content (%):	Not specified	
Moisture Content (%):	Not specified	
Relative Humidity (%):	Not specified	

16. Type of pollutant(s) controlled: ☐ SO_x ☐ Odor
☐ Particulate (type): ☒ Other CO, VOC, and HCHO

17. Inlet gas velocity: 194 ft/sec

18. Pollutant specific gravity:

19. Gas flow into the collector:
9,126 ACF @ 992°F and PSIA

20. Gas stream temperature:
Inlet: 992 °F
Outlet: 992 °F

21. Gas flow rate:
Design Maximum: 9,126 ACFM
Average Expected: ACFM

22. Particulate Grain Loading in grains/scf: N/A
Inlet:
Outlet:

23. Emission rate of each pollutant (specify) into and out of collector:

Pollutant	IN Pollutant		Emission Capture Efficiency %	OUT Pollutant		Control Efficiency %
	lb/hr	grains/acf		lb/hr	grains/acf	
A CO	7.39		--	0.74		90
B VOC	1.46		--	0.73		50
B HCHO	0.53		--	0.13		76

24. Dimensions of stack: Height 20 ft. Diameter 1.0 ft.

25. Supply a curve showing proposed collection efficiency versus gas volume from 25 to 130 percent of design rating of collector.

Particulate Distribution

26. Complete the table:	Particle Size Distribution at Inlet to Collector	Fraction Efficiency of Collector
Particulate Size Range (microns)	Weight % for Size Range	Weight % for Size Range
0 – 2		
2 – 4		
4 – 6		
6 – 8		
8 – 10		
10 – 12		
12 – 16		
16 – 20		
20 – 30		
30 – 40		
40 – 50		
50 – 60		
60 – 70		
70 – 80		
80 – 90		
90 – 100		
>100		

27. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification): **None**

28. Describe the collection material disposal system: Catalyst elements can be cleaned and/or replaced; materials are not disposed on site.

29. Have you included ***Other Collectores Control Device*** in the Emissions Points Data Summary Sheet? yes

30. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING:	RECORDKEEPING:
-Monitor catalyst inlet temperature	**-Keep records of manufacturer specifications** **-Keep records of inspections, observations, preventive maintenance, and malfunctions.** **-Keep records of engine run time and catalyst inlet temperature.**
REPORTING:	TESTING:
-Reporting as required by WVDAQ	**-NSPS JJJJ stack testing every 8,760 hours of operation**

MONITORING:	Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment or air control device.
RECORDKEEPING:	Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.
TESTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.

31. Manufacturer's Guaranteed Control Efficiency for each air pollutant.
CO: 90%, VOC: 50%, HCHO: 76%

32. Manufacturer's Guaranteed Control Efficiency for each air pollutant.

33. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.
Inlet temperature range is 750 F – 1250 F. Engine must be operated between 50 – 100 % load. Engine lube oil shall contain less than 0.5 wt% sulfated ash. Catalyst must not be exposed to the following: antimony, arsenic, chromium, copper, iron, lead, lithium, magnesium, mercury, nickel, phosphorous, potassium, silicon, sodium, sulfur, tin, zinc.

Attachment I.
Supporting Emission Calculations

Emission Calculations

EMISSIONS SUMMARY TOTAL

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Facility Location:	**Harrison County, West Virginia**

UNCONTROLLED POTENTIAL EMISSION SUMMARY

Source	NOx		CO		VOC		SO_2		PM-10		PM-2.5		HAPs		CO_2e
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	tpy
Engines															
Compressor Engine	1.52	6.66	7.39	32.38	1.46	6.40	0.006	0.03	0.10	0.44	0.10	0.44	0.73	3.19	6,322
Storage Tanks															
Produced Water Tanks	---	---	---	---	0.54	2.38	---	---	---	---	---	---	0.02	0.10	520
Dehydrators															
TEG Dehydrator	---	---	---	---	2.71	11.87	---	---	---	---	---	---	1.93	8.46	161
Heaters															
Reboiler	0.06	0.27	0.05	0.23	0.003	0.01	0.0004	0.002	0.005	0.02	0.005	0.02	0.001	0.005	257
Hydrocarbon Loading															
Truck Loadout	---	---	---	---	0.71	0.14	---	---	---	---	---	---	0.03	0.01	30
Fugitive Emissions															
Component Leak Emissions	---	---	---	---	0.13	0.58	---	---	---	---	---	---	0.01	0.03	28
Venting Emissions	---	---	---	---	---	0.29	---	---	---	---	---	---	---	0.02	62
Haul Road Dust Emissions	---	---	---	---	---	---	---	---	0.07	0.31	0.007	0.03	---	---	---
Total Facility PTE =	**1.58**	**6.93**	**7.44**	**32.61**	**5.56**	**21.66**	**0.01**	**0.03**	**0.18**	**0.77**	**0.11**	**0.49**	**2.72**	**11.81**	**7,378**

CONTROLLED POTENTIAL EMISSION SUMMARY

Source	NOx		CO		VOC		SO_2		PM-10		PM-2.5		HAPs		CO_2e
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	tpy
Engines															
Compressor Engine	1.52	6.66	0.74	3.24	0.73	3.20	0.006	0.03	0.10	0.44	0.10	0.44	0.23	1.00	6,322
Storage Tanks															
Produced Water Tanks	---	---	---	---	0.54	2.38	---	---	---	---	---	---	0.02	0.10	520
Dehydrators															
TEG Dehydrator	---	---	---	---	1.91	8.36	---	---	---	---	---	---	1.72	7.52	5
Heaters															
Reboiler	0.06	0.27	0.05	0.23	0.04	0.19	0.0004	0.002	0.005	0.02	0.005	0.02	0.01	0.05	265
Hydrocarbon Loading															
Truck Loadout	---	---	---	---	0.71	0.14	---	---	---	---	---	---	0.03	0.01	30
Fugitive Emissions															
Component Leak Emissions	---	---	---	---	0.13	0.58	---	---	---	---	---	---	0.01	0.03	28
Venting Emissions	---	---	---	---	---	0.29	---	---	---	---	---	---	---	0.02	62
Haul Road Dust Emissions	---	---	---	---	---	---	---	---	0.07	0.31	0.007	0.03	---	---	---
Total Facility PTE =	**1.58**	**6.93**	**0.79**	**3.46**	**4.06**	**15.13**	**0.01**	**0.03**	**0.18**	**0.77**	**0.11**	**0.49**	**2.02**	**8.73**	**7,231**

Compressor Engine Emission Calculations

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Facility Location:	**Harrison County, West Virginia**
Source Description:	**Compressor Engine**

Source Information-Per Engine

Emission Unit ID:	CE-4	
Engine Make/Model	Caterpillar G3516B	
Service	Compression	
Controls - Y or N / Type	Y	OxCat/AFRC
Site Horsepower Rating[1]	1,380	hp
Fuel Consumption (BSFC)[1]	7,301	Btu/(hp-hr)
Heat Rating[2]	10.08	MMBtu/hr
Fuel Consumption[2]	77.54	MMscf/yr
Fuel Consumption[2]	8,851	scf/hr
Fuel Heating Value	1,138	Btu/scf
Operating Hours	8,760	hrs/yr

Notes:

1. Values from Caterpillar specification sheet
2. Calculated values.

Potential Emissions

	Uncontrolled					***Controlled***					
Pollutant	**Emission Factor**		**Estimated Emissions[2]**			**Emission Factor**		**Estimated Emissions[2]**			**Source of Emissions Factors**
	(lb/MMBtu)	**(g/hp-hr)**	**(lb/hr)**	**(lb/yr)**	**(tpy)**	**(lb/MMBtu)**	**(g/bhp-hr)**	**(lb/hr)**	**(lb/yr)**	**(tpy)**	
NOx[4]	---	0.50	1.52	---	6.66	---	0.50	1.52	---	6.66	Uncontrolled and controlled - manufacturer specifications
CO[4]	---	2.43	7.39	---	32.38	---	0.24	0.74	---	3.24	Uncontrolled - manufacturer specifications; controlled - catalyst specifications
VOC	---	0.48	1.46	---	6.40	---	0.24	0.73	---	3.20	Uncontrolled - manufacturer specifications; controlled - catalyst specifications
SO_2	5.88E-04	---	0.0059	---	0.026	5.88E-04	---	0.0059	---	0.026	AP-42, Chapter 3.2, Table 3.2-2
PM_{10}	9.99E-03	---	0.10	---	0.44	9.99E-03	---	0.10	---	0.44	AP-42, Chapter 3.2, Table 3.2-2
$PM_{2.5}$	9.99E-03	---	0.10	---	0.44	9.99E-03	---	0.10	---	0.44	AP-42, Chapter 3.2, Table 3.2-2
1,3-Butadiene[4]	2.67E-04	---	2.69E-03	23.57	1.18E-02	1.34E-04	---	1.35E-03	11.78	5.89E-03	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
2,2,4-Trimethylpentane[4]	2.50E-04	---	2.52E-03	22.07	1.10E-02	1.25E-04	---	1.26E-03	11.03	5.52E-03	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Acenaphthene	1.25E-06	---	1.26E-05	0.11	5.52E-05	1.25E-06	---	1.26E-05	0.11	5.52E-05	AP-42, Chapter 3.2, Table 3.2-2
Acenaphthylene	5.53E-06	---	5.57E-05	0.49	2.44E-04	5.53E-06	---	5.57E-05	0.49	2.44E-04	AP-42, Chapter 3.2, Table 3.2-2
Acetaldehyde[4]	8.36E-03	---	8.42E-02	737.9	3.69E-01	4.18E-03	---	4.21E-02	368.9	1.84E-01	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Acrolein[4]	5.14E-03	---	5.18E-02	453.7	2.27E-01	2.57E-03	---	2.59E-02	226.8	1.13E-01	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Benzene[4]	4.40E-04	---	4.43E-03	38.83	1.94E-02	2.20E-04	---	2.22E-03	19.42	9.71E-03	AP-42, Chapter 3.2, Table 3.2-2
Benzo(b)fluoranthene	1.66E-07	---	1.67E-06	0.015	7.33E-06	1.66E-07	---	1.67E-06	0.015	7.33E-06	AP-42, Chapter 3.2, Table 3.2-2
Benzo(e)pyrene	4.15E-07	---	4.18E-06	0.037	1.83E-05	4.15E-07	---	4.18E-06	0.037	1.83E-05	AP-42, Chapter 3.2, Table 3.2-2
Benzo(g,h,i)perylene	4.14E-07	---	4.17E-06	0.037	1.83E-05	4.14E-07	---	4.17E-06	0.037	1.83E-05	AP-42, Chapter 3.2, Table 3.2-2
Biphenyl[4]	2.12E-04	---	2.14E-03	18.71	9.36E-03	1.06E-04	---	1.07E-03	9.36	4.68E-03	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Chrysene	6.93E-07	---	6.98E-06	0.061	3.06E-05	6.93E-07	---	6.98E-06	0.061	3.06E-05	AP-42, Chapter 3.2, Table 3.2-2
Ethylbenzene[4]	3.97E-05	---	4.00E-04	3.50	1.75E-03	1.99E-05	---	2.00E-04	1.75	8.76E-04	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Fluoranthene	1.11E-06	---	1.12E-05	0.10	4.90E-05	1.11E-06	---	1.12E-05	0.10	4.90E-05	AP-42, Chapter 3.2, Table 3.2-2
Fluorene	5.67E-06	---	5.71E-05	0.50	2.50E-04	5.67E-06	---	5.71E-05	0.50	2.50E-04	AP-42, Chapter 3.2, Table 3.2-2
Formaldehyde	5.28E-02	--	5.32E-01	4,660	2.33E+00	1.27E-02	---	1.28E-01	1,118	5.59E-01	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - catalyst specifications
Methanol[4]	2.50E-03	---	2.52E-02	220.7	1.10E-01	1.25E-03	---	1.26E-02	110.3	5.52E-02	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Methylene Chloride[4]	2.00E-05	---	2.02E-04	1.77	8.83E-04	1.00E-05	---	1.01E-04	0.88	4.41E-04	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
n-Hexane[4]	1.11E-03	---	1.12E-02	97.97	4.90E-02	5.55E-04	---	5.59E-03	48.98	2.45E-02	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Napthalene	7.44E-05	---	7.50E-04	6.57	3.28E-03	7.44E-05	---	7.50E-04	6.57	3.28E-03	AP-42, Chapter 3.2, Table 3.2-2
PAH	2.69E-05	---	2.71E-04	2.37	1.19E-03	2.69E-05	---	2.71E-04	2.37	1.19E-03	AP-42, Chapter 3.2, Table 3.2-2
Phenanthrene	1.04E-05	---	1.05E-04	0.92	4.59E-04	1.04E-05	---	1.05E-04	0.92	4.59E-04	AP-42, Chapter 3.2, Table 3.2-2
Phenol[4]	2.40E-05	---	2.42E-04	2.12	1.06E-03	1.20E-05	---	1.21E-04	1.06	5.30E-04	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Pyrene	1.36E-06	---	1.37E-05	0.12	6.00E-05	1.36E-06	---	1.37E-05	0.12	6.00E-05	AP-42, Chapter 3.2, Table 3.2-2
Tetrachloroethane[4]	2.48E-06	---	2.50E-05	0.22	1.09E-04	1.24E-06	---	1.25E-05	0.11	5.47E-05	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Toluene[4]	4.08E-04	---	4.11E-03	36.01	1.80E-02	2.04E-04	---	2.06E-03	18.01	9.00E-03	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Vinyl Chloride[4]	1.49E-05	---	1.50E-04	1.32	6.58E-04	7.45E-06	---	7.51E-05	0.66	3.29E-04	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Xylenes[4]	1.95E-04	---	1.96E-03	17.21	8.61E-03	9.75E-05	---	9.82E-04	8.61	4.30E-03	Uncontrolled - AP-42, Chapter 3.2, Table 3.2-2; controlled - see note 4
Other HAPs[3]	2.62E-04	---	2.64E-03	23.10	1.15E-02	2.62E-04	---	2.64E-03	23.10	1.15E-02	AP-42, Chapter 3.2, Table 3.2-2
Total HAPS			0.73	6,370	3.19			0.23	1,991	1.00	
Pollutant	**Emission Factor**		**Estimated Emissions[2]**			**Emission Factor**		**Estimated Emissions[2]**			**Source of Emissions Factors**
	(kg/MMBtu)	**(g/hp-hr)**	**(lb/hr)**	**(lb/yr)**	**(tpy)**	**(kg/MMBtu)**	**(g/bhp-hr)**	**(lb/hr)**	**(lb/yr)**	**(tpy)**	
CO_2	---	474	1,442.1	---	6,316	---	474	1,442.1	---	6,316	Uncontrolled and controlled - manufacturer specifications
CH_4	0.001	---	0.022	---	0.10	0.001	---	0.022	---	0.10	40 CFR Part 98, Subpart C, Table C-2
N_2O	0.0001	---	0.0022	---	0.010	0.0001	---	0.0022	---	0.010	40 CFR Part 98, Subpart C, Table C-2
CO_2e	---	---	1,443.3	---	6,322	---	---	1,443.3	---	6,322	40 CFR Part 98, Subpart A, Table A-1, effective January 2014

Notes:

3. Other HAPs include those HAPs listen in AP-42 below the detection thresholds.
4. All those HAPs that are also VOCs will be controlled to the same efficiency as VOCs by the oxidation catalyst.

Example Calculations

lb/hr = (g/kp-hr) * (hp) * (1 lb/453.6 g) or (lb/MMBtu) * (MMBtu/hr)

tpy = (lb/hr) * (1 ton/2000 lb) * (hrs/yr) or (MMscf/yr) * (Btu/scf) * (lb/MMBtu) *(1 ton/2000 lb)

Produced Water Storage Tank Flashing Emissions

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Facility Location:	**Harrison County, West Virginia**
Source Description:	**Produced Water Tanks**
Emission Unit ID:	**T01 and T02**

Number of Produced Water Storage Tanks: **2** tanks
Produced Water Throughput: **210** bbl/day

Component	Produced Water Flashing Emissions			
	Uncontrolled Flashing Emissions [1] (lb/hr)		Uncontrolled Flashing Emissions (tons/yr)	
	T01	T02	T01	T02
Methane	3.82	0.93	16.73	4.06
Ethane	0.71	0.17	3.10	0.76
Propane	0.20	0.049	0.89	0.22
i-Butane	0.043	0.010	0.19	0.045
n-Butane	0.055	0.013	0.24	0.059
i-Pentane	0.027	0.0066	0.12	0.029
n-Pentane	0.019	0.0047	0.085	0.021
Hexanes	0.0064	0.0015	0.028	0.0067
Heptanes	0.027	0.0066	0.12	0.029
Octanes	0.028	0.0068	0.12	0.030
Nonanes	0.0063	0.0015	0.028	0.0067
Decanes+	0.0023	0.00056	0.010	0.0025
Benzene	0.00019	0.00010	0.00085	0.00046
Toluene	0.0010	0.00052	0.0046	0.0023
Ethylbenzene	0.00021	0.00010	0.0009	0.00044
Xylenes	0.0012	0.00069	0.0055	0.0030
n-Hexane	0.016	0.0037	0.068	0.016
Water	0.10	0.025	0.45	0.11
Nitrogen	0.013	0.0031	0.057	0.014
Carbon Dioxide	0.012	0.0035	0.052	0.015
VOC Subtotal	0.54		2.38	
HAP Subtotal[2]	0.02		0.10	
CO_2e Subtotal[3]	118.69		519.87	
Total	6.33		27.73	

Notes:

1. Flashing emissions calculated by ProMax 3.2. Flash gas is stream Uncontrolled Flash Gas of the associated ProMax simulation.
2. HAP emissions include those of benzene, toluene, ethylbenzene, xylenes and n-hexane.
3. CO_2e emissions calculated using global warming potentials published in 40 CFR Part 98 Subpart A Table A-1.
4. No control devices are utilized for the produced water tanks.

Storage Tank Working and Breathing Emissions

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Facility Location:	**Harrison County, West Virginia**
Source Description:	**Produced Water Tanks**
Emission Unit ID:	**T01 and T02**

Tank Description	Uncontrolled VOC Emissions[1] (tons/yr)	Uncontrolled Benzene Emissions[1] (tons/yr)	Uncontrolled Toluene Emissions[1] (tons/yr)	Uncontrolled Ethylbenzene Emissions[1] (tons/yr)	Uncontrolled Xylenes Emissions[1] (tons/yr)	Uncontrolled n-Hexane Emissions[1] (tons/yr)	Uncontrolled HAP Emissions[2] (tons/yr)	Uncontrolled CH_4 Emissions[1] (tons/yr)	Uncontrolled CO_2e Emissions[3] (tons/yr)
210 bbl Produced Water Storage Tank (T01)	3.48E-05	3.60E-09	9.30E-09	1.10E-09	7.60E-09	6.20E-10	2.22E-08	2.60E-03	0.065
50 bbl Produced Water Storage Tank (T02)	5.77E-06	1.30E-09	3.00E-09	3.50E-10	2.70E-09	1.00E-10	7.45E-09	4.20E-04	0.011
TOTAL	**4.06E-05**	**4.90E-09**	**1.23E-08**	**1.45E-09**	**1.03E-08**	**7.20E-10**	**2.97E-08**	**3.02E-03**	**0.08**

Notes:

1. Uncontrolled emissions retrieved from Tank Losses simulation tool in ProMax for individual tanks.
2. HAP emissions are the sum of benzene, toluene, ethylbenzene, xylenes, and n-hexane emissions.
3. CO_2e emissions estimated using global warming potentials retrieved from 40 CFR Part 98 Subpart A Table A-1.
4. No control devices are utilized for the produced water tanks.

Dehydrator Emissions

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Facility Location:	**Harrison County, West Virginia**
Source Description:	**Dehydrator Unit**

Total Gas Throughput:	**6.0**	MMSCFD
Number of Dehydrators:	**1**	dehydrator

Potential Emissions

Pollutant	Emission Unit ID: DEHY-001			
	Dehydrator Still Vent		Flash Tank Gas	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Uncontrolled Emissions [1]				
VOC	1.91	8.36	0.80	3.51
Total HAPs	1.72	7.52	0.21	0.94
Benzene	0.062	0.27	0.01	0.05
Toluene	0.39	1.72	0.06	0.27
Ethylbenzene	0.087	0.38	0.01	0.04
Xylenes	1.17	5.11	0.10	0.45
n-Hexane	0.0093	0.041	0.03	0.12
Methane	0.049	0.21	1.42	6.22
Carbon Dioxide	0.0045	0.020	0.023	0.10
CO_2e	1.22	5.36	35.5	155
Controlled Emissions [2]				
VOC	1.91	8.36	0.040	0.18
Total HAPs	1.72	7.52	0.011	0.047
Benzene	0.062	0.27	0.0006	0.0025
Toluene	0.39	1.72	0.0031	0.014
Ethylbenzene	0.087	0.38	0.0005	0.0022
Xylenes	1.17	5.11	0.0052	0.023
n-Hexane	0.0093	0.041	0.0014	0.0060
Methane	0.049	0.21	0.071	0.31
Carbon Dioxide	0.0045	0.020	0.023	0.10
CO_2e	1.22	5.36	1.80	7.9

[1] Output from GRI-GLYCalc 4.0 for both the still vent (regenerator) and flash tank gas emissions.

[2] Flash tank gas is used in the reboiler as the primary fuel source. Assumed 95% combustion of flash tank gas. The still vent will not be controlled.

Natural Gas Fueled Reboiler Emissions

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Location:	**Harrison County, West Virginia**
Source Description:	**Reboiler**

Source Information

Emission Unit ID:	RB-01	
Source Description:	Reboiler	
Number of Heaters	1	heater
Hours of Operation	8,760	hr/yr
Design Heat Rate	0.5	MMBtu/hr per Heater
Heater Efficiency	0.8	
Fuel Heat Value[1]	1,138	Btu/scf
Fuel Use	4.8	MMscf/yr per Heater

[1] Site-specific gas heating value.

Emission Calculations

Pollutant	Emission Factor (lb/MMscf)	Emissions (lb/hr)	Emissions (tpy)	Emission Factor Source
NO_X	100	0.061	0.27	AP-42 Ch. 1.4 Table 1.4-1
CO	84	0.051	0.23	AP-42 Ch. 1.4 Table 1.4-1
VOC	5.5	0.0034	0.015	AP-42 Ch. 1.4 Table 1.4-2
PM_{10}	7.6	0.0047	0.020	AP-42 Ch. 1.4 Table 1.4-2
$PM_{2.5}$	7.6	0.0047	0.020	AP-42 Ch. 1.4 Table 1.4-2
SO_2	0.6	0.00037	0.0016	AP-42 Ch. 1.4 Table 1.4-2
2-Methylnapthalene	2.40E-05	1.47E-08	6.44E-08	AP-42 Ch. 1.4 Table 1.4-3
Benzene	2.10E-03	1.29E-06	5.64E-06	AP-42 Ch. 1.4 Table 1.4-3
Dichlorobenzene	1.20E-03	7.35E-07	3.22E-06	AP-42 Ch. 1.4 Table 1.4-3
Fluoranthene	3.00E-06	1.84E-09	8.05E-09	AP-42 Ch. 1.4 Table 1.4-3
Fluorene	2.80E-06	1.72E-09	7.51E-09	AP-42 Ch. 1.4 Table 1.4-3
Formaldehyde	7.50E-02	4.60E-05	2.01E-04	AP-42 Ch. 1.4 Table 1.4-3
n-Hexane	1.80E+00	1.10E-03	4.83E-03	AP-42 Ch. 1.4 Table 1.4-3
Napthalene	6.10E-04	3.74E-07	1.64E-06	AP-42 Ch. 1.4 Table 1.4-3
Phenanathrene	1.70E-05	1.04E-08	4.56E-08	AP-42 Ch. 1.4 Table 1.4-3
Pyrene	5.00E-06	3.06E-09	1.34E-08	AP-42 Ch. 1.4 Table 1.4-3
Toluene	3.40E-03	2.08E-06	9.13E-06	AP-42 Ch. 1.4 Table 1.4-3
Total HAPs	1.88	0.0012	0.0051	AP-42 Ch. 1.4 Table 1.4-3
Pollutant	**Emission Factor (kg/MMBtu)**	**Emissions (lb/hr)**	**Emissions (tpy)**	**Emission Factor Source**
Carbon Dioxide	53.06	58.6	257	40 CFR Part 98, Subpart C, Table C-1
Methane	0.001	0.0011	0.0048	40 CFR Part 98, Subpart C, Table C-2
Nitrous Oxide	0.0001	0.00011	0.00048	40 CFR Part 98, Subpart C, Table C-2
CO_2e	----	58.7	257	40 CFR Part 98, Subpart A, Table A-1

1. Only those HAPs that are above detection thresholds are speciated. Total HAPs includes all HAPs above and below detection.

Sample Calculations:

$$\text{Fuel Consumption (MMscf/yr)} = \frac{\text{Heater Size (MMBtu/hr)} * \text{Hours of Operation (hrs/yr)}}{\text{Fuel Heat Value (Btu/scf)} * \text{Heater Efficiency}}$$

$$\text{Emissions (tons/yr)} = \frac{\text{Emission Factor (lbs/MMscf)} * \text{Fuel Consumption (MMscf/yr)}}{\text{2,000 (lbs/ton)}}$$

Truck Loading Emissions

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Facility Location:	**Harrison County, West Virginia**
Source Description:	**Produced Water Truck Loadout**
Emission Unit ID:	**LDOUT**

AP - 42, Chapter 5.2 $L_L = 12.46 \times S \times P \times M / T$

L_L = Loading Loss Emission Factor (lbs VOC/1000 gal loaded)
S = Saturation Factor
P = True Vapor Pressure of the Loaded Liquid (psia)
M = Vapor Molecular Weight of the Loaded Liquid (lbs/lbmol)
T = Temperature of Loaded Liquid (ºR)

VOC Emissions (tpy) = $\frac{L_L \text{ (lbs VOC/1000 gal)} * 42 \text{ gal/bbl} * 365 \text{ days/year} * \text{production (bbl/day)}}{1000 \text{ gal} * 2000 \text{ lbs/ton}}$

								Uncontrolled							
Source	**S[1]**	**P (psia)[2]**	**M[3]**	**T (ºF)[4]**	**T (ºR)**	**L_L (lb/1000 gal)**	**Loading bbl/day**	**VOC (tpy)**	**Benzene[5] (tpy)**	**Toluene[5] (tpy)**	**E-benzene[5] (tpy)**	**Xylenes[5] (tpy)**	**n-Hexane[5] (tpy)**	**HAPs[5] (tpy)**	**CO_2e[6] (tpy)**
Produced Water	0.6	0.3	18	65	524.77	0.08	210	**0.14**	**6.52E-05**	**3.48E-04**	**6.97E-05**	**4.24E-04**	**4.83E-03**	**0.006**	**29.7**

Notes:
1. Saturation factor from AP-42, Table 5.2-1 (Submerged loading (bottom loading): dedicated normal service)
2. True vapor pressure is estimated from ProMax working and breathing report calculated using the Tank Losses simulation tool.
3. Molecular weight of vapor is estimated from ProMax 3.2 report "Uncontrolled Flash Gas" stream.
4. Temperature based on ProMax working and breathing report (the annual average temperature of Charleston, West Virginia).
5. HAP emissions estimated assuming 0.4% by weight of the vent gas are HAPs and 8.5% by weight are VOCs (per ProMax simulation). Speciated HAPs use their individual weight fraction to calculate emissions.
6. CO_2e emissions estimated assuming 75% of the vent gas by weight is methane and 8.5% by weight are VOCs (per ProMax simulation).

Assume 1 truck loaded per hour, 200 bbl truck, for short term emissions

								Uncontrolled							
Source	**S[1]**	**P (psia)[2]**	**M[3]**	**T (ºF)[4]**	**T (ºR)**	**L_L (lb/1000 gal)**	**Loading bbl/hr**	**VOC (lb/hr)**	**Benzene[5] (lb/hr)**	**Toluene[5] (lb/hr)**	**E-benzene[5] (lb/hr)**	**Xylenes[5] (lb/hr)**	**n-Hexane[5] (lb/hr)**	**HAPs[5] (lb/hr)**	**CO_2e[6] (lb/hr)**
Produced Water	0.6	0.3	18	65	524.77	0.08	200	**0.71**	**3.40E-04**	**1.82E-03**	**3.64E-04**	**2.21E-03**	**2.52E-02**	**0.03**	**154.8**

Component Fugitive Emissions

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Facility Location:	**Harrison County, West Virginia**
Source Description:	**Fugitive Emissions - Component Leaks**

VOC Fugitive Emissions						
Equipment Type and Service	**Number of Units [1]**	**Hours of Operation (hours/yr)**	**THC Emission Factor[2] (kg/hr-unit)**	**VOC Weight Fraction[3]**	**THC Emissions (tpy)**	**VOC Emissions (tpy)**
Flanges - Gas Service	75	8,760	3.90E-04	0.088	0.28	0.025
Valves - Gas Service	105	8,760	4.50E-03	0.088	4.57	0.40
Other - Gas Service	5	8,760	8.80E-03	0.088	0.43	0.038
Flanges - Liquid Service	38	8,760	1.10E-04	0.085	0.040	0.0035
Valves - Liquid Service	53	8,760	2.50E-03	0.085	1.28	0.11
Total Emissions (tons/yr)					**6.61**	**0.58**

HAP Fugitive Emissions										
Equipment Type and Service	**Benzene of VOC Weight Fraction[3]**	**Benzene Emissions (tpy)**	**Toluene of VOC Weight Fraction[3]**	**Toluene Emissions (tpy)**	**Ethylbenzene of VOC Weight Fraction[3]**	**Ethylbenzene Emissions (tpy)**	**Xylenes of VOC Weight Fraction[3]**	**Xylene Emissions (tpy)**	**n-Hexane of VOC Weight Fraction[3]**	**n-Hexane Emissions (tpy)**
Flanges - Gas Service	0.002	4.10E-05	0.007	1.69E-04	0.001	2.72E-05	0.01	2.50E-04	0.03	8.70E-04
Valves - Gas Service	0.002	6.63E-04	0.007	2.73E-03	0.001	4.39E-04	0.01	4.04E-03	0.03	1.40E-02
Other - Gas Service	0.002	6.17E-05	0.007	2.54E-04	0.001	4.09E-05	0.01	3.77E-04	0.03	1.31E-03
Flanges - Liquid Service	0.0005	1.66E-06	0.003	8.87E-06	0.0005	1.78E-06	0.003	1.08E-05	0.04	1.23E-04
Valves - Liquid Service	0.0005	5.27E-05	0.003	2.81E-04	0.0005	5.63E-05	0.003	3.43E-04	0.04	3.90E-03
Total Emissions (tons/yr)		**8.20E-04**		**3.44E-03**		**5.65E-04**		**5.02E-03**		**2.02E-02**

1) Component counts estimated from configuration of similar compressor station.

2) API average emission factors are for oil and gas production operations - Table 2.4, EPA Protocol for Equipment Leak Emission Estimates - 1995.

3) Gas and liquid weight fractions from site-specific gas analysis and ProMax simulation.

GHG Fugitive Emissions								
Equipment Type	**Number of Units [4]**	**Hours of Operation (hours/yr)**	**Emission Factor[5] (scf/hr-unit)**	**CH_4 Concentration[6]**	**CO_2 Concentration[6]**	**CH_4 Emissions (tpy)**	**CO_2 Emissions (tpy)**	**CO_2e Emissions (tpy)**
Flanges	113	8,760	0.003	0.98	0.011	0.061	0.0019	1.53
Valves	158	8,760	0.027	0.98	0.011	0.77	0.024	19.30
Other	5	8,760	0.300	0.98	0.011	0.27	0.0084	6.79
Total Emissions (tons/yr)						**1.10**	**0.03**	**27.62**

4) Component counts estimated from configuration of similar compressor station.

5) Emission factors from 40 CFR Part 98 Subpart W, Table W1-A; Gas service where available, else light crude service

6) CH_4 and CO_2 concentrations as defined in 40 CFR Part 98.233(r)

Fugitive Emissions From Venting Episodes

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Facility Location:	**Harrison County, West Virginia**
Source Description:	**Fugitive Emissions-Venting Episodes**

VOC Venting Emissions						
Type of Event	**Number Of Events[1] (event/yr)**	**Amount Vented per Event (scf/event)**	**Molecular Weight of Vented Gas (lb/lb-mol)**	**Total Emissions (ton/yr)**	**VOC Weight Fraction[4]**	**VOC Emissions (ton/yr)**
Compressor Blowdown[2]	12	10,000	18.49	2.92	0.088	0.26
Compressor Startup[3]	12	1,050	18.49	0.31	0.088	0.027
Total Emissions (tons/yr)						**0.29**

HAPs Venting Emissions										
Type of Event	**Benzene Weight Fraction[4]**	**Benzene Emissions (tpy)**	**Toluene Weight Fraction[4]**	**Toluene Emissions (tpy)**	**Ethylbenzene Weight Fraction[4]**	**Ethylbenzene Emissions (tpy)**	**Xylene Weight Fraction[4]**	**Xylene Emissions (tpy)**	**n-Hexane Weight Fraction[4]**	**n-Hexane Emissions (tpy)**
Compressor Blowdown[2]	0.0001	4.24E-04	0.0006	1.74E-03	0.0001	2.81E-04	0.0009	2.58E-03	0.003	8.98E-03
Compressor Startup[3]	0.0001	4.45E-05	0.0006	1.83E-04	0.0001	2.95E-05	0.0009	2.71E-04	0.003	9.43E-04
Total Emissions (tons/yr)		**0.0005**		**0.002**		**0.0003**		**0.003**		**0.01**

GHG Venting Emissions								
Type of Event	**Number Of Events[1] (event/yr)**	**Amount Vented per Event (scf/event)**	**Molecular Weight of Vented Gas (lb/lb-mol)**	**CH_4 Weight Fraction[4]**	**CO_2 Weight Fraction[4]**	**CH_4 Emissions (ton/yr)**	**CO_2 Emissions (ton/yr)**	**CO_2e Emissions (tpy)**
Compressor Blowdown[2]	12	10,000	18.49	0.76	0.003	2.23	0.0088	55.84
Compressor Startup[3]	12	1,050	18.49	0.76	0.003	0.23	0.00093	5.86
Total Emissions (tons/yr)						**2.47**	**0.01**	**61.70**

1) Estimated number of events and venting per event from engineering based on other facilities.

2) Total number of compressor blowdowns based on 12 blowdowns per compressor per year.

3) Total number of compressor startups based on 12 starts per compressor per year.

4) Weight Fractions are from a site-specific gas analysis.

Fugitive Dust Emissions

Company:	**Antero Midstream LLC**
Facility Name:	**Bluestone Compressor Station**
Facility Location:	**Harrison County, West Virginia**
Source Description:	**Fugitive Dust Emissions**

Gravel Access Road	Loaded Truck Weight[1]	Trips per year[2]	Trips per day[2]	Distance per round trip (truck in and out)[3]		VMT per year[4]
	tons			feet	miles	miles
Produced Water Tank Truck	40.00	730	2.0	2,500	0.47	346
Pick-Up Trucks	3.00	730	2.0	2,500	0.47	346

Equation Parameter	PM-10/PM-2.5	PM-Total
E, annual size-specific emission factor for PM_{10} & $PM_{2.5}$ (upaved industrial roads) extrapolated for natural mitigation[6]	**see table below**	**see table below**
k, Particle size multiplier for particle size range (PM_{10}), (lb/VMT) (Source: AP-42 Table 13.2.2-2)	**1.5**	**4.9**
k, Particle size multiplier for particle size range ($PM_{2.5}$), (lb/VMT) (Source: AP-42 Table 13.2.2-2)	**0.15**	
s, surface material silt content, (%) (Source: AP-42 Table 13.2.2-1)	**4.8**	**4.8**
W, mean weight (tons) of the vehicles traveling the road	**21.50**	**21.50**
a, constant for PM_{10} and $PM_{2.5}$ on industrial roads (Source: AP-42 Table 13.2.2-2)	**0.9**	**0.7**
b, constant for PM_{10} and $PM_{2.5}$ on industrial roads (Source: AP-42 Table 13.2.2-2)	**0.45**	**0.45**
P, number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, based on AP-42 Figure 13.2.2-1.	**160**	**160**

$$E = \left[k \left(\frac{s}{12} \right)^{a} \times \left(\frac{W}{3} \right)^{b} \right] \times (365 - P/365)$$

Source of Equation: AP-42 Section 13.2.2

PM_{10} Emissions

Emission Factor (lb/VMT)	Vehicle miles traveled (VMT/yr)[4]	Annual Uncontrolled PM_{10} Emissions (tpy)
0.90	691	0.31

$PM_{2.5}$ Emissions (tons/yr)

Emission Factor (lb/VMT)	Vehicle miles traveled (VMT/yr)[4]	Annual Uncontrolled $PM_{2.5}$ Emissions (tpy)
0.090	691	0.031

PM- Total Emissions (tons/yr)

Emission Factor (lb/VMT)	Vehicle miles traveled (VMT/yr)[4]	Annual Uncontrolled PM-Total Emissions (tpy)
3.52	691	1.22

Notes:

1. Loaded truck weight for tanker trucks is based on typical weight limit for highway vehicles. Loaded truck weight for pick-up trucks is based on typical weight for mid-sized pick-up gasoline trucks.
2. Based on production, it's assumed a maximum of two produced water trucks (200 bbl truck) will be onsite per day. Also, it is assumed 2 pick up trucks carrying onsite personnel will be onsite per day.
3. Distance per round trip is based on the site layout. The one way distance is measured as 1,250 feet for the gravel access road.
4. VMT/yr = Trips/yr x Roundtrip Distance
5. Hourly emissions determined from tons per year calculation using 2,000 lb/ton and 8,760 hours per year.

Facility Gas Analysis

	MOL %	MW	Component Weight lb/lb-mol	Wt. Fraction
Methane	88.05	16.04	14.12	0.76
Ethane	8.74	30.07	2.63	0.14
Propane	1.71	44.10	0.75	0.041
i-Butane	0.27	58.12	0.15	0.0084
n-Butane	0.35	58.12	0.21	0.011
i-Pentane	0.14	72.15	0.10	0.0055
n-Pentane	0.099	72.15	0.071	0.0039
Hexanes	0.027	106.72	0.029	0.0016
Heptanes	0.10	100.20	0.10	0.0054
Octanes	0.085	114.23	0.10	0.0053
Nonanes	0.018	128.26	0.022	0.0012
Decanes+	0.0064	142.29	0.0091	0.00049
Benzene	0.0034	78.11	0.0027	0.00014
Toluene	0.012	92.14	0.011	0.00060
Ethylbenzene	0.0017	106.17	0.0018	0.00010
Xylenes	0.015	106.16	0.016	0.00088
n-Hexane	0.066	86.18	0.057	0.0031
Nitrogen	0.17	28.01	0.049	0.0026
Carbon Dioxide	0.13	44.01	0.056	0.0030
Total	100.000		18.49	1.00

Heating Value (Btu/scf)	1,138.3
Molecular weight	18.49
VOC weight fraction	0.088
Methane weight fraction	0.76
HAPs weight fraction	0.0048
THC weight fraction	0.99
VOC of THC wt fraction	0.089
CH4 of THC wt fraction	0.77
HAPs of THC wt fraction	0.0048

1. Site-specific gas sample from Bluestone Compressor Station.
2. Speciated BTEX is estimated based on mole fractions from nearby well.

Gas Evolved from Flashed Liquid

	MOL %	MW	Component Weight lb/lb-mol	Wt. Fraction
Methane	85.93	16.04	13.79	0.75
Ethane	8.51	30.07	2.56	0.14
Propane	1.66	44.10	0.73	0.040
i-Butane	0.27	58.12	0.15	0.0084
n-Butane	0.34	58.12	0.20	0.011
i-Pentane	0.14	72.15	0.10	0.0054
n-Pentane	0.097	72.15	0.070	0.0038
Hexanes	0.027	86.18	0.023	0.0012
Heptanes	0.099	100.20	0.10	0.0054
Octanes	0.089	114.23	0.10	0.0055
Nonanes	0.018	128.26	0.023	0.0012
Decanes +	0.0059	142.28	0.0084	0.00046
Benzene	0.0010	78.11	0.00076	0.000041
Toluene	0.0044	92.14	0.0040	0.00022
Ethylbenzene	0.00076	106.17	0.00081	0.000044
Xylenes	0.0046	106.17	0.0049	0.00027
n-Hexane	0.065	86.18	0.056	0.0030
Nitrogen	0.17	28.01	0.047	0.0025
Carbon Dioxide	0.099	44.01	0.043	0.0024
Water	2.48	18.02	0.45	0.024
Totals	100.00		18.46	1.00

Molecular weight	18.46
VOC weight fraction	0.085
Methane weight fraction	0.75
HAPs weight fraction	0.0036
THC weight fraction	0.97
VOC of THC wt fraction	0.088
CH_4 of THC wt fraction	0.77
HAPs of THC wt fraction	0.0037

1. Stream "Uncontrolled Flash Gas" of site-specific ProMax simulation.

ProMax 3.2 Simulation

Bryan Research & Engineering, Inc.

ProMax® 3.2

with

TSWEET® & PROSIM®

Simulation Report

Project: Bluestone CS.pmx

Licensed to Kleinfelder, Inc. and Affiliates

Client Name: Antero Midstream LLC
Location: West Virginia
Job: Bluestone Compressor Station

ProMax Filename: W:\20161518 Antero Bluestone CS Air Permit\2.0 Technical Information\WVDEQ Application\Attachment I\ProMax\Bluestone CS.pmx
ProMax Version: 3.2.13330.0
Simulation Initiated: 8/11/2015 12:04:15 PM

Bryan Research & Engineering, Inc.
Chemical Engineering Consultants
P.O. Box 4747 Bryan, Texas 77805
Office: (979) 776-5220
FAX: (979) 776-4818
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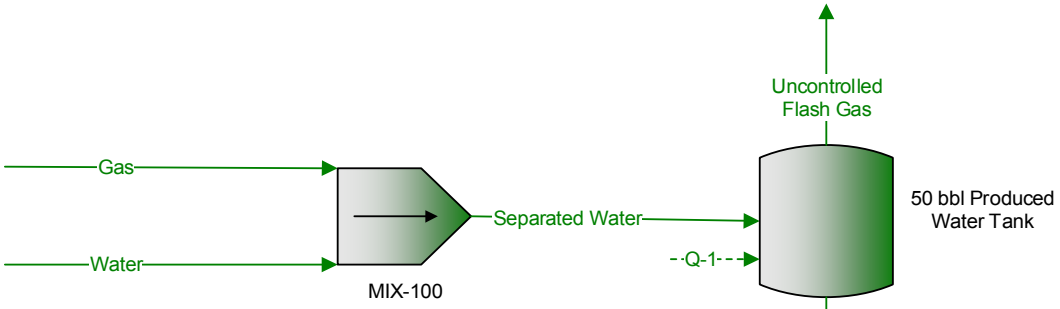
Report Navigator can be activated via the ProMax Navigator Toolbar.
An asterisk (*), throughout the report, denotes a user specified value.
A question mark (?) after a value, throughout the report, denotes an extrapolated or approximate value.

Stream Uncontrolled Flash Gas C3+ Mass Flow =0.11 lb/h

Stream Uncontrolled Flash Gas C3+ Mass Flow =0.47 ton/yr



Properties	Produced Water	
Std Liquid Volumetric Flow(Total)	10	bbl/day

Process Streams		Gas	Produced Water	Separated Water	Uncontrolled Flash Gas	Water
Composition	**Status:**	Solved	Solved	Solved	Solved	Solved
Phase: **Total**	**From Block:**	--	50 bbl Produced Water Tank	MIX-100	50 bbl Produced Water Tank	--
	To Block:	MIX-100	--	50 bbl Produced Water Tank	--	MIX-100
Mole Fraction		%	%	%	%	%
CO2		0.130003*	6.59409E-05	0.00104897	0.119754	0*
N2		0.170003*	2.10267E-06	0.00137173	0.166760	0*
CH4		88.0518*	0.00223425	0.710474	86.2338	0*
C2		8.74017*	0.000265912	0.0705229	8.55439	0*
C3		1.71003*	6.20594E-05	0.0137980	1.67247	0*
iC4		0.270005*	3.33323E-06	0.00217863	0.264855	0*
nC4		0.350007*	9.27948E-06	0.00282414	0.342732	0*
iC5		0.140003*	2.66282E-06	0.00112966	0.137220	0*
nC5		0.0990020*	1.79856E-06	0.000798830	0.0970441	0*
2-Methylpentane		0.0270005*	2.31346E-07	0.000217863	0.0264979	0*
C7		0.100002*	9.57788E-07	0.000806899	0.0981280	0*
C8		0.0900018*	4.82150E-07	0.000726209	0.0883611	0*
C9		0.0180004*	1.59040E-07	0.000145242	0.0176647	0*
C10		0.00600012*	3.25627E-08	4.84139E-05	0.00589069	0*
Benzene		0.00300006*	7.85817E-06	2.42070E-05	0.00199840	0*
Toluene		0.0120002*	2.75142E-05	9.68278E-05	0.00846677	0*
Ethylbenzene		0.00200004*	4.46290E-06	1.61380E-05	0.00142596	0*
o-Xylene		0.0150003*	4.14378E-05	0.000121035	0.00973275	0*
n-C6		0.0660013*	4.53975E-07	0.000532553	0.0647860	0*
H2O		0*	99.9973	99.1931	2.08806	100*
Mass Fraction		%	%	%	%	%
CO2		0.309401*	0.000161086	0.00256198	0.285319	0*
N2		0.257541*	3.26959E-06	0.00213255	0.252902	0*
CH4		76.3893*	0.00198957	0.632536	74.8933	0*
C2		14.2123*	0.000443827	0.117684	13.9252	0*
C3		4.07778*	0.000151901	0.0337658	3.99254	0*
iC4		0.848669*	1.07539E-05	0.00702734	0.833384	0*
nC4		1.10013*	2.99380E-05	0.00910952	1.07843	0*
iC5		0.546248*	1.06642E-05	0.00452316	0.535969	0*
nC5		0.386275*	7.20295E-06	0.00319852	0.379046	0*
2-Methylpentane		0.125829*	1.10663E-06	0.00104191	0.123620	0*
C7		0.541887*	5.32724E-06	0.00448705	0.532309	0*
C8		0.555968*	3.05713E-06	0.00460365	0.546424	0*
C9		0.124847*	1.13224E-06	0.00103379	0.122652	0*
C10		0.0461671*	2.57174E-07	0.000382283	0.0453743	0*
Benzene		0.0126727*	3.40718E-05	0.000104936	0.00845072	0*
Toluene		0.0597936*	0.000140720	0.000495116	0.0422331	0*
Ethylbenzene		0.0114827*	2.63000E-05	9.50816E-05	0.00819563	0*
o-Xylene		0.0861202*	0.000244194	0.000713112	0.0559385	0*
n-C6		0.307581*	2.17156E-06	0.00254690	0.302245	0*
H2O		0*	99.9967	99.1720	2.03647	100*
Mass Flow		lb/h	lb/h	lb/h	lb/h	lb/h
CO2		0.00376916*	0.000234993	0.00376916	0.00353417	0*
N2		0.00313740*	4.76969E-06	0.00313740	0.00313263	0*
CH4		0.930583*	0.00290240	0.930583	0.927680	0*
C2		0.173135*	0.000647457	0.173135	0.172488	0*
C3		0.0496760*	0.000221594	0.0496760	0.0494544	0*
iC4		0.0103386*	1.56878E-05	0.0103386	0.0103229	0*
nC4		0.0134018*	4.36737E-05	0.0134018	0.0133582	0*
iC5		0.00665444*	1.55570E-05	0.00665444	0.00663889	0*
nC5		0.00470564*	1.05077E-05	0.00470564	0.00469513	0*
2-Methylpentane		0.00153286*	1.61436E-06	0.00153286	0.00153124	0*
C7		0.00660132*	7.77141E-06	0.00660132	0.00659355	0*
C8		0.00677285*	4.45975E-06	0.00677285	0.00676839	0*
C9		0.00152090*	1.65172E-06	0.00152090	0.00151925	0*
C10		0.000562412*	3.75166E-07	0.000562412	0.000562037	0*
Benzene		0.000154381*	4.97041E-05	0.000154381	0.000104677	0*
Toluene		0.000728411*	0.000205282	0.000728411	0.000523129	0*
Ethylbenzene		0.000139883*	3.83666E-05	0.000139883	0.000101517	0*
o-Xylene		0.00104913*	0.000356231	0.00104913	0.000692894	0*
n-C6		0.00374698*	3.16788E-06	0.00374698	0.00374381	0*
H2O		0*	145.876	145.901	0.0252251	145.901*

Process Streams		Gas	Produced Water	Separated Water	Uncontrolled Flash Gas	Water
Properties	**Status:**	Solved	Solved	Solved	Solved	Solved
Phase: **Total**	**From Block:**	--	50 bbl Produced Water Tank	MIX-100	50 bbl Produced Water Tank	--
	To Block:	MIX-100	--	50 bbl Produced Water Tank	--	MIX-100
Property	**Units**					
Temperature	°F	82.8909	65*	65.0520	65	65*
Pressure	psia	54.6959*	14.6959*	54.6959	14.6959	54.6959*
Mole Fraction Vapor	%	100	0	0.801497	100	0
Mole Fraction Light Liquid	%	0	100	99.1985	0	100
Mole Fraction Heavy Liquid	%	0	0	0	0	0
Molecular Weight	lb/lbmol	18.4917	18.0154	18.0191	18.4716	18.0153
Mass Density	lb/ft^3	0.175515	62.3194	16.3447	0.0483624	62.3236
Molar Flow	lbmol/h	0.0658788	8.09756	8.16462	0.0670579	8.09874
Mass Flow	lb/h	1.21821	145.881	147.119	1.23867	145.901
Vapor Volumetric Flow	ft^3/h	6.94078	2.34085	9.00102	25.6123	2.34102
Liquid Volumetric Flow	gpm	0.865344	0.291846	1.12221	3.19322	0.291868
Std Vapor Volumetric Flow	MMSCFD	0.0006*	0.0737495	0.0743603	0.000610739	0.0737603
Std Liquid Volumetric Flow	sgpm	0.00757162	0.291643	0.299238	0.00759579	0.291667*
Compressibility		0.989703	0.000754514	0.0107082	0.996886	0.00280798
Specific Gravity		0.638467	0.999205		0.637776	0.999271
API Gravity			10.0162			10.0069
Mass Cp	Btu/(lb*°F)	0.509225	0.983569	0.979603	0.497539	0.983484
Ideal Gas CpCv Ratio		1.27127	1.32608	1.32560	1.27683	1.32608
Net Ideal Gas Heating Value	Btu/ft^3	1026.79	0.0304586	8.28503	1005.06	0
Net Liquid Heating Value	Btu/lb	21036.2	-1059.09	-876.796	20591.8	-1059.76
Gross Ideal Gas Heating Value	Btu/ft^3	1135.60	50.3421	59.0670	1112.64	50.31
Gross Liquid Heating Value	Btu/lb	23269.0	0.703069	192.678	22801.9	0

Input Summary

Process Stream	Produced Water	
Tank Geometry	Vertical Cylinder	
Shell Length	6	ft
Shell Diameter	8	ft
Number of Storage Tanks Employed	1	
Location	Charleston, WV	
Annual Net Throughput	10	bbl/day
Include Non-VOC components in calculations?	FALSE	
Maximum fraction fill of tank	90	%
Average fraction fill of tank	50	%
Material category	Light Organics	
Tank Color	Dark Green	
Shell Paint Condition	Good	
Operating Pressure	0	psig
Breather Vent Pressure	0.03	psig
Breather Vacuum Pressure	-0.03	psig
Roof Type	Dome	
Radius of domed roof	4	ft
Roof Color	Dark Green	
Roof Paint Condition	Good	

Promax AP-42 Emissions Report

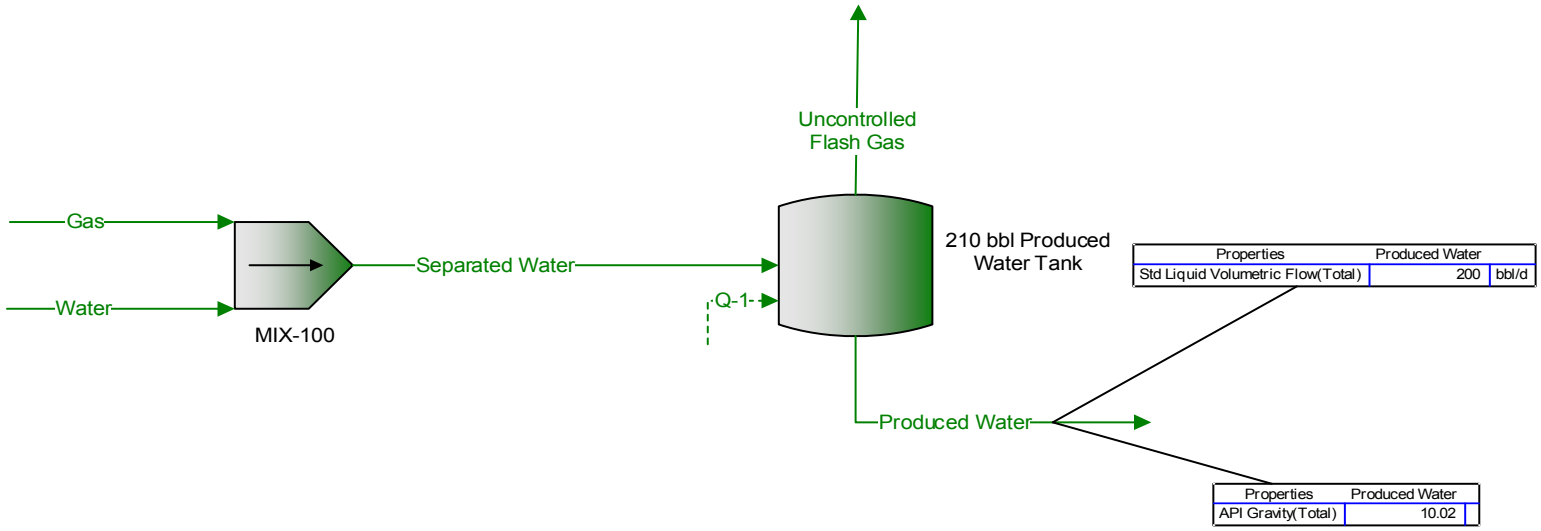
Annual Emissions

Vertical Cylinder

Components	Working Losses (ton/yr)	Breathing Losses (ton/yr)	Total Losses (ton/yr)
Mixture	0.0060	0.0047	0.011
CO2	2.30E-05	1.80E-05	4.00E-05
N2	2.90E-07	2.20E-07	5.10E-07
CH4	0.00024	0.00018	0.00042
C2	4.10E-05	3.20E-05	7.30E-05
C3	3.00E-06	2.30E-06	5.30E-06
iC4	7.70E-08	6.00E-08	1.40E-07
nC4	1.50E-07	1.20E-07	2.70E-07
iC5	1.90E-08	1.50E-08	3.40E-08
nC5	9.60E-09	7.50E-09	1.70E-08
C6	5.90E-10	4.60E-10	1.10E-09
C7	5.20E-10	4.10E-10	9.30E-10
C8	9.50E-11	7.50E-11	1.70E-10
C9	1.00E-11	8.00E-12	1.80E-11
C10	6.90E-13	5.40E-13	1.20E-12
Benzene	7.10E-10	5.60E-10	1.30E-09
Toluene	1.70E-09	1.30E-09	3.00E-09
Ethylbenzene	1.90E-10	1.50E-10	3.50E-10
o-Xylene	1.50E-09	1.20E-09	2.70E-09
n-C6	5.70E-11	4.40E-11	1.00E-10
H2O	0.0057	0.0044	0.01

Stream Uncontrolled Flash Gas C3+ Mass Flow =0.44 lb/h

Stream Uncontrolled Flash Gas C3+ Mass Flow =1.91 ton/yr



Process Streams		Gas	Produced Water	Separated Water	Uncontrolled Flash Gas	Water
Composition	**Status:**	Solved	Solved	Solved	Solved	Solved
Phase: **Total**	**From Block:**	--	210 bbl Produced Water Tank	MIX-100	210 bbl Produced Water Tank	--
	To Block:	MIX-100	--	210 bbl Produced Water Tank	--	MIX-100
Mole Fraction		%	%	%	%	%
CO2		0.130003*	5.38172E-05	0.000219940	0.0977378	0*
N2		0.170003*	2.11676E-06	0.000287614	0.167881	0*
CH4		88.0518*	0.00223550	0.148967	86.2837	0*
C2		8.74017*	0.000265430	0.0147867	8.53912	0*
C3		1.71003*	6.17772E-05	0.00289306	1.66492	0*
iC4		0.270005*	3.35554E-06	0.000456798	0.266638	0*
nC4		0.350007*	9.27955E-06	0.000592146	0.342748	0*
iC5		0.140003*	2.67221E-06	0.000236858	0.137710	0*
nC5		0.0990020*	1.80562E-06	0.000167493	0.0974296	0*
2-Methylpentane		0.0270005*	2.33307E-07	4.56798E-05	0.0267238	0*
C7		0.100002*	9.65439E-07	0.000169185	0.0989177	0*
C8		0.0900018*	4.86968E-07	0.000152266	0.0892501	0*
C9		0.0180004*	1.60365E-07	3.04532E-05	0.0178131	0*
C10		0.00600012*	3.28866E-08	1.01511E-05	0.00594976	0*
Benzene		0.00300006*	3.54736E-06	5.07554E-06	0.000902152	0*
Toluene		0.0120002*	1.33423E-05	2.03021E-05	0.00410589	0*
Ethylbenzene		0.00200004*	2.19479E-06	3.38369E-06	0.000701296	0*
o-Xylene		0.0150003*	1.81561E-05	2.53777E-05	0.00426462	0*
n-C6		0.0660013*	4.58188E-07	0.000111662	0.0653908	0*
H2O		0*	99.9973	99.8308	2.08805	100*
Mass Fraction		%	%	%	%	%
CO2		0.309401*	0.000131469	0.000537267	0.233070	0*
N2		0.257541*	3.29151E-06	0.000447214	0.254826	0*
CH4		76.3893*	0.00199069	0.132648	75.0027	0*
C2		14.2123*	0.000443025	0.0246792	13.9126	0*
C3		4.07778*	0.000151210	0.00708096	3.97800	0*
iC4		0.848669*	1.08258E-05	0.00147369	0.839733	0*
nC4		1.10013*	2.99383E-05	0.00191034	1.07943	0*
iC5		0.546248*	1.07018E-05	0.000948544	0.538356	0*
nC5		0.386275*	7.23126E-06	0.000670756	0.380888	0*
2-Methylpentane		0.125829*	1.11601E-06	0.000218498	0.124784	0*
C7		0.541887*	5.36981E-06	0.000940971	0.537065	0*
C8		0.555968*	3.08768E-06	0.000965422	0.552408	0*
C9		0.124847*	1.14167E-06	0.000216794	0.123791	0*
C10		0.0461671*	2.59732E-07	8.01679E-05	0.0458696	0*
Benzene		0.0126727*	1.53808E-05	2.20059E-05	0.00381833	0*
Toluene		0.0597936*	6.82384E-05	0.000103830	0.0204986	0*
Ethylbenzene		0.0114827*	1.29340E-05	1.99394E-05	0.00403422	0*
o-Xylene		0.0861202*	0.000106995	0.000149545	0.0245323	0*
n-C6		0.307581*	2.19172E-06	0.000534106	0.305335	0*
H2O		0*	99.9970	99.8264	2.03825	100*
Mass Flow		lb/h	lb/h	lb/h	lb/h	lb/h
CO2		0.0157048*	0.00383628	0.0157048	0.0118685	0*
N2		0.0130725*	9.60464E-05	0.0130725	0.0129764	0*
CH4		3.87743*	0.0580884	3.87743	3.81934	0*
C2		0.721397*	0.0129275	0.721397	0.708470	0*
C3		0.206983*	0.00441232	0.206983	0.202571	0*
iC4		0.0430774*	0.000315898	0.0430774	0.0427615	0*
nC4		0.0558410*	0.000873600	0.0558410	0.0549674	0*
iC5		0.0277268*	0.000312279	0.0277268	0.0274146	0*
nC5		0.0196068*	0.000211008	0.0196068	0.0193958	0*
2-Methylpentane		0.00638690*	3.25653E-05	0.00638690	0.00635434	0*
C7		0.0275055*	0.000156691	0.0275055	0.0273488	0*
C8		0.0282202*	9.00987E-05	0.0282202	0.0281301	0*
C9		0.00633710*	3.33140E-05	0.00633710	0.00630379	0*
C10		0.00234338*	7.57899E-06	0.00234338	0.00233581	0*
Benzene		0.000643253*	0.000448813	0.000643253	0.000194440	0*
Toluene		0.00303505*	0.00199120	0.00303505	0.00104385	0*
Ethylbenzene		0.000582847*	0.000377414	0.000582847	0.000205433	0*
o-Xylene		0.00437135*	0.00312210	0.00437135	0.00124925	0*
n-C6		0.0156124*	6.39544E-05	0.0156124	0.0155485	0*
H2O		0*	2917.92	2918.02	0.103793	2918.02*

Process Streams		Gas	Produced Water	Separated Water	Uncontrolled Flash Gas	Water
Properties	**Status:**	Solved	Solved	Solved	Solved	Solved
Phase: **Total**	**From Block:**	--	210 bbl Produced Water Tank	MIX-100	210 bbl Produced Water Tank	--
	To Block:	MIX-100	--	210 bbl Produced Water Tank	--	MIX-100
Property	**Units**					
Temperature	°F	-22.3552	65*	64.9329	65	65*
Pressure	psia	54.6959*	14.6959*	54.6959	14.6959	54.6959*
Mole Fraction Vapor	%	99.6407	0	0.160271	100	0
Mole Fraction Light Liquid	%	0.359272	100	99.8397	0	100
Mole Fraction Heavy Liquid	%	0	0	0	0	0
Molecular Weight	lb/lbmol	18.4917	18.0153	18.0161	18.4554	18.0153
Mass Density	lb/ft^3	0.220674	62.3194	39.8852	0.0483196	62.3236
Molar Flow	lbmol/h	0.274495	161.973	162.249	0.275923	161.975
Mass Flow	lb/h	5.07588	2918.00	2923.10	5.09227	2918.02
Vapor Volumetric Flow	ft^3/h	23.0016	46.8233	73.2877	105.387	46.8205
Liquid Volumetric Flow	gpm	2.86774	5.83772	9.13717	13.1392	5.83736
Std Vapor Volumetric Flow	MMSCFD	0.0025*	1.47519	1.47771	0.00251301	1.47521
Std Liquid Volumetric Flow	sgpm	0.0315484	5.83363	5.86488	0.0312487	5.83333*
Compressibility		0.976610	0.000754512	0.00438843	0.996890	0.00280798
Specific Gravity			0.999205		0.637215	0.999271
API Gravity			10.0163			10.0069
Mass Cp	Btu/(lb*°F)	0.481504	0.983570	0.982774	0.497852	0.983484
Ideal Gas CpCv Ratio		1.29591	1.32608	1.32599	1.27692	1.32608
Net Ideal Gas Heating Value	Btu/ft^3	1026.79	0.0284305	1.73714	1004.79	0
Net Liquid Heating Value	Btu/lb	21036.2	-1059.13	-1021.39	20604.5	-1059.76
Gross Ideal Gas Heating Value	Btu/ft^3	1135.60	50.3400	52.1461	1112.37	50.31
Gross Liquid Heating Value	Btu/lb	23269.0	0.658717	40.4061	22816.7	0

Input Summary

Process Stream	Produced Water	
Tank Geometry	Vertical Cylinder	
Shell Length	15	ft
Shell Diameter	10	ft
Number of Storage Tanks Employed	1	
Location	Charleston, WV	
Annual Net Throughput	200	bbl/day
Include Non-VOC components in calculations?	FALSE	
Maximum fraction fill of tank	90	%
Average fraction fill of tank	50	%
Material category	Light Organics	
Tank Color	Dark Green	
Shell Paint Condition	Good	
Operating Pressure	0	psig
Breather Vent Pressure	0.03	psig
Breather Vacuum Pressure	-0.03	psig
Roof Type	Dome	
Radius of domed roof	5	ft
Roof Color	Dark Green	
Roof Paint Condition	Good	

Promax AP-42 Emissions Report

Annual Emissions

Vertical Cylinder

Components	Working Losses (ton/yr)	Breathing Losses (ton/yr)	Total Losses (ton/yr)
Mixture	0.052	0.013	0.065
CO2	1.60E-04	4.00E-05	2.00E-04
N2	2.50E-06	6.20E-07	3.10E-06
CH4	2.00E-03	5.10E-04	2.60E-03
C2	3.60E-04	8.90E-05	4.50E-04
C3	2.60E-05	6.50E-06	3.20E-05
iC4	6.70E-07	1.70E-07	8.40E-07
nC4	1.30E-06	3.20E-07	1.60E-06
iC5	1.70E-07	4.10E-08	2.10E-07
nC5	8.40E-08	2.10E-08	1.00E-07
C6	5.20E-09	1.30E-09	6.50E-09
C7	4.60E-09	1.10E-09	5.70E-09
C8	8.40E-10	2.10E-10	1.00E-09
C9	9.00E-11	2.20E-11	1.10E-10
C10	6.00E-12	1.50E-12	7.50E-12
Benzene	2.90E-09	7.20E-10	3.60E-09
Toluene	7.50E-09	1.90E-09	9.30E-09
Ethylbenzene	8.70E-10	2.20E-10	1.10E-09
o-Xylene	6.10E-09	1.50E-09	7.60E-09
n-C6	4.90E-10	1.20E-10	6.20E-10
H2O	0.049	0.012	0.062

GRI-GLYCalc 4.0 Reports

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Bluestone Compressor Station
File Name: W:\20161518 Antero Bluestone CS Air Permit\2.0 Technical Information\WVDEQ Application\Attachment I\GLYCalc\Bluestone CS.ddf
Date: August 12, 2015

DESCRIPTION:

Description: 1 x 6 MMSCFD TEG Dehydration Unit with 0.5 MMBtu/hr reboiler

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 70.00 deg. F
Pressure: 875.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.1270
Nitrogen	0.1743
Methane	88.0529
Ethane	8.7429
Propane	1.7103
Isobutane	0.2658
n-Butane	0.3537
Isopentane	0.1404
n-Pentane	0.0987
n-Hexane	0.0659
Other Hexanes	0.0271
Heptanes	0.0997
Benzene	0.0034
Toluene	0.0120
Ethylbenzene	0.0017
Xylenes	0.0154
C8+ Heavies	0.1090

DRY GAS:

Flow Rate: 6.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 1.5 wt% H2O
Recirculation Ratio: 3.0 gal/lb H2O

PUMP:

Glycol Pump Type: Gas Injection
Gas Injection Pump Volume Ratio: 0.029 acfm gas/gpm glycol

FLASH TANK:

Flash Control:	Combustion device
Flash Control Efficiency:	95.00 %
Temperature:	250.0 deg. F
Pressure:	120.0 psig

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Bluestone Compressor Station
File Name: W:\20161518 Antero Bluestone CS Air Permit\2.0 Technical Information\WVDEQ Application\Attachment I\GLYCalc\Bluestone CS.ddf
Date: July 21, 2015

DESCRIPTION:

Description: 1 x 6 MMSCFD TEG Dehydration Unit with 0.5 MMBtu/hr reboiler

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0488	1.171	0.2137
Ethane	0.0325	0.780	0.1423
Propane	0.0229	0.551	0.1005
Isobutane	0.0069	0.165	0.0301
n-Butane	0.0129	0.310	0.0565
Isopentane	0.0061	0.147	0.0268
n-Pentane	0.0059	0.143	0.0260
n-Hexane	0.0093	0.224	0.0409
Other Hexanes	0.0026	0.062	0.0112
Heptanes	0.0382	0.917	0.1674
Benzene	0.0617	1.480	0.2701
Toluene	0.3923	9.415	1.7182
Ethylbenzene	0.0867	2.080	0.3796
Xylenes	1.1675	28.019	5.1135
C8+ Heavies	0.0962	2.309	0.4213
Total Emissions	1.9905	47.771	8.7183
Total Hydrocarbon Emissions	1.9905	47.771	8.7183
Total VOC Emissions	1.9092	45.820	8.3622
Total HAP Emissions	1.7174	41.218	7.5223
Total BTEX Emissions	1.7081	40.994	7.4814

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0710	1.703	0.3108
Ethane	0.0193	0.464	0.0847
Propane	0.0070	0.168	0.0307
Isobutane	0.0018	0.042	0.0077
n-Butane	0.0028	0.068	0.0124
Isopentane	0.0014	0.034	0.0062
n-Pentane	0.0012	0.029	0.0053
n-Hexane	0.0014	0.033	0.0060
Other Hexanes	0.0005	0.011	0.0020
Heptanes	0.0037	0.089	0.0163
Benzene	0.0006	0.014	0.0025
Toluene	0.0031	0.075	0.0136
Ethylbenzene	0.0005	0.012	0.0022
Xylenes	0.0052	0.124	0.0226
C8+ Heavies	0.0109	0.262	0.0478

Total Emissions	0.1303	3.128	0.5709
Total Hydrocarbon Emissions	0.1303	3.128	0.5709
Total VOC Emissions	0.0401	0.961	0.1754
Total HAP Emissions	0.0107	0.258	0.0470
Total BTEX Emissions	0.0094	0.225	0.0410

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	1.4191	34.058	6.2155
Ethane	0.3866	9.277	1.6931
Propane	0.1400	3.361	0.6134
Isobutane	0.0352	0.844	0.1541
n-Butane	0.0568	1.362	0.2486
Isopentane	0.0283	0.679	0.1238
n-Pentane	0.0241	0.577	0.1054
n-Hexane	0.0275	0.661	0.1206
Other Hexanes	0.0093	0.223	0.0407
Heptanes	0.0744	1.786	0.3260
Benzene	0.0115	0.276	0.0504
Toluene	0.0622	1.493	0.2725
Ethylbenzene	0.0102	0.246	0.0449
Xylenes	0.1031	2.475	0.4517
C8+ Heavies	0.2185	5.243	0.9568
Total Emissions	2.6067	62.562	11.4175
Total Hydrocarbon Emissions	2.6067	62.562	11.4175
Total VOC Emissions	0.8011	19.227	3.5089
Total HAP Emissions	0.2146	5.151	0.9401
Total BTEX Emissions	0.1871	4.490	0.8194

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.1198	2.874	0.5245
Ethane	0.0518	1.244	0.2270
Propane	0.0299	0.719	0.1311
Isobutane	0.0086	0.207	0.0378
n-Butane	0.0157	0.378	0.0690
Isopentane	0.0075	0.181	0.0330
n-Pentane	0.0071	0.172	0.0313
n-Hexane	0.0107	0.257	0.0469
Other Hexanes	0.0030	0.073	0.0133
Heptanes	0.0420	1.007	0.1837
Benzene	0.0623	1.494	0.2727
Toluene	0.3954	9.490	1.7318
Ethylbenzene	0.0872	2.092	0.3818
Xylenes	1.1726	28.143	5.1360
C8+ Heavies	0.1071	2.571	0.4692
Total Emissions	2.1208	50.899	9.2891
Total Hydrocarbon Emissions	2.1208	50.899	9.2891
Total VOC Emissions	1.9492	46.782	8.5377
Total HAP Emissions	1.7281	41.475	7.5693
Total BTEX Emissions	1.7174	41.218	7.5223

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	6.4293	0.5245	91.84
Ethane	1.8354	0.2270	87.63
Propane	0.7139	0.1311	81.63
Isobutane	0.1842	0.0378	79.48
n-Butane	0.3051	0.0690	77.40
Isopentane	0.1506	0.0330	78.09
n-Pentane	0.1314	0.0313	76.18
n-Hexane	0.1616	0.0469	70.94
Other Hexanes	0.0520	0.0133	74.44
Heptanes	0.4934	0.1837	62.76
Benzene	0.3206	0.2727	14.94
Toluene	1.9907	1.7318	13.00
Ethylbenzene	0.4244	0.3818	10.05
Xylenes	5.5651	5.1360	7.71
C8+ Heavies	1.3781	0.4692	65.96
Total Emissions	20.1358	9.2891	53.87
Total Hydrocarbon Emissions	20.1358	9.2891	53.87
Total VOC Emissions	11.8711	8.5377	28.08
Total HAP Emissions	8.4624	7.5693	10.55
Total BTEX Emissions	8.3008	7.5223	9.38

EQUIPMENT REPORTS:

ABSORBER

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages:	1.25	
Calculated Dry Gas Dew Point:	2.10	lbs. H2O/MMSCF
Temperature:	70.0	deg. F
Pressure:	875.0	psig
Dry Gas Flow Rate:	6.0000	MMSCF/day
Glycol Losses with Dry Gas:	0.0222	lb/hr
Wet Gas Water Content:	Saturated	
Calculated Wet Gas Water Content:	25.68	lbs. H2O/MMSCF
Specified Lean Glycol Recirc. Ratio:	3.00	gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	8.16%	91.84%
Carbon Dioxide	99.94%	0.06%
Nitrogen	100.00%	0.00%
Methane	100.00%	0.00%
Ethane	99.99%	0.01%
Propane	99.98%	0.02%
Isobutane	99.97%	0.03%
n-Butane	99.96%	0.04%
Isopentane	99.96%	0.04%
n-Pentane	99.95%	0.05%
n-Hexane	99.91%	0.09%
Other Hexanes	99.93%	0.07%
Heptanes	99.84%	0.16%
Benzene	95.83%	4.17%
Toluene	93.77%	6.23%

Ethylbenzene	91.86%	8.14%
Xylenes	88.21%	11.79%
C8+ Heavies	99.75%	0.25%

FLASH TANK

Flash Control: Combustion device
Flash Control Efficiency: 95.00 %
Flash Temperature: 250.0 deg. F
Flash Pressure: 120.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.05%	0.95%
Carbon Dioxide	16.55%	83.45%
Nitrogen	3.29%	96.71%
Methane	3.33%	96.67%
Ethane	7.75%	92.25%
Propane	14.08%	85.92%
Isobutane	16.34%	83.66%
n-Butane	18.53%	81.47%
Isopentane	18.11%	81.89%
n-Pentane	20.14%	79.86%
n-Hexane	25.66%	74.34%
Other Hexanes	22.30%	77.70%
Heptanes	34.25%	65.75%
Benzene	85.06%	14.94%
Toluene	87.39%	12.61%
Ethylbenzene	90.53%	9.47%
Xylenes	92.94%	7.06%
C8+ Heavies	38.58%	61.42%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	25.24%	74.76%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	2.12%	97.88%
n-Pentane	2.02%	97.98%
n-Hexane	1.71%	98.29%
Other Hexanes	3.80%	96.20%
Heptanes	1.36%	98.64%
Benzene	5.86%	94.14%
Toluene	9.03%	90.97%
Ethylbenzene	11.50%	88.50%
Xylenes	13.93%	86.07%
C8+ Heavies	29.90%	70.10%

STREAM REPORTS:

WET GAS STREAM

Temperature: 70.00 deg. F
Pressure: 889.70 psia
Flow Rate: 2.50e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	5.41e-002	6.42e+000
Carbon Dioxide	1.27e-001	3.68e+001
Nitrogen	1.74e-001	3.22e+001
Methane	8.80e+001	9.31e+003
Ethane	8.74e+000	1.73e+003
Propane	1.71e+000	4.97e+002
Isobutane	2.66e-001	1.02e+002
n-Butane	3.54e-001	1.35e+002
Isopentane	1.40e-001	6.67e+001
n-Pentane	9.86e-002	4.69e+001
n-Hexane	6.59e-002	3.74e+001
Other Hexanes	2.71e-002	1.54e+001
Heptanes	9.96e-002	6.58e+001
Benzene	3.40e-003	1.75e+000
Toluene	1.20e-002	7.29e+000
Ethylbenzene	1.70e-003	1.19e+000
Xylenes	1.54e-002	1.08e+001
C8+ Heavies	1.09e-001	1.22e+002
Total Components	100.00	1.22e+004

DRY GAS STREAM

Temperature: 70.00 deg. F
Pressure: 889.70 psia
Flow Rate: 2.50e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	4.41e-003	5.24e-001
Carbon Dioxide	1.27e-001	3.68e+001
Nitrogen	1.74e-001	3.22e+001
Methane	8.81e+001	9.31e+003
Ethane	8.74e+000	1.73e+003
Propane	1.71e+000	4.97e+002
Isobutane	2.66e-001	1.02e+002
n-Butane	3.54e-001	1.35e+002
Isopentane	1.40e-001	6.67e+001
n-Pentane	9.87e-002	4.69e+001
n-Hexane	6.58e-002	3.74e+001
Other Hexanes	2.71e-002	1.54e+001
Heptanes	9.95e-002	6.57e+001
Benzene	3.26e-003	1.68e+000
Toluene	1.13e-002	6.83e+000
Ethylbenzene	1.56e-003	1.09e+000
Xylenes	1.36e-002	9.50e+000
C8+ Heavies	1.09e-001	1.22e+002
Total Components	100.00	1.22e+004

LEAN GLYCOL STREAM

Temperature: 70.00 deg. F
Flow Rate: 2.33e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.83e+001	1.29e+002
Water	1.50e+000	1.97e+000
Carbon Dioxide	1.75e-012	2.29e-012
Nitrogen	1.08e-013	1.42e-013
Methane	9.20e-018	1.20e-017
Ethane	7.65e-008	1.00e-007
Propane	3.22e-009	4.22e-009
Isobutane	6.85e-010	8.98e-010
n-Butane	1.01e-009	1.33e-009
Isopentane	1.01e-004	1.33e-004
n-Pentane	9.36e-005	1.23e-004
n-Hexane	1.24e-004	1.63e-004
Other Hexanes	7.73e-005	1.01e-004
Heptanes	4.02e-004	5.27e-004
Benzene	2.93e-003	3.84e-003
Toluene	2.97e-002	3.89e-002
Ethylbenzene	8.59e-003	1.13e-002
Xylenes	1.44e-001	1.89e-001
C8+ Heavies	3.13e-002	4.10e-002
Total Components	100.00	1.31e+002

RICH GLYCOL AND PUMP GAS STREAM

Temperature: 70.00 deg. F
Pressure: 889.70 psia
Flow Rate: 2.55e-001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.10e+001	1.29e+002
Water	5.56e+000	7.87e+000
Carbon Dioxide	1.93e-002	2.73e-002
Nitrogen	3.71e-003	5.25e-003
Methane	1.04e+000	1.47e+000
Ethane	2.96e-001	4.19e-001
Propane	1.15e-001	1.63e-001
Isobutane	2.97e-002	4.20e-002
n-Butane	4.92e-002	6.97e-002
Isopentane	2.44e-002	3.45e-002
n-Pentane	2.13e-002	3.01e-002
n-Hexane	2.62e-002	3.70e-002
Other Hexanes	8.45e-003	1.20e-002
Heptanes	8.00e-002	1.13e-001
Benzene	5.44e-002	7.70e-002
Toluene	3.49e-001	4.93e-001
Ethylbenzene	7.64e-002	1.08e-001
Xylenes	1.03e+000	1.46e+000
C8+ Heavies	2.51e-001	3.56e-001
Total Components	100.00	1.42e+002

FLASH TANK OFF GAS STREAM

Temperature: 250.00 deg. F

Pressure: 134.70 psia
Flow Rate: 4.40e+001 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	3.56e+000	7.44e-002
Carbon Dioxide	4.46e-001	2.27e-002
Nitrogen	1.56e-001	5.08e-003
Methane	7.63e+001	1.42e+000
Ethane	1.11e+001	3.87e-001
Propane	2.74e+000	1.40e-001
Isobutane	5.22e-001	3.52e-002
n-Butane	8.42e-001	5.68e-002
Isopentane	3.38e-001	2.83e-002
n-Pentane	2.87e-001	2.41e-002
n-Hexane	2.76e-001	2.75e-002
Other Hexanes	9.30e-002	9.30e-003
Heptanes	6.40e-001	7.44e-002
Benzene	1.27e-001	1.15e-002
Toluene	5.82e-001	6.22e-002
Ethylbenzene	8.32e-002	1.02e-002
Xylenes	8.37e-001	1.03e-001
C8+ Heavies	1.11e+000	2.18e-001
Total Components	100.00	2.71e+000

FLASH TANK GLYCOL STREAM

Temperature: 250.00 deg. F
Flow Rate: 2.49e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.27e+001	1.29e+002
Water	5.61e+000	7.79e+000
Carbon Dioxide	3.25e-003	4.51e-003
Nitrogen	1.25e-004	1.73e-004
Methane	3.52e-002	4.88e-002
Ethane	2.34e-002	3.25e-002
Propane	1.65e-002	2.29e-002
Isobutane	4.95e-003	6.87e-003
n-Butane	9.30e-003	1.29e-002
Isopentane	4.50e-003	6.25e-003
n-Pentane	4.37e-003	6.07e-003
n-Hexane	6.85e-003	9.50e-003
Other Hexanes	1.92e-003	2.67e-003
Heptanes	2.79e-002	3.88e-002
Benzene	4.72e-002	6.55e-002
Toluene	3.11e-001	4.31e-001
Ethylbenzene	7.05e-002	9.79e-002
Xylenes	9.77e-001	1.36e+000
C8+ Heavies	9.89e-002	1.37e-001
Total Components	100.00	1.39e+002

FLASH GAS EMISSIONS

Flow Rate: 1.65e+002 scfh
Control Method: Combustion Device
Control Efficiency: 95.00

Component	Conc. (vol%)	Loading (lb/hr)

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.11e+001	4.77e+000
Carbon Dioxide	3.76e+001	7.17e+000
Nitrogen	4.18e-002	5.08e-003
Methane	1.02e+000	7.10e-002
Ethane	1.48e-001	1.93e-002
Propane	3.66e-002	7.00e-003
Isobutane	6.98e-003	1.76e-003
n-Butane	1.13e-002	2.84e-003
Isopentane	4.52e-003	1.41e-003
n-Pentane	3.84e-003	1.20e-003
n-Hexane	3.69e-003	1.38e-003
Other Hexanes	1.24e-003	4.65e-004
Heptanes	8.56e-003	3.72e-003
Benzene	1.70e-003	5.75e-004
Toluene	7.79e-003	3.11e-003
Ethylbenzene	1.11e-003	5.12e-004
Xylenes	1.12e-002	5.16e-003
C8+ Heavies	1.48e-002	1.09e-002
Total Components	100.00	1.21e+001

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 1.32e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.33e+001	5.83e+000
Carbon Dioxide	2.96e-002	4.51e-003
Nitrogen	1.78e-003	1.73e-004
Methane	8.78e-001	4.88e-002
Ethane	3.12e-001	3.25e-002
Propane	1.50e-001	2.29e-002
Isobutane	3.41e-002	6.87e-003
n-Butane	6.40e-002	1.29e-002
Isopentane	2.45e-002	6.12e-003
n-Pentane	2.38e-002	5.94e-003
n-Hexane	3.13e-002	9.34e-003
Other Hexanes	8.59e-003	2.57e-003
Heptanes	1.10e-001	3.82e-002
Benzene	2.28e-001	6.17e-002
Toluene	1.23e+000	3.92e-001
Ethylbenzene	2.35e-001	8.67e-002
Xylenes	3.17e+000	1.17e+000
C8+ Heavies	1.63e-001	9.62e-002
Total Components	100.00	7.82e+000

Gas Analysis

MSES consultants, inc.

MSES consultants, inc. CORROSION PRODUCTS DIVISION

Extended Fractional Analysis

Antero Resources

PO Drawer 190 - Clarksburg, WV 26302-0190
Telephone: 304.624.9700 - Fax: 304.622.0981

Analysis No:	1
Analysis Date:	07/01/2015
MSES Project No.:	15-040

SAMPLE COLLECTION INFORMATION

Client:	Antero Resources	Sample Date:	6/26/2015
Sample Location:	luestone Compressor Dischar	Sample Time:	1:30 PM
Sample Collection Source:	Discharge	Collected By:	TB
MSES Sample Number:	N/A	Sample Pressure:	875
Date Received at Lab:	6/26/2015	Sample Temp. (°F):	N/A
Collection Remarks:	N/A	Sample Container Type:	Cylinder
		MSES/CPD ID#	070
		Client ID #:	N/A

ANALYSIS REPORT

FRACTIONAL ANALYSIS

COMPONENTS	MOLE PERCENT	GPM
NITROGEN	0.1743	
CARBON DIOXIDE	0.1270	
METHANE	88.0529	
ETHANE	8.7429	2.33
PROPANE	1.7103	0.47
I-BUTANE	0.2658	0.09
N-BUTANE	0.3537	0.11
I-PENTANES	0.1404	0.05
N-PENTANE	0.0987	0.04
I-HEXANES	0.0305	0.01
N-HEXANE	0.0659	0.03
I-HEPTANES	0.0398	0.02
N-HEPTANE	0.0719	0.03
I-OCTANES	0.0109	0.01
N-OCTANE	0.0913	0.05
I-NONANES	0.0080	0.00
N-NONANE	0.0095	0.01
I-DECANES	0.0024	0.00
N-DECANE	0.0037	0.00
I-UNDECANES	<0.0001	0.00
I-DECANE	<0.0001	0.00
DODECANES +	<0.0001	0.00
TOTAL	100.000	

ANALYTICAL RESULTS

REAL VALUES ARE CALCULATED AT 14.696 PSI AND 60° F

BTU/SCF (DRY):	1138.32
BTU/SCF (WET):	1133.29
SUM. FACTOR (DRY):	0.9973
SUM. FACTOR (WET):	0.9968
ETHANE + GPM:	3.2488
REAL DENSITY:	0.6397

COMMENTS

ANALYTICAL METHODS AND VALUES

(1) Extended analysis and reporting performed following procedures outlined in GPA 2286-95: Tentative Method of Extended Analysis for Natural Gas and Similar Mxitures by Temperature Programmed Gas Chromatography

(2) Physical properties and values used in calculations were acquired from GPA 2145-09: Table of Physical properties for Hydrocarbons and Other Compounds of Interest to the Natural Gas Industry

(3) Limit of Detection = 0.0001 Mole Percent

Attachment J.
Public Notice

AIR QUALITY PERMIT NOTICE
Notice of Application – Bluestone Compressor Station

Notice is given that Antero Midstream LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a modification to the existing General Permit Registration G35-A004A for natural gas compressor station located north of US-50 near Salem, in Harrison County, West Virginia. The latitude and longitude coordinates are: 39.29885N, 80.59530W.

The applicant estimates the change in potential to discharge of the following Regulated Air Pollutants in the table below. Please note that negative changes are a result of decreased potential to emit and positive change are a result of increased potential to emit.

Pollutant	Emission Change (tons per year)
Nitrogen Oxides (NOx)	-69.87
Carbon Monoxide (CO)	-70.74
Volatile Organic Compounds (VOC)	-3.22
Formaldehyde	-9.13
Benzene	0.17
Toluene	1.44
Ethylbenzene	-0.02
Xylenes	4.05
n-Hexane	-0.28

Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice.

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 1227, during normal business hours.

Dated the 17th day of August 2015.

By: Antero Midstream LLC
Luz Slauter
Midstream Environmental and Regulatory Manager
1615 Wynkoop Street
Denver, CO 80202

Attachment N.
Material Safety Data Sheets

SAFETY DATA SHEET

Material Name: Dry Field Natural Gas **US GHS**

SYNONYMS: **CNG, Natural Gas, Methane.**

* * * Section 1 – PRODUCT AND COMPANY IDENTIFICATION * * *

PRODUCT NAME: **Dry Field Natural Gas**
PRODUCT CODES: **CAS Reg. No. 68410-63-9**

EMERGENCY PHONE: **(800) 878-1373**
AFTER HOURS: **(800) 878-1373**

PRODUCER: **Antero Resources**
ADDRESS: **1615 Wynkoop Street**
Denver, Colorado 80202

CHEMTREC PHONE: **(800) 424-9300**

* * * Section 2 – HAZARDS IDENTIFICATION * * *

GHS Classification:

Flammable Gas – Category 1.
Gases Under Pressure – Gas.
Specific Target Organ Systemic Toxicity (STOT) – Single Exposure Category 2.

GHS LABEL ELEMENTS

Symbol(s)

Signal Word

Danger

Hazard Statements

Extremely flammable gas.
Contains gas under pressure, may explode if heated.
May cause damage to central nervous and respiratory systems.

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking.
Do not breathe fume/gas/mist/vapors/spray.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.

Response

Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.
If exposed to gas, or concerned about possible exposure: Call a POISON CENTER or doctor/physician.

Storage

Protect from sunlight. Store in a well-ventilated place.
Store in a secure area.

Disposal

Dispose of contents/containers in accordance with local/regional/national/international regulations.

* * * Section 3 – COMPOSITION / INFORMATION ON INGREDIENTS * * *

CAS #	Component	Percent
74-82-8	Methane	95.01
78-84-0	Ethane	3.99
74-98-6	Propane	0.32
106-97-8	Butanes	0.07
109-66-0	Pentanes	0.02
110-54-3	Hexanes	0.01
7727-37-9	Nitrogen	0.35
124-38-9	Carbon Dioxide	0.19
7782-44-7	Oxygen	0.03

Because natural gas is a natural product, composition can vary greatly.

* * * Section 4 – FIRST AID MEASURES * * *

First Aid: Eyes

In case of freeze burn, cover eyes to protect from light. Flush eyes with running water for at least fifteen (15) minutes. Following flushing, seek medical attention.

First Aid: Skin

Remove contaminated clothing. In case of blistering, frostbite or freeze burns, seek immediate medical attention.

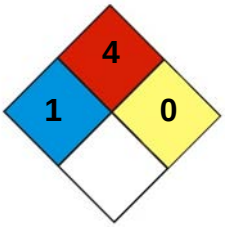
First Aid: Ingestion

Risk of ingestion is extremely low. However, if oral exposure occurs, seek immediate medical assistance.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 – FIRE FIGHTING MEASURES * * *



NFPA 704 Hazard Class

Health: **1** Flammability: **4** Instability: **0** (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

General Fire Hazards

See Section 9 for Flammability Properties.
Forms a flammable mixture with air. If released, the resulting vapors will disperse with the prevailing wind. If a source of ignition is present where the vapor exists at a 5 – 15% concentration in air, the vapor will burn along the flame front toward the source of the fuel.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Extinguishing Media

Any extinguisher suitable for Class B fires, dry chemical, fire fighting foam, CO2, and other gaseous agents. However, fire should not be extinguished unless flow of gas can be immediately stopped.

Unsuitable Extinguishing Media

None.

Fire Fighting Equipment / Instructions

Gas fires should not be extinguished unless flow of gas can be immediately stopped. Shut off gas source and allow gas to burn out. If spill or leak has not ignited, determine

if water spray may assist in dispersing gas or vapor to protect personnel attempting to stop leak. Use water to cool equipment, surfaces and piping exposed to fire and excessive heat. For large fire, the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Isolate area, particularly around piping. Let the fire burn unless leak can be stopped. Concentrate fire-fighting efforts on objects / materials ignited by the initial fire. Withdraw immediately in the event of a rising sound from a venting safety device.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH-approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

* * * Section 6 – ACCIDENTAL RELEASE MEASURES * * *

Recovery and Neutralization

Stop the source of the release, if safe to do so.

Materials and Methods for Clean-Up

Consider the use of water spray to disperse gas vapors. Do not use water spray to direct gas vapors toward sewer or drainage systems. Isolate the area until gas has dispersed. Ventilate and gas test area before entering.

Emergency Measures

Evacuate nonessential personnel and secure all ignition sources. No road flares, smoking or flames in hazard area. Consider wind direction. Stay upwind and uphill, if possible. Vapor cloud may be white, but color will dissipate as cloud disperses. Fire and explosion hazard is still present.

Personal Precautions and Protective Equipment

Cooling effect of expanding gas from leak may present frostbite / freeze burn hazard. Wear flame retardant (FR) clothing around un-ignited leak. Wear fire protective clothing around an active fire.

Environmental Precautions

Do not flush gas vapors toward sewer or drainage systems.

Prevention of Secondary Hazards

None.

* * * Section 7 – HANDLING AND STORAGE * * *

Handling Procedures

Keep away from flame, sparks and excessive temperatures. Bond and ground containers. Use only in well ventilated areas.

Storage Procedures

Natural gas will be contained in the pipeline. Keep away from flame, sparks, excessive temperatures and open flames. Empty pipeline segments may contain explosive residues from natural gas liquids. Do not cut, heat, weld or expose containers to sources of ignition sections of pipeline unless the sections have been purged of natural gas residues.

Incompatibilities

Keep away from strong oxidizers, ignition sources and heat.

* * * Section 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION * * *

Component Exposure Limits

Methane (74-82-8)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases : Alkane C1-4)

Ethane (74-84-0)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases : Alkane C1-4)

Propane (74-98-6)

ACGIH: 2500 ppm TWA (listed under Aliphatic hydrocarbon gases : Alkane C1-4)

Butane (106-97-8)

ACGIH: 800 ppm TWA (listed under Aliphatic hydrocarbon gases : Alkane C1-4)

Pentanes (109-66-0)

ACGIH: 600 ppm TWA (listed under Pentane, all isomers)

Hexanes (110-54-3)

ACGIH: 50 ppm TWA (listed under n-Hexane)

Nitrogen (7727-37-9)

Simple Asphyxiant

Carbon Dioxide (124-38-9)

ACGIH: 5000 ppm TWA (listed under Carbon Dioxide)

Oxygen (7782-44-7)

N/A – Necessary for life

Engineering Measures

Use adequate ventilation to keep gas and vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces. Use explosion-proof equipment and lighting in classified / controlled areas.

Personal Protective Equipment: Respiratory

Use a NIOSH approved positive-pressure, supplied air respirator with escape bottle or self-contained breathing apparatus (SCBA) for gas concentrations above occupational exposure limits, for potential for uncontrolled release, if exposure levels are not known, or in an oxygen-deficient atmosphere. CAUTION: Flammability limits (i.e., explosion hazard should be considered when assessing the need to expose personnel to concentrations requiring respiratory protection.

Personal Protective Equipment: Hands

Use cold-impervious, insulating flame-retardant (FR) gloves where contact with pressurized gas may occur.

Personal Protective Equipment: Eyes

Where there is a possibility of pressurized gas contact, wear splash-proof safety goggles and faceshield.

Personal Protective Equipment: Skin and Body

Where contact with pressurized gas may occur, wear flame-retardant (FR) and a faceshield.

* * * Section 9 – PHYSICAL AND CHEMICAL PROPERTIES * * *

Appearance:	Colorless	**Odor:**	Odorless to slight petroleum odor
Physical State:	Gas	**pH:**	ND
Vapor Pressure:	40 atm @ -187°F (-86°C)	**Vapor Density:**	0.6
Boiling Point:	-259°F (-162°C)	**Melting Point:**	ND
Solubility (H2O):	3.5%	**Specific Gravity:**	0.4 @ -263°F (-164°C)

Evaporation Rate:	ND	**VOC:**	ND
Octanol / H2O Coeff.:	ND	**Flash Point:**	Flammable Gas
Flash Point Method:	N/A		
Lower Flammability Limit: (LFL):	3.8 – 6.5	**Upper Flammability Limit: (UFL):**	13-17
Auto Ignition:	900-1170°F (482-632°C)	**Burning Rate:**	ND

* * * Section 10 – CHEMICAL STABILITY & REACTIVITY INFORMATION * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Keep away from strong oxidizers, ignition sources and heat.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

* * * Section 11 – TOXICOLOGICAL INFORMATION * * *

Acute Toxicity

A: General Product Information

Methane and ethane, the main components of natural gas, are considered practically inert in terms of physiological effects. At high concentrations these materials act as simple asphyxiants and may cause death due to lack of oxygen.

B. Component Analysis – LD50/LC50

Methane (74-82-8)

Inhalation LC50 Mouse 326 g/m3 2h

Ethane (74-84-0)

Inhalation LC50 Rat 658 mg/l 4h

Propane (74-98-6)

Inhalation LC50 Rat 658 mg/l 4h

Butanes (106-97-8)
Inhalation LC50 Rat 658 g/m3 4h

Pentanes (109-66-0)
Inhalation LD50 Rat 364 g/m3 4h

Hexanes (110-54-3)
Inhalation LC50 Rat > 20 mg/l 4h

Nitrogen (7727-37-9)
Simple Asphyxiant

Carbon Dioxide (124-38-9)
Inhalation LC50 Human 100,000 ppm 1minute

Oxygen (7782-44-7)
N/A – Necessary for life

Potential Health Effects: Skin Corrosion Property / Stimulativeness
This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity
This product is not reported to have any mutagenic effects.

Carcinogenicity

A: General Product Information
This product is not reported to have any carcinogenic effects.

B: Component Carcinogenicity
None of this product's components are listed by ACGIH, IARC, OSHA, NIOSH, or NTP.

Reproductive Toxicity
This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure
This product may cause damage to the heart.

Specified Target Organ General Toxicity: Repeated Exposure
This product is not reported to have any specific target organ repeat effects.

Aspiration Respiratory Organs Hazard
This product is not reported to have any aspiration hazard effects.

* * * Section 12 – ECOLOGICAL INFORMATION * * *

Ecotoxicity

A: General Product Information

Keep gas and vapors out of sewers, drainage areas, and waterways. Report spills and releases, as applicable under Federal and State regulations.

B: Component Analysis – Ecotoxicity – Aquatic Toxicity

No ecotoxicity data are available for this product's components.

Persistance / Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

* * * Section 13 – DISPOSAL CONSIDERATIONS * * *

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment Recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents / container in accordance with local / regional / national / international regulations.

* * * Section 14 – TRANSPORTATION INFORMATION * * *

DOT Information

Shipping Name: Natural Gas, Compressed

UN #: 1971 **Hazard Class:** 2.1

Placard:

* * * Section 15 – REGULATORY INFORMATION * * *

Regulatory Information

Component Analysis

None of this products components are listed under SARA Section 302 (40 CFR 355 Appendix A.
n-hexane is listed under SARA Section 313 (40 CFR 372.65). However the concentration of this component is approximately 0.01 % in compressed natural gas and is therefore far under the reporting threshold for the chemical.

n-hexane is listed under CERCLA (40 CFR 302.4). However the concentration of this component is approximately 0.01 % in compressed natural gas and is therefore far under the reporting threshold for the chemical.

SARA Section 311/312 – Hazard Classes

Acute Health	Chronic Health	Fire	Sudden Release of Pressure	Reactive
---	---	X	X	---

SARA Section 313 – Supplier Notification

This product contains one chemical (n-Hexane) that is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-to-know act (EPCRA) of 1986 and of 40 CFR 372. However the concentration of this component is approximately 0.01 % in compressed natural gas and is therefore far under the reporting threshold for the chemical.

State Regulations

Component Analysis – State

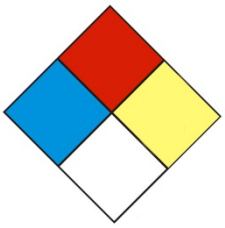
The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Methane	74-82-8	No	No	Yes	Yes	Yes	No
Ethane	78-84-0	No	No	Yes	Yes	Yes	No
Propane	74-98-6	No	No	Yes	Yes	Yes	Yes
Butane	106-97-8	Yes	No	Yes	Yes	Yes	Yes
Pentanes	109-66-0	Yes	No	Yes	Yes	Yes	Yes
Hexanes	110-54-3	Yes	Yes	Yes	Yes	Yes	Yes
Nitrogen	7727-37-9	No	No	No	No	No	No
Carbon Dioxide	124-38-9	Yes	No	Yes	Yes	Yes	Yes
Oxygen	7782-44-7	No	No	No	No	No	No

* * * Section 16 – OTHER INFORMATION * * *

NFPA® Hazard Rating

Health	1
Fire	4
Reactivity	0



HMIS® Hazard Rating

Health	1	Moderate
Fire	4	Severe
Physical	0	Minimal
		* Chronic

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act: ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; NJTSR = New Jersey Trade Secret Registry.

Literature References

None

Other Information

The information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

Date of Preparation: January 30, 2014

Date of Last Revision: March 4, 2014

End of Sheet

SAFETY DATA SHEET

Material Name: Produced Water **US GHS**

SYNONYMS: **Produced Brine Water, Brine, Brine Water, Formation Water**

* * * Section 1 – PRODUCT AND COMPANY IDENTIFICATION * * *

PRODUCT NAME: **Produced Water**
PRODUCT CODES: **Mixture**

EMERGENCY PHONE: **(800) 878-1373**
AFTER HOURS: **(800) 878-1373**

PRODUCER: **Antero Resources**
ADDRESS: **1615 Wynkoop Street**
Denver, Colorado 80202

CHEMTREC PHONE: **(800) 424-9300**

* * * Section 2 – HAZARDS IDENTIFICATION * * *

GHS Classification:

Eye Irritant – Category 2A.

GHS LABEL ELEMENTS
Symbol(s)

Signal Word

Warning

Hazard Statements

Causes serious eye irritation

Precautionary Statements

Prevention

Wear protective gloves/protective clothing/eye protection/face protection.

Response

If on SKIN (or hair): Rinse skin with water / shower. Remove / Take off all contaminated clothing immediately.

If in EYES: Rinse cautiously with water for at least fifteen (15) minutes. Remove Contact Lenses, if present and easy to do. Continue rinsing.

If EYE irritation persists, get medical advice / attention.

Storage
Store in a secure area.

Disposal
Dispose of contents/containers in accordance with regulations.

* * * Section 3 – COMPOSITION / INFORMATION ON INGREDIENTS * * *

CAS #	Component	Percent
7732-18-5	Water	80
7647-14-5	Sodium Chloride	20

Because brine water is a natural product, composition can vary greatly.

* * * Section 4 – FIRST AID MEASURES * * *

First Aid: Eyes
Flush eyes with clean running water for at least fifteen (15) minutes. If irritation or redness develops from exposure, following flushing, seek medical attention.

First Aid: Skin
First aid is not required, normally. However, it is a good practice to wash any chemical from the skin.

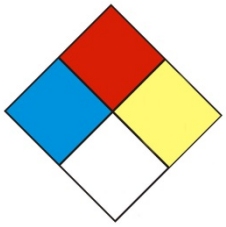
First Aid: Ingestion (Swallowing)
First aid is not required, normally. If spontaneous vomiting occurs, lean the victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. If symptoms develop, seek medical attention.

First Aid: Inhalation (Breathing)
Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

Most important symptoms and effects

None known or anticipated.

* * * Section 5 – FIRE FIGHTING MEASURES * * *



NFPA 704 Hazard Class

Health: 1 Flammability: 0 Instability: 0 (0=Minimal, 1=Slight, 2=Moderate, 3=Serious, 4=Severe)

General Fire Hazards

No fire hazards are expected.

General Fire Hazards

No unusual fire or explosion hazards are expected. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media

The material is non-flammable. Use extinguishing agent suitable for the type of surrounding fire.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment / Instructions

Small fires in the beginning stage may typically be extinguished using handheld portable fire extinguishers and other firefighting equipment. Isolate area around container involved in fire and keep unauthorized personnel out. Stop spill/release if it can be done safely. Move undamaged containers from the immediate hazard area if it can be done safely. Cool equipment exposed to fire with water, if it can be done safely.

Hazardous Combustion Products

None Anticipated. See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

* * * Section 6 – ACCIDENTAL RELEASE MEASURES * * *

Recovery and Neutralization

Contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios of this material. However, local conditions and regulations may influence or limit the choice of appropriate actions to be taken. See Section 13 for information on appropriate disposal.

Emergency Measures

The material is not considered hazardous. Nevertheless, evacuate nonessential personnel and secure the area. Stay upwind and uphill, if possible.

Personal Precautions and Protective Equipment

Stay upwind and away from the spill/release. Avoid direct contact with the material. For large spillages, notify persons downstream of the spill/release. Isolate the immediate hazard area and keep unauthorized personnel out. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking or absorbents, if possible. Do not flush down sewer or drainage systems. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If a spill occurs on water, notify appropriate authorities and advise shipping of any hazard.

Prevention of Secondary Hazards

None

* * * Section 7 – HANDLING AND STORAGE * * *

Handling Procedures

Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29 CFR 1910.146. Do not wear contaminated clothing or shoes.

Storage Procedures

Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well ventilated areas. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

Incompatibilities

Keep away from excessive heat to prevent rupture of container.

* * * Section 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION * * *

Component Exposure Limits

Water (7732-18-5)

ACGIH: Not listed

Sodium Chloride (7647-14-5)

ACGIH: Not listed

Engineering Measures

If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Personal Protective Equipment: Respiratory

Emergencies or conditions that could result in significant airborne exposures may require the use of NIOSH approved respiratory protection. An industrial hygienist or other appropriate health and safety professional should be consulted for specific guidance under these situations.

A respiratory protection program that meets or is equivalent to OSHA 29 CFR

1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use.

Personal Protective Equipment: Skin and Hands

The use of skin protection is not normally required; however, good industrial hygiene practice suggests the use of gloves or other appropriate skin protection whenever working with chemicals.

Personal Protective Equipment: Eyes

Safety glasses or goggles that meet or exceed ANSI Z-87.1 are recommended where there is a possibility of splashing or spraying.

Hygiene Measures

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Promptly remove contaminated clothing and launder before reuse.

* * * Section 9 – PHYSICAL AND CHEMICAL PROPERTIES * * *

Appearance:	Clear to Brown	**Odor:**	Salty
Physical State:	Liquid	**pH:**	ND
Vapor Pressure:	< 0.36 psia @ 70°F / 21.1°C	**Vapor Density:**	> 1
Boiling Point:	212°F / 100°C	**Melting Point:**	2.4°F / -16.5°C
Solubility (H2O):	Complete	**Specific Gravity:**	1.1 @ 68°F / 20°C
Evaporation Rate:	Variable	**VOC:**	ND
Octanol / H2O Coeff.:	ND	**Flash Point:**	ND
Flash Point Method:	ND		
Lower Flammability Limit: (LFL):	ND	**Upper Flammability Limit: (UFL):**	ND
Auto Ignition:	ND	**Burning Rate:**	ND

* * * Section 10 – CHEMICAL STABILITY & REACTIVITY INFORMATION * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will react with alkali and alkaline metals to form flammable hydrogen gas.

Conditions to Avoid

Avoid contact with alkali metals (lithium, sodium, potassium), alkaline metals (beryllium, magnesium, calcium, strontium, and barium), and metallic hydrides like lithium aluminum hydride.

Hazardous Decomposition Products

Not anticipated under normal conditions of use.

Hazardous Polymerization

Not known to occur.

* * * Section 11 – TOXICOLOGICAL INFORMATION * * *

Acute Toxicity

A: General Product Information

Unlikely to be harmful.

B. Component Analysis – D50/LC50

Water (7732-18-5)

Oral LD50 Rat 90 g/kg

Sodium Chloride (7647-14-5)

Oral LD50 Rat 3 g/kg

Potential Health Effects: Skin Corrosion Property / Stimulativeness

May cause skin irritation with prolonged or repeated contact. Not expected to be a skin sensitizer.

Potential Health Effects: Eye Critical Damage / Stimulativeness

Contact with eyes may cause moderate irritation.

Potential Health Effects: Ingestion

Ingestion may result in nausea, vomiting, diarrhea, abdominal cramps, and dehydration (thirst).

Potential Health Effects: Inhalation

No information available on the mixture. However, none of the components have been classified for respiratory sensitization (or are below the concentration threshold for classification).

Generative Cell Mutagenicity

Not expected to cause genetic effects.

Carcinogenicity

General Product Information

Not expected to cause cancer. This substance is not listed as a carcinogen by IARC, NTP or OSHA.

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity multiple exposure effects.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

* * * Section 12 – ECOLOGICAL INFORMATION * * *

Ecotoxicity

A: General Product Information

Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable under Federal and State regulations.

Persistence / Degradability

No information available

Bioaccumulation

No information available

Mobility in Soil

No information available

* * * Section 13 – DISPOSAL CONSIDERATIONS * * *

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment Recommendations.

Disposal of Contaminated Containers or Packaging

Recover or recycle if possible. It is the responsibility of the generator to determine the toxicity and physical properties of the material generated so as to properly classify the waste and ensure disposal methods comply with applicable regulations.

This material, if discarded as produced, is not a RCRA "listed" hazardous waste, and is not believed to exhibit characteristics of hazardous waste. Consult state and local regulations regarding the proper disposal of this material. Do not dispose of brine water by draining onto the ground. This will result in soil and groundwater contamination. Waste arising from spillage or tank cleaning should be disposed of in accordance with applicable regulations.

Container contents should be completely used and containers should be emptied prior to discard. Container rinsate should not be considered a RCRA hazardous waste but must be disposed of with care and in full compliance with federal, state and local regulations. Larger empty containers, such as drums, should be returned to the distributor or to a qualified drum reconditioner. To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

* * * Section 14 – TRANSPORTATION INFORMATION * * *

DOT Information

Shipping Description: Not Regulated

UN #: Not Regulated

* * * Section 15 – REGULATORY INFORMATION * * *

CERCLA/SARA – Section 302 Extremely Hazardous Substances and TPQs (in pounds):
This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372,

CERCLA/SARA – Section 313 and 40 CFR 372):
This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

EPA (CERCLA) Reportable Quantity (in pounds):
This material does not contain any chemicals with CERCLA Reportable Quantities.

State Regulations

Component Analysis

The following components appear on one or more of the following state hazardous substances list.

California Proposition 65:
This material does not contain any chemicals that are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

National Chemical Inventories:
All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.

U.S. Export control classification Number: EAR99.

* * * Section 16 – OTHER INFORMATION * * *

NFPA® Hazard Rating

Health	1
Fire	0
Reactivity	0

HMIS® Hazard Rating	Health	1	Slight
	Fire	0	Minimal
	Physical	0	Minimal

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act: ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; NJTSR = New Jersey Trade Secret Registry.

Literature References

None

Other Information

The information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

Date of Preparation: January 28, 2014

Date of Last Revision: March 4, 2014

End of Sheet

Material Safety Data Sheet
(TRIETHYLENE GLYCOL (TEG))

JMN Specialties, Inc.
1100 Victory Drive
Westwego, LA 70094
(504) 341-3749
ISO 9001 Registered

HMIS HEALTH:.....2
HMIS FLAMMABILITY: 1
HMIS REACTIVITY:.....0
PERSONAL PROTECTION: C

EMERGENCY NUMBER: 800-255-3924

SECTION 1 – IDENTIFICATION OF CHEMICAL PRODUCT

PRODUCT NAME:..... TRIETHYLENE GLYCOL (TEG)
EFFECTIVE DATE:..... October 1, 2007
CHEMICAL FAMILY:..... Glycol
FORMULA: $C_6H_{14}O_4$
CAS NUMBER:..... 112-27-6

SECTION 2 – COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS INGREDIENT	PERCENT	CAS NUMBER	PEL
TRIETHYLENE GLYCOL	> 99	112-27-6	None Established by ACGIH or OSHA.

The criteria for listing components in the composition section are as follows: Carcinogens are listed when present at 0.1% or greater; components which are otherwise hazardous according to OSHA are listed when present at 1.0% or greater. Non-hazardous components may be listed at 3.0% or greater if not proprietary in nature. This is not intended to be complete compositional disclosure. Refer to section 14 for applicable states right to know and other regulatory information.

SECTION 3 – HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

APPEARANCE / ODOR:..... Clear Liquid / Mild Odor

SHORT TERM EXPOSURE: **Inhalation:** No adverse health effects expected from inhalation. **Ingestion:** No adverse effects expected. **Skin Contact:** Prolonged exposure may cause skin irritation. **Eye Contact:** Splashing in eye causes irritation with transitory disturbances of corneal epithelium. However, these effects diminish and no permanent injury is expected. Vapors are non-irritating. **Chronic Exposure:** Possible skin irritation. **Aggravation of Pre-existing Conditions:** No information found.

OSHA REGULATED:..... No

LISTED CARCINOGEN: ..... **NTP:** No **IARC MONOGRAPHS:** No

POTENTIAL HEALTH EFFECTS

INHALATION: ..... Unlikely
INGESTION:..... Irritant
SKIN (DERMAL): ..... Slight Irritant After Prolonged Contact

OVER EXPOSURE EFFECTS: **Inhalation:** No adverse health effects expected from inhalation. **Ingestion:** No adverse effects expected. **Skin Contact:** Prolonged exposure may cause skin irritation. **Eye Contact:** Splashing in eye causes irritation with transitory disturbances of corneal epithelium. However, these effects diminish and no permanent injury is expected. Vapors are non-irritating. **Chronic Exposure:** Possible skin irritation. **Aggravation of Pre-existing Conditions:** No information found.

SECTION 4 – FIRST AID MEASURES

FIRST AID: **SKIN CONTACT:** Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately. **EYE CONTACT:** Flush eyes immediately with large amounts of water or normal saline solution, occasionally lifting upper and lower lids until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately. **INGESTION:** Give large amounts of fresh water or milk immediately. Do not give anything by mouth if person is unconscious or otherwise unable to swallow. If vomiting occurs, keep head below hips to prevent aspiration. Treat symptomatically and supportively. Seek medical attention immediately. **INHALATION:** Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial resuscitation. Keep person warm and at rest. Treat symptomatically and supportively. Seek medical attention immediately. Qualified medical personnel should consider administering oxygen.

NOTE TO PHYSICIAN: ..... Ethylene Glycol (EG) and diethylene glycol (DEG) intoxication may initially produce behavioral changes, drowsiness, vomiting, diarrhea, thirst, and convulsions. EG and DEG are nephrotoxic. End stages of poisoning may include renal damage or failure with acidosis. Supportive measures, supplemented with hemodialysis if indicated, may limit the progression and severity of toxic effects. Primary toxic effects of EG when swallowed are kidney damage and metabolic acidosis. This product may contain trace amounts of Ethylene Glycol (EG) or Diethylene Glycol (DEG).

SECTION 5 - FIRE FIGHTING MEASURES

FLASHPOINT:..... 350°F

EXTINGUISHING MEDIA: Water fog or spray, Foam, Dry Powder, Carbon Dioxide (CO_2).

DECOMPOSITION PRODUCTS:..... From fire; Smoke, Carbon dioxide, & Carbon Monoxide

LOWER FLAME LIMIT:..... < 0.9

HIGHER FLAME LIMIT:..... > 9

UNUSUAL FIRE AND EXPLOSION HAZARDS:..... Toxic levels of carbon monoxide, carbon dioxide, irritation aldehydes and ketones may be formed on burning. Heating in air may produce irritating aldehydes, acids, and ketones.

FIRE FIGHTING

EQUIPMENT: ..... Fire fighters and others exposed to products of combustion should wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

CHEMTEL EMERGENCY NUMBER (24 Hour): **1-800-255-3924**

SPILL: ..... Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer!

RCRA STATUS: ..... None

SECTION 7 – HANDLING AND STORAGE

HANDLE IN ACCORDANCE WITH GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES. THESE PRACTICES INCLUDE AVOIDING UNNECESSARY EXPOSURE AND PROMPT REMOVAL OF MATERIAL FROM EYES, SKIN, AND CLOTHING.

HANDLING AND STORAGE: .. No special storage requirements. Do not store above 120°F.

PRECAUTIONARY MEASURES: ..... Provide fresh air ventilation during and after application. Close container after each use. Avoid prolonged or repeated contact with skin. Avoid contact with skin, eyes, and clothing. After handling this product, wash hands before eating, drinking, or smoking. If needed, take first aid action shown in Section 4.

SECTION 8 – EXPOSURE CONTROL / PERSONAL PROTECTION

GENERAL CONSIDERATIONS:

Consider the potential hazards of this material (see section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment.

EYE PROTECTION: ..... Chemical safety goggles meeting the specifications of OSHA 29CFR 1910.133 / ANSI Standard Z87.1 should be worn whenever there is the possibility of splashing or other contact with the eyes. Wear safety glasses meeting the specifications of OSHA 29CFR 1910.133 / ANSI Standard Z87.1 where no contact with the eye is anticipated.

RESPIRATORY PROTECTION: ..... Not normally needed. Use NIOSH approved vapor respirator if exposure is unknown or exceeds permissible limits. A respiratory protection program that meets OSHA's 29 CFR 1910.134 or ANSI Z88.2 requirements must be followed whenever workplace conditions warrant respirator use.

Use NIOSH / MSHA approved respiratory protection equipment when airborne exposure limits are exceeded (see below). Consult the respirator manufacturer to determine appropriate type of

equipment for a given application. Observe respirator use limitations specified by NIOSH / MSHA or the manufacturer. Respiratory protection programs must comply with 29 CFR 1910.134.
WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
PROTECTIVE GLOVES:..... Wear impervious gloves
VENTILATION: A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
MECHANICAL EXHAUST: ..... Desired in closed places
LOCAL EXHAUST: ..... Recommended

VENTILATION NOTES: Provide natural or mechanical ventilation to control exposure levels below Airborne exposure limits (see below). The use of local mechanical exhaust ventilation is preferred at sources of air contamination such as open process equipment. Consult NFPA Standard 91 for design of exhaust systems.

THRESHOLD LIMIT VALUE: . None Established
PROTECTIVE EQUIPMENT:... HMIS PERSONAL PROTECTION: C: Safety Glasses, Gloves, Apron
The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE / ODOR: ..... Clear Liquid / Mild Odor
BOILING POINT: ..... > 500°F
FREEZING POINT: ..... < 32°F
VAPOR PRESSURE:..... > 1
VAPOR DENSITY (AIR=1): 5.1
SPECIFIC GRAVITY: 1.1
pH: 8.2
SOLUBILITY IN WATER: ..... Complete

SECTION 10 – STABILITY AND REACTIVITY

STABILITY:..... Stable
HAZARDOUS
POLYMERIZATION:..... Will Not Occur
POLYMERIZATION AVOID:... None
INCOMPATIBILITY:..... Explosive decomposition may occur if combined with strong acids or strong bases and subjected to elevated temperatures. Therefore, avoid strong acids and strong bases at elevated temperatures. Avoid contamination with strong oxidizing agentsand materials reactive with hydroxyl compounds. Avoid burning or heating in air. This may produce irritating aldehydes, acids, and ketones.
CONDITIONS TO AVOID:..... Excessive heat. Will ignite in air at 700°F

Material Safety Data Sheet
(TRIETHYLENE GLYCOL (TEG))

SECTION 11 – TOXICOLOGICAL INFORMATION

EYE EFFECTS:
The eye irritation hazard is based on data from information supplied by raw material(s) supplier(s).
SKIN EFFECTS:
The skin irritation hazard is based on data from information supplied by raw material(s) supplier(s).
ACUTE ORAL EFFECTS:
The acute oral toxicity is based on data from information supplied by raw material(s) supplier(s).
ACUTE INHALATION EFFECTS:
The acute respiratory toxicity is based on data from information supplied by raw material(s) supplier(s).

SECTION 12 – ECOLOGICAL INFORMATION

Data from laboratory studies and from scientific literature is noted below if available.

SECTION 13 DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: ..... Treatment, storage, transportation and disposal must be in accordance with Federal, State/Provincial and Local Regulations. Regulations may vary in different locations. Characterization and compliance with applicable laws are the responsibility solely of the generator. Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

SECTION 14- TRANSPORTATION INFORMATION

The data provided in this section is for information only. The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate regulations to properly classify your shipment for transportation.

PROPER SHIPPING NAME:..... DOT NON-REGULATED - TRIETHYLENE GLYCOL (TEG)
REPORTABLE QUANTITY:..... None
HAZARD CLASS AND LABEL: NON-REGULATED
UN NUMBER: ..... None
NA NUMBER: ..... None
PACKAGING SIZE:..... Pail, Drum & Bulk

SECTION 15 - REGULATORY INFORMATION

SARA 311 CATEGORIES:
EPA ACUTE:..... Yes (Eyes)

EPA CHRONIC: ..... No
EPA IGNITABILITY: ..... No
EPA REACTIVITY: ..... No
EPA SUDDEN RELEASE
OF PRESSURE: ..... No

CERCLA RQ VALUE: ..... None
SARA TPQ: ..... None
SARA RQ: ..... None
EPA HAZARD WASTE #: ..... None
CLEAN AIR: ..... NA
CLEAN WATER: ..... NA
SARA SECTION 313: ..... No
NFPA HEALTH: 2
NFPA FLAMMABILITY: 1
NFPA REACTIVITY: 0
DEA Chemical Trafficking Act:.. No
TSCA STATUS: ..... All ingredients in this product are on the TSCA Inventory List.

SECTION 16 - ADDITIONAL INFORMATION

FOOT NOTES: NA - NOT APPLICABLE ND - NO DATA AVAILABLE > = GREATER THAN < = LESS THAN

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1) by the Company Health and Risk Assessment Unit, PO Box 1519, Gretna, LA 70054-1519.

REVISION STATEMENT: Changes have been made throughout this Material Safety Data Sheet. Please read the entire document.

DISCLAIMER:
Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, the Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving this MSDS will make their own determination as to its suitability for their intended purposes prior to use. Since the product is within the exclusive control of the user, it is the user's obligation to determine the conditions of safe use of this product. Such conditions should comply with all Federal Regulations concerning the Product. It must be recognized that the physical and chemical properties of any product may not be fully understood and that new, possibly hazardous products may arise from reactions between chemicals. The information given in this data sheet is based on our present knowledge and shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

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Attachment O.
Emissions Summary Sheets

G35-A EMISSIONS SUMMARY SHEET

COMPRESSOR STATION EMISSION SUMMARY SHEET FOR CRITERIA POLLUTANTS										
Compressor Station						**Registration Number** (Agency Use) **G35-A**				
	Potential Emissions (lbs/hr)					**Potential Emissions (tons/yr)**				
Source ID No.	**NO_X**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NO_X**	**CO**	**VOC**	**SO_2**	**PM_{10}**
CE-4 (1E)	1.52	0.74	0.73	0.006	0.10	6.66	3.24	3.20	0.03	0.44
T01 (2E)	--	--	0.44	--	--	--	--	1.91	--	--
T02 (3E)	--	--	0.11	--	--	--	--	0.47	--	--
DEHY-001 (4E)	--	--	1.91	--	--	--	--	8.36	--	--
RB-1 (5E)	0.06	0.05	0.04	0.0004	0.005	0.27	0.23	0.19	0.002	0.02
LDOUT (6E)	--	--	0.71	--	--	--	--	0.14	--	--
Total	**1.58**	**0.79**	**3.93**	**0.01**	**0.11**	**6.93**	**3.46**	**14.27**	**0.03**	**0.46**

COMPRESSOR STATION EMISSION SUMMARY SHEET FOR HAZARDOUS/TOXIC POLLUTANTS

Compressor Station							Registration Number (Agency Use) G35-A					
	Potential Emissions (lbs/hr)						Potential Emissions (tons/yr)					
Source ID No.	Benzene	Ethyl-benzene	Toluene	Xylenes	n-Hexane	Formalde-hyde	Benzene	Ethyl-benzene	Toluene	Xylenes	n-Hexane	Formalde-hyde
CE-4 (1E)	0.002	0.0002	0.002	0.001	0.006	0.13	0.01	0.0009	0.009	0.004	0.02	0.56
T01 (2E)	0.0002	0.0002	0.001	0.001	0.02	--	0.0009	0.001	0.005	0.006	0.07	--
T02 (3E)	0.0001	0.0001	0.0005	0.0007	0.004	--	0.0005	0.0005	0.002	0.003	0.02	--
DEHY-001 (4E)	0.06	0.09	0.39	1.17	0.009	--	0.27	0.38	1.72	5.11	0.04	--
RB-1 (5E)	0.0006	0.0005	0.003	0.005	0.002	4.6E-5	0.003	0.002	0.01	0.02	0.01	0.0002
LDOUT (6E)	0.0003	0.0004	0.002	0.002	0.03	--	0.00007	0.00007	0.0003	0.0004	0.005	--
Total	**0.06**	**0.09**	**0.40**	**1.18**	**0.04**	**0.13**	**0.28**	**0.38**	**1.75**	**5.15**	**0.17**	**0.56**

G35-A FUGITIVE EMISSIONS SUMMARY SHEET

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants - Chemical Name/CAS [1]	Maximum Potential Uncontrolled Emissions [2]		Maximum Potential Controlled Emissions [3]		Est. Method Used [4]
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads	PM-10 PM-2.5	--- ---	--- ---	--- ---	--- ---	EE
Unpaved Haul Roads	PM-10 PM-2.5	0.07 0.007	0.31 0.03	0.07 0.007	0.31 0.03	EE
Loading/Unloading Operations						
Equipment Leaks	VOC HAPs CO2e	Does not apply	0.58 0.03 27.6	Does not apply	0.58 0.03 27.6	EE
Blowdown Emissions						
Other – Venting Episodes	VOC HAPs CO2e	Does not apply	0.29 0.02 61.7	Does not apply	0.29 0.02 61.7	EE

[1] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. DO NOT LIST H_2, H_2O, N_2, O_2, and Noble Gases.
[2] Give rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).
[3] Give rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).
[4] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; M = modeling; O = other (specify).

Attachment R.
Authority of Corporation

Attachment R
AUTHORITY OF CORPORATION
OR OTHER BUSINESS ENTITY (DOMESTIC OR FOREIGN)

TO: The West Virginia Department of Environmental Protection, Division of Air Quality

DATE: _____, _____

ATTN.: Director

Corporation's / other business entity's Federal Employer I.D. Number 46-5517375

The undersigned hereby files with the West Virginia Department of Environmental Protection, Division of Air Quality, a permit application and hereby certifies that the said name is a trade name which is used in the conduct of an incorporated business or other business entity.

Further, the corporation or the business entity certifies as follows:

(1) Luz Slauter and Lou Ann Lee (is/are) the authorized representative(s) and in that capacity may represent the interest of the corporation or the business entity and may obligate and legally bind the corporation or the business entity.

(2) The corporation or the business entity is authorized to do business in the State of West Virginia.

(3) If the corporation or the business entity changes its authorized representative(s), the corporation or the business entity shall notify the Director of the West Virginia Department of Environmental Protection, Division of Air Quality, immediately upon such change.

Troy Roach, Vice President - EHS

President or Other Authorized Officer
(Vice President, Secretary, Treasurer or other official in charge of a principal business function of the corporation or the business entity)

(If not the President, then the corporation or the business entity must submit certified minutes or bylaws stating legal authority of other authorized officer to bind the corporation or the business entity).

Secretary

Antero Midstream LLC
Name of Corporation or business entity