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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-3285
Plant ID No.:	085-00055
Applicant:	Antero Midstream LLC
Facility Name:	Lafferty Compressor Station
Location:	Near Pennsboro, Ritchie County
SIC/NAICS Code:	4923/221210
Application Type:	Construction
Received Date:	December 15, 2015
Engineer Assigned:	Joe Kessler
Fee Amount:	$4,500
Date Received:	December 15, 2015
Complete Date:	January 14, 2016
Due Date:	April 13, 2016
Applicant's Ad Date:	December 23, 2015
Newspaper:	*The Pennsboro News*
UTM's:	508.091 km Easting • 4,341.658 km Northing • Zone 17
Latitude/Longitude:	39.22418/-80.90627
Description:	Construction of a natural gas compressor station.

DESCRIPTION OF PROCESS

Antero Midstream LLC (Antero) is proposing to construct a natural gas compressor station to be located approximately 5.4 miles southeast of Pennsboro, WV just east of White Oak Road (County Route 10/4). The proposed Lafferty Compressor Station will consist of thirteen (13) Waukesha 7044 GSI 4-Stroke Rich Burn (4SRB) 1,680 horsepower (hp) compressor engines, one (1) Capstone C600 Standard 600kWe Microturbine, two (2) 72.5 mmscf/day triethylene glycol (TEG) dehydration units (GDUs), one (1) 0.024 mmBtu/hr Catalytic Heater, one (1) 9.2 mmBtu/hr Abutec Model Number 100 non-assisted enclosed flare, one (1) 21,000 gallon produced liquids settling tank, and four (4) 16,800 gallon produced liquids (condensate and water) storage tanks.

Natural gas produced in area wells will enter into the facility and will be compressed by the engines (C-2100 through C-2220). The compressed gas is sent through the GDUs (SV-3110 and SV-3210) where it is dehydrated to the desired level. The compressor engines are each controlled (NO_x, CO, VOCs, and formaldehyde) by an EMIT Technologies RT-3615-T oxidation catalyst (1C through 13C).

Glycol dehydration is a liquid desiccant system used for the removal of water from natural gas. In each GDU, lean, water-free glycol is fed to the top of an absorber (known as a "contactor") where it is contacted with the wet natural gas stream. The glycol removes water from the natural gas by physical absorption and is carried out the bottom of the column. The dry natural gas leaves the top of the absorption column and is fed into a pipeline for transportation. The dehydrator still vent gases are each sent to the enclosed flare (FL-1000) for destruction (@ 98% DRE). Additionally, each GDU contains several TEG storage tanks. However, the storage tanks are defined as *de minimis* sources under Table 45-13B of 45CSR13 as they are each less than 10,000 gallons and TEG has an extremely low vapor pressure (<0.01 mm Hg).

After leaving the absorber, each glycol stream - now referred to as "rich" glycol - is fed to a flash vessel (FT-3110 and FT-3210) where flashed hydrocarbon vapors are either sent to the reboiler as fuel or, if the reboiler is not in operation, automatically re-routed to the storage tanks where it is captured by the vapor recovery units (VRU-6000 and VRU-6100) and recycled back into the system prior to the inlet gas scrubber. Any liquids removed in the flash tank are sent first to the settling tank (TK-9000) and then to either one of the condensate or produced liquid water storage tanks (TK-9000 through TK-9110). Vapors from the produced liquids storage tanks (working/breathing/flashing) are captured by the primary VRU (VRU-6000). In the event of downtime of the primary VRU, a backup VRU is employed (VRU-6100).

After leaving the flash vessel, in each unit, the rich glycol is fed to a Glycol Regenerator Column. Each Regenerator Column consists of a column, an overhead condenser, and the reboiler. The glycol is thermally regenerated to remove excess water and regain high purity. The heat for the regeneration is provided by two (2) 1.50 mmBtu/hr natural gas-fired reboilers (R-3110 and R3210). The hot, lean glycol is cooled by a heat-exchanger and is then fed to a pump where it is sent to the glycol absorber for reuse. Liquids produced in the regeneration process are sent to one of the facility storage tanks.

A portion of the gas is withdrawn after dehydration but before the station outlet metering and sent to the fuel gas system. The fuel gas is directed through a fuel gas scrubber and metering before being directed to the compressor engines and other gas-powered equipment.

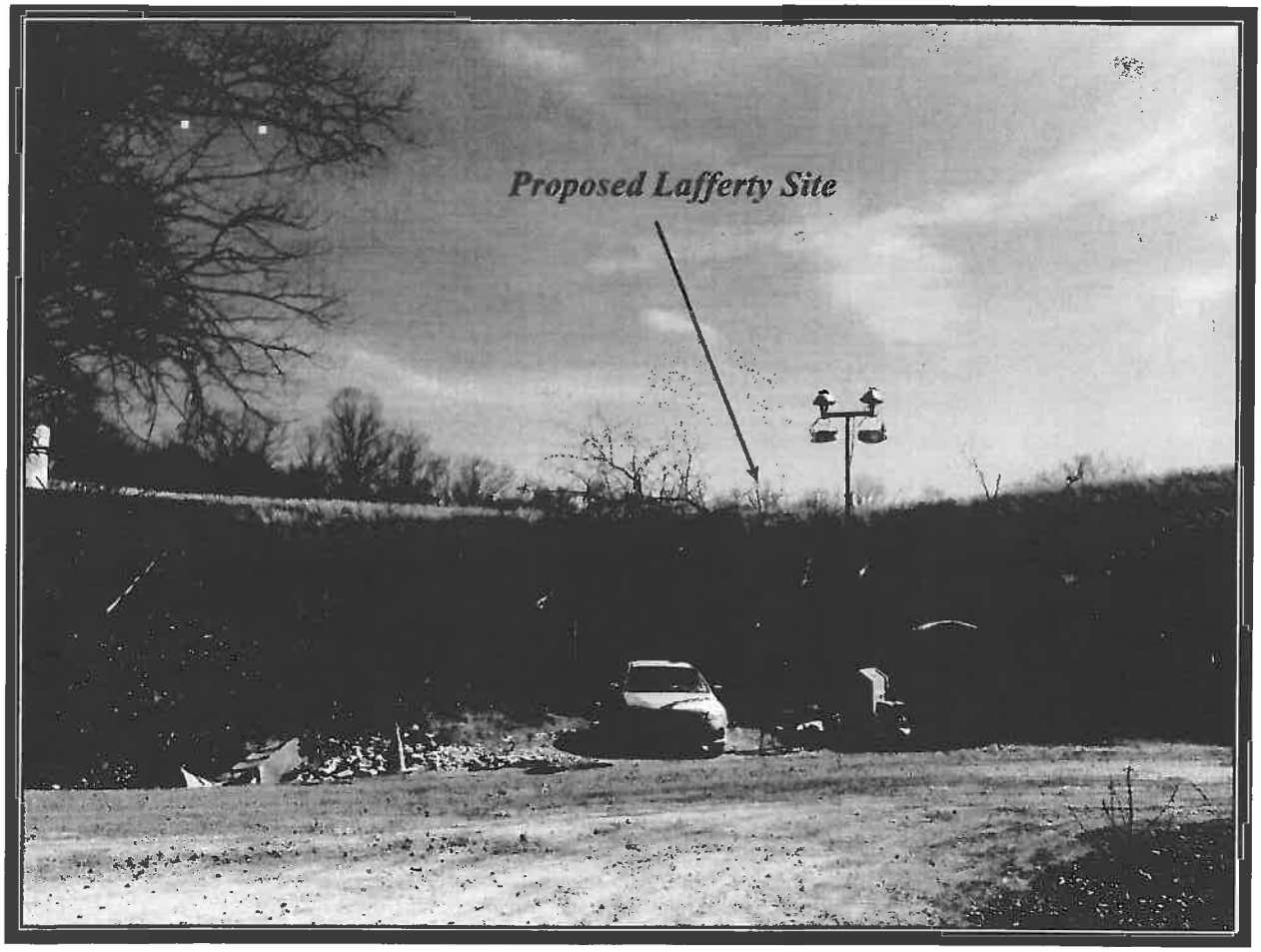
Additionally, the proposed facility will utilize an uncontrolled truck loadout (LDOUT1) to remove condensate and produced water from the site (estimated to be a maximum of 2,300,000 gallons/year of condensate and 690,000 gallons/year of produced water). One (1) 600 kW_e uncontrolled Microturbine (G-8000) will be used to produce primary power for the facility. One (1) 0.024 mmBtu/hr natural gas-fired catalytic heater (CATHT1) will be used in the fuel gas system (providing gas to the microturbine) to prevent the formation of hydrates and to minimize condensate dropout from the pressure reduction.

SITE INSPECTION

On March 30, 2016, the writer conducted an inspection of the proposed location of the Lafferty Compressor Station. The proposed Lafferty site is located in a rural area of Ritchie County approximately 5.4 miles southeast of Pennsboro, WV just east of White Oak Road (County Route 10/4). The writer was accompanied on the inspection by Ms. Lou Ann Lee, Environmental Coordinator with Antero. Observations from the inspection include:

- The proposed facility will lie atop a hill approximately 5.4 miles southeast of Pennsboro, WV. The area is rural in nature with scattered homes and farms within several miles of the proposed location;
- At the time of the inspection, no substantive work had been undertaken at the site; and
- The occupied dwelling located nearest to the proposed site is approximately 0.25 miles west of the proposed site along White Oak Road.

The following is a picture of the proposed site of the Lafferty Compressor Station:



Directions: [Latitude: 39.22418, Longitude: -80.90627] From the intersection of United States (US) Route 50 and State Route (SR) 74 (Pullman Drive), travel south on SR 74 for approximately 1.3 miles and then turn left onto CR 7/1 (Lynn Camp Road). Follow the Lynn Camp Road for approximately 4.1 miles and then turn left onto White Oak Drive (CR 10/4). Travel on White Oak Road for approximately 0.3 miles to the compressor station located at the top of a small hill.

AIR EMISSIONS AND CALCULATION METHODOLOGIES

Antero included in Attachment N of the permit application air emissions calculations for the equipment and processes at the Lafferty Compressor Station. The following will summarize the calculation methodologies used by Antero to calculate the potential-to-emit (PTE) of the proposed facility.

Compressor Engines

Potential emissions from each of the thirteen (13) Waukesha 7044 GSI 4SRB 1,680 hp compressor engines (1E through 13E) were based on post-control emission factors provided by the oxidation catalyst vendor, the engine vendor, and as given in AP-42, Section 3.2 (AP-42 is a database of emission factors maintained by USEPA). Hourly emissions were based on the (as calculated using a fuel heat rating of 8,302 Btu/hp-hr) maximum design heat input (MDHI) of the engines of 13.95 mmBtu/hr and the maximum hp rating. Annual emissions were based on 8,760 hours of operation per year. The compressor engines are each controlled (NO_x, CO, VOCs, and formaldehyde) by an EMIT Technologies RT-3615-T oxidation catalyst (97.5%, 97.5%, 84%, and formaldehyde 90%, respectively). The following table details the PTE of each compressor engine:

Table 1: Per-Compressor Engine PTE

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
CO(1)	0.32 g/hp-hr (controlled)	Catalyst Vendor	1.19	5.19
NO_x(1)	0.34 g/hp-hr (controlled)	Catalyst Vendor	1.26	5.52
$PM_{2.5}/PM_{10}/PM$(2)	19.41×10^{-3} lb/mmBtu	AP-42, Table 3.2-2	0.27	1.19
SO_2	5.88×10^{-4} lb/mmBtu	AP-42, Table 3.2-2	0.01	0.04
VOCs(1)	0.19 g/hp-hr (controlled)	Catalyst Vendor	0.70	3.08
Total HAPs	Various	AP-42, Table 3.2-2	0.21	0.92
Formaldehyde(1)	0.01 g/hp-hr (controlled)	Catalyst Vendor	0.04	0.19

(1) Based on post-control emission factor provided by the catalytic converter vendor. VOC emissions based on NMNEHC + CH_2O emission factors.
(2) Includes condensables.

Microturbines

Emissions from the one (1) 6.18 mmBtu/hr Capstone C600 Standard 600kWe Microturbine (14E) were based on the emission factors provided by the vendor and taken from AP-42, Section 3.1.

Hourly emissions were based on the maximum electrical output and the MDHI of the units. Annual emissions were based on an annual operation of 8,760 hours. The PTE generated by the microturbine and the emission factor/emission factor source are given in the following table:

Table 2: Microturbine PTE

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
NO_X	0.40 lb/MWe-hr	Vendor Information	0.24	1.05
CO	1.10 lb/MWe-hr	Vendor Information	0.66	2.89
$PM_{2.5}/PM_{10}/PM^{(1)}$	6.6×10^{-3} lb/mmBtu	AP-42, Table 3.1-2a	0.04	0.18
SO_2	3.4×10^{-4} lb/mmBtu	AP-42, Table 3.1-2a	0.02	0.09
VOC	0.10 lb/MWe-hr	Vendor Information	0.06	0.26
Total HAPs	Various	AP-42, Table 3.1-3	0.01	0.03

(1) Includes condensables.

Glycol Regenerator Column/GDU Flash Tank Emissions

Uncontrolled VOC and Hazardous Air Pollutant (HAP) emissions from the glycol regenerators (15E and 18E) and GDU flash tanks (16E and 19E) are based on the emissions calculation program GRI-GLYCalc Version 4.0. GRI-GLYCalc is a well-known program for estimating air emissions from glycol units using TEG. Included in the application is a copy of the appropriate GLY-Calc analysis sheets. Controlled emissions from the regenerators were based on a 98% destruction and removal efficiency (DRE) of hydrocarbons at the flare. Controlled emissions from the flash tanks were based on a 95% DRE of hydrocarbons in the reboiler (with a VRU/VRU backup system in the event of reboiler downtime).

Flare Combustion Exhaust Emissions

Emissions created from the combustion of the hydrocarbons (coming from the GDU Still Vents) at the flare (FL-1000) were based on emission factors provided for natural gas combustion as given in AP-42 Section 13.5 (NO_x and CO) and Section 1.4 (other pollutants). Hourly emissions were based on the capacity of the flare (9.2 mmBtu/hr) and annual emissions were based on an annual operation of 8,760 hours. A waste gas heat content value of 1,020 Btu/ft^3 was used in the calculations.

Reboilers/Fuel Heater Combustion Exhaust Emissions

Combustion emissions from the 1.5 mmBtu/hr reboilers (17E and 20E) and 0.024 mmBtu/hr Catalytic Heater (26E) were based on the emission factors provided for natural gas combustion as given in AP-42 Section 1.4. Hourly emissions were based on the MDHI of the units and annual emissions were based on an annual operation of 8,760 hours. A fuel/waste gas heat content value of 1,020 Btu/ft^3 was used in the calculations.

Storage Tanks

Antero provided an estimate of the uncontrolled emissions produced from the one (1) 21,000 gallon produced liquids settling tank and four (4) 16,800 gallon produced liquids (condensate and water) storage tanks (21E through 25E) using the TANKS 4.09d program (working/breathing losses) as provided under AP-42, Section 7 and using ProMax Simulation Software (flashing emissions from the settling tank). ProMax software is a chemical process simulator for design and modeling of amine gas treating, glycol dehydration units, and other natural gas components. Based on a detailed input gas analysis and the components of the facility, the software can simulate and model the inputs and outputs of the system. As stated above, the uncontrolled emissions from the storage tanks are captured and sent, via a VRU (with a second VRU backup), back into the process for recycling. The controlled emissions from the noted storage tanks are, therefore, based on a minimum control efficiency of 98%. Additionally, worst-case annual emissions were based on a maximum storage tank throughput of 2,300,000 gal/year of condensate and 690,000 gal/year of produced water.

Truck Loadouts

Air emissions from produced liquid loading operations (LDOUT1) occur as fugitive emissions generated by displacement of vapors when loading trucks. The emission factor used to generate the uncontrolled VOC emissions is based on Equation (1) of AP-42 Section 5.2-4. In this equation, Antero used variables specific to the liquids loaded and to the method of loading - in this case "submerged loading - dedicated normal service." Additionally, worst-case annual emissions were based on a maximum loading rate of 2,300,000 gal/year of condensate and 690,000 gal/year of produced water. The maximum hourly emission rate was based on a pumping rate of 7,560 gal/hour of both condensate and produced water. Truck loadout operations are uncontrolled.

Fugitives

Equipment Leaks

Antero based their VOC fugitive equipment leak calculations on emission factors taken from the document EPA-453/R-95-017 - "Protocol for Equipment Leak Emission Estimates" Table 2-4 (VOCs). No control efficiencies, as based on a Leak Detection and Repair (LDAR) protocol, were applied. Component counts were given and shall be limited in the draft permit. VOC/HAP by-weight percentages of the material streams were based on a representative gas analysis.

Maintenance and Emergency Events

Antero also included in their fugitive emission estimate a certain number of scenarios where natural gas is released for emergency or maintenance purposes. Those included were compressor blowdown/startup events (132 events/year for each), station emergency shutdowns (2 events/year), and "pigging" events (26 events/year). The amount of gas released per event was taken from "engineering based on other facilities." VOC/HAP by-weight percentages of the natural gas were based on a representative gas analysis.

Emissions Summary

Based on the above estimation methodology as submitted in Attachment N of the permit application, the facility-wide PTE of the proposed Lafferty Compressor Station is given in Attachment A.

REGULATORY APPLICABILITY

The proposed Lafferty Compressor Station is subject to the following substantive state and federal air quality rules and regulations: 45CSR2, 45CSR6, 45CSR13, 40 CFR 60 Subpart JJJJ, and 40 CFR 63, Subparts HH and ZZZZ. Each applicable rule (and those that have questionable non-applicability) and Antero's compliance therewith will be discussed in detail below.

45CSR2: To Prevent and Control Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers

Pursuant to the definition of "fuel burning unit" under 45CSR2 ("producing heat or power by indirect heat transfer"), 45CSR2 does not apply to the compressor engines or the microturbine.

The GDU Reboilers and the Catalytic Heater have been determined to each meet the definition of a "fuel burning unit" under 45CSR2 and are, therefore, subject to the applicable requirements therein. However, pursuant to the exemption given under §45-2-11, as the MDHI of the GDU Reboilers and the Catalytic Heater are less than 10 mmBtu/hr, the units are not subject to sections 4, 5, 6, 8 and 9 of 45CSR2. The only remaining substantive requirement is under Section 3.1 - Visible Emissions Standards.

Pursuant to 45CSR2, Section 3.1, the reboilers and heater are subject to an opacity limit of 10%. Proper maintenance and operation of the units (and the use of flash gas or natural gas as fuel) should keep the opacity of the units well below 10% during normal operations.

45CSR6: To Prevent and Control Particulate Air Pollution from Combustion of Refuse

Antero has proposed flaring for control of the waste gas produced from GDU Regenerator Still Vents. The flare meets the definition of an "incinerator" under 45CSR6 and is, therefore, subject to the requirements therein. The substantive requirements applicable to the flare are discussed below.

45CSR6 Emission Standards for Incinerators - Section 4.1

Section 4.1 limits PM emissions from incinerators to a value determined by the following formula:

Emissions (lb/hr) = F **x** Incinerator Capacity (tons/hr)

Where, the factor, F, is as indicated in Table I below:

Table I: Factor, F, for Determining Maximum Allowable Particulate Emissions

Incinerator Capacity	Factor F
A. Less than 15,000 lbs/hr	5.43
B. 15,000 lbs/hr or greater	2.72

For the flare (FL-1000) servicing the GDU Regenerator Still Vents, based on information included in the application, the maximum vapor mass sent to each flare will be 275 lb/hr (0.14 tons/hour). Based on the above equation, the particulate matter limit of the flare is 0.76 lbs/hr. Conservatively using AP-42 Section 1.4 natural gas emission factors (see above), total PM from the flare was estimated to be less than 0.01 lbs/hr, which is in compliance with the 45CSR6 limit.

45CSR6 Opacity Limits for - Section 4.3, 4.4

Pursuant to Section 4.3, and subject to the exemptions under 4.4, the enclosed flare has a 20% limit on opacity during operation. Proper design and operation of the enclosed flare should prevent any substantive opacity from the units.

45CSR10: To Prevent and Control Air Pollution from the Emission of Sulfur Oxides (NON-APPLICABILITY)

Pursuant to the definition of "fuel burning unit" under 45CSR10 ("producing heat or power by indirect heat transfer"), the limitations on fuel burning units under 45CSR10 do not apply to the compressor engines or microturbines.

45CSR10 has requirements limiting SO_2 emissions from "fuel burning units," limiting in-stack SO_2 concentrations of "manufacturing processes," and limiting H_2S concentrations in process gas streams. The only potential applicability of 45CSR10 to the Lafferty Compressor Station is the limitations on fuel burning units. The GDU Reboilers and the Catalytic Heater have each been determined to meet the definition of a "fuel burning unit" under 45CSR10. However, pursuant to the exemption given under §45-10-10.1, as the MDHI of the GDU Reboilers the Catalytic Heater are less than 10 mmBtu/hr, the units are not subject to the limitations on fuel burning units under 45CSR10.

45CSR13: Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation

The proposed construction of the Lafferty Compressor Station has a potential to emit in excess of six (6) lbs/hour and ten (10) TPY of a regulated pollutant (see Attachment A) and, therefore, pursuant to §45-13-2.24, the construction is defined as a "stationary source" under 45CSR13. Pursuant to §45-13-5.1, "[n]o person shall cause, suffer, allow or permit the construction . . . and operation of any stationary source to be commenced without . . . obtaining a permit to construct." Therefore, Antero is required to obtain a permit under 45CSR13 for the construction and operation of the facility.

As required under §45-13-8.3 ("Notice Level A"), Antero placed a Class I legal advertisement in a "newspaper of *general circulation* in the area where the source is . . . located." The ad ran on December 23, 2015 in *The Pennsboro News* and the affidavit of publication for this legal advertisement was submitted on January 8, 2016.

45CSR14: Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration - (NON APPLICABILITY)

The Lafferty Compressor Station is proposed to be located in Ritchie County, WV. Ritchie County is classified as "in attainment" with all National Ambient Air Quality Standards. Therefore, as the facility is not a "listed source" under §45-14-2.43, the individual major source applicability threshold for all pollutants is 250 TPY. As given in Attachment A, the facility-wide PTE of the proposed Lafferty Compressor Station is less than 250 TPY for all criteria pollutants. Therefore, the facility is not defined as a "major stationary source" under either 45CSR14 and the rule does not apply.

45CSR27: To Prevent and Control the Emissions of Toxic Air Pollutants - (NON APPLICABILITY)

Pursuant to §45-27-3.1, the "owner or operator of a plant that discharges or may discharge a toxic air pollutant into the open air in excess of the amount shown in the Table A [of 45CSR27] shall employ [Best Available Technology] at all chemical processing units emitting the toxic air pollutant." As calculated from Table 1 above, the aggregate PTE of formaldehyde generated by the compressor engines is greater than 0.5 TPY - greater than the 1,000 pound per year threshold given in Table A of 45CSR27. However, internal combustion engines do no meet the definition of "chemical processing units" under §45-27-2.4 and, therefore, they are not subject to BAT under 45CSR27.

45CSR30: Requirements for Operating Permits

45CSR30 provides for the establishment of a comprehensive air quality permitting system consistent with the requirements of Title V of the Clean Air Act. The proposed Lafferty Compressor Station does not meet the definition of a "major source under §112 of the Clean Air Act" as outlined under §45-30-2.26 and clarified (fugitive policy) under 45CSR30b. The proposed facility-wide PTE (see Attachment B) of any regulated pollutant does not exceed 100 TPY. Additionally, the facility-wide PTE does not exceed 10 TPY of any individual HAP or 25 TPY of aggregate HAPs.

However, as the proposed facility is subject to two New Source Performance Standard (NSPS) - 40 CFR 60, Subpart JJJJ and Subpart OOOO - and two Maximum Achievable Control Technology (MACT) rules - 40 CFR 63, Subpart ZZZZ and 40 CFR 63, Subpart HH, the facility would, in most cases, be subject to Title V as a "deferred source." However, pursuant to §60.4230(c), §60.5370(c), §63.6585(d), and §63.760(h) as a non-major "area source," Antero is not required to obtain a Title V permit for the proposed facility. Therefore, the Lafferty Compressor Station is not subject to 45CSR30.

Subpart Kb—Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984 - (NON APPLICABILITY)

Pursuant to §60.110b, 40 CFR 60, Subpart Kb applies to "each storage vessel with a capacity greater than or equal to 75 cubic meters (m^3) that is used to store volatile organic liquids (VOL) for

which construction, reconstruction, or modification is commenced after July 23, 1984." However, pursuant to §60.110b(d)(4), "[v]essels with a design capacity less than or equal to 1,589.874 m^3 [420,000 gallons] used for petroleum or condensate stored, processed, or treated prior to custody transfer" are not subject to Subpart Kb. The largest storage tank proposed for the Lafferty Compressor Station is 21,000 gallons (79 m^3) and will only contain condensate or produced water. Therefore, Subpart Kb does not apply to any storage tanks at the proposed facility.

40 CFR 60 Subpart KKKK: Standards of Performance for Stationary Combustion Turbines - (NON-APPLICABILITY)

Pursuant to §60.4305(a), 40 CFR 60, Subpart KKKK applies if "you are the owner or operator of a stationary combustion turbine with a heat input at peak load equal to or greater than 10.7 gigajoules (10 MMBtu) per hour, based on the higher heating value of the fuel, which commenced construction, modification, or reconstruction after February 18, 2005." The microturbine proposed for the Lafferty Compressor Station is rated at 6.18 mmBtu/hr and is not, therefore, subject to Subpart KKKK. Further it is important to note that, pursuant to §60.4305(b), stationary combustion turbines regulated under Subpart KKKK are exempt from the requirements of 40 CFR 60, Subpart GG.

40 CFR 60 Subpart JJJJ: Standards of Performance for Stationary Spark Ignition Internal Combustion Engines.

Antero's thirteen (13) Waukesha 7044 GSI 4SRB 1,680 hp compressor engines proposed for the Lafferty Compressor Station are defined under 40 CFR 60, Subpart JJJJ as stationary spark-ignition internal combustion engines (SI ICE) and are each, pursuant to §60.4230(a)(4)(i), subject to the applicable provisions of the rule. Pursuant to §60.4233(e): "Owners and operators of stationary SI ICE with a maximum engine power greater than or equal to 75 KW (100 HP) (except gasoline and rich burn engines that use LPG) must comply with the emission standards in Table 1 to this subpart for their stationary SI ICE." Therefore, as the proposed Antero's compressor engines are greater than 100 hp, each engine must comply with the emission standards under Table 1 for "Non-Emergency SI ICE ≥ 500 hp manufactured after July 1, 2010:" NO_x - 1.0 g/HP-hr, CO - 2.0 g/HP-hr, and VOC - 0.7 g/HP-hr. The emission standards and the proposed compliance therewith of the engines are given in the following table:

Table 3: Waukesha, 7044 GSI Subpart JJJJ Compliance

Pollutant	Standard (g/HP-hr)	Uncontrolled Emissions (g/bhp)(1)	Control Percentage	Controlled Emissions (g/bhp)(1)	JJJJ Compliant?
NO_x	1.0	13.50	97.48%	0.34	Yes
CO	2.0	12.50	97.44%	0.32	Yes
VOC	0.7	0.48	60.42%	0.19	Yes

(1) Based on the EMIT Technologies, Inc. Model RT-3615-T oxidation catalyst specification sheet. Controlled VOC emissions based on NMNEHC + CH_2O emission factors. However, Subpart JJJJ standard does not include CH_2O emissions.

The Waukesha 7044 GSI is not a "certified" engine under Subpart JJJJ so Antero will have to show compliance with the emission standards pursuant to §60.4243(b)(2)(ii): conducting an initial performance test and thereafter conducting subsequent performance testing every 8,760 hours or 3 years, whichever comes first, to demonstrate compliance. Performance testing requirements are given under §60.4244 of Subpart JJJJ. Antero will additionally have to meet all applicable monitoring, recording, and record-keeping requirements under Subpart JJJJ.

40 CFR 60, Subpart OOOO: Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution

On April 27, 2012, the USEPA issued a final rule (with amendments finalized on August 16, 2012) that consists of federal air standards for natural gas wells that are hydraulically fractured, along with requirements for several other sources of pollution in the oil and gas industry that currently are not regulated at the federal level. Each potentially applicable section of Subpart OOOO is discussed below.

Compressor Engines

Pursuant to §60.5365(c), "[e]ach reciprocating compressor affected facility, which is a single reciprocating compressor located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment" that is constructed after August 23, 2011 is subject to the applicable provisions of Subpart OOOO. As the Lafferty Compressor Station is located before the point of custody transfer, the compressor engines are applicable to Subpart OOOO. The substantive requirements for the engines are given under §60.5385(a): the engines' "rod packing" must replaced according to the given schedule and the engine must meet applicable MRR given under §60.5410(c), §60.5415(c), and §60.5420(b)(1).

Pneumatic Controllers - (NON APPLICABILITY)

Pursuant to §60.5365(d)(2), "[f]or the natural gas production segment (between the wellhead and the point of custody transfer to the natural gas transmission and storage segment and not including natural gas processing plants), each pneumatic controller affected facility, which is a single continuous bleed natural gas-driven pneumatic controller operating at a natural gas bleed rate greater than 6 scfh" that is constructed after August 23, 2011 is subject to the applicable provisions of Subpart OOOO. As the Lafferty Compressor Station is located before the point of custody transfer, any pneumatic controllers that meet the above definition will be required to meet the substantive requirement for pneumatic controllers as given under §60.5390. However, in the permit application, Antero stated that "[t]he pneumatic controllers installed at Lafferty Compressor Station are air-actuated and therefore exempt from the requirements of this subpart."

Storage Tanks

Pursuant to §60.5365(e), for "[e]ach storage vessel affected facility, which is a single storage vessel located in the oil and natural gas production segment, natural gas processing segment or natural gas transmission and storage segment, and has the potential for VOC emissions equal to or greater than 6 tpy " that is constructed after April 15, 2014 is defined as a Group 2 storage vessel

must meet the control requirements under §60.5395(c) as of April 15, 2014. The substantive requirement is to "reduce VOC emissions by 95.0 percent or greater." The as-controlled VOC emissions from the Settling Tank (TK-9000) have been calculated to be 8.85 TPY and the tank is, therefore, subject to the control requirements under §60.5395(c). Antero has proposed to meet this requirement through the use of a VRU (with a second VRU backup). The controlled emissions from the noted storage tanks are, therefore, based on a minimum control efficiency of 98% which is compliance with the Subpart OOOO requirement.

40 CFR 63 Subpart HH: National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities

On June 1, 2013 the DAQ took delegation of the area source provisions of 40 CFR 63, Subpart HH. Pursuant to §63.760(a)(3), as the Lafferty Compressor Station - an area source of HAPs (see Attachment A) - "process[es], upgrade[s], or store[s] natural gas prior to the point at which natural gas enters the natural gas transmission and storage source category or is delivered to a final end user," it is defined as an area source subject to the applicable provisions under Subpart HH.

Pursuant to §63.760(b)(2), each TEG GDU located at an area source that meets the requirements under §63.760(a)(3) is defined as an affected facility under Subpart HH. The requirements for affected sources at area sources are given under §63.764(d). However, for a GDU, exemptions to these requirements are given under §63.764(e): if (1) "actual annual average flowrate of natural gas to the glycol dehydration unit is less than 85 thousand standard cubic meters [3 mmscf/day] per day" or (2) "actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere are less than 0.90 megagram [1 TPY] per year."

Information in the permit application indicates the maximum aggregate PTE of benzene emissions from each GDU is less than 1 TPY. Therefore, the GDUs are exempt from the Subpart HH requirements given under §63.764(d).

40 CFR 63 Subpart ZZZZ: Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

On June 1, 2013 the DAQ took delegation of the area source provisions of 40 CFR 63, Subpart ZZZZ. As the Lafferty Compressor Station is defined as an area source of HAPs (see Attachment A), the facility is subject to applicable requirements of Subpart ZZZZ. Pursuant to §63.6590(c):

> An affected source that meets any of the criteria in paragraphs (c)(1) through (7) of this section must meet the requirements of this part by meeting the requirements of 40 CFR part 60 subpart IIII, for compression ignition engines or 40 CFR part 60 subpart JJJJ, for spark ignition engines. No further requirements apply for such engines under this part.

§63.6590(c)(1) specifies that "[a] new or reconstructed stationary RICE located at an area source" is defined as a RICE that shows compliance with the requirements of Subpart ZZZZ by "meeting the requirements of . . . 40 CFR part 60 subpart JJJJ, for spark ignition engines." Pursuant to §63.6590(a)(2)(iii), a "stationary RICE located at an area source of HAP emissions is new if [the applicant] commenced construction of the stationary RICE on or after June 12, 2006." The engines

proposed for the Lafferty Compressor Station are each defined as a new stationary RICE (application states manufacture date of engines is July 2013) and, therefore, will show compliance with Subpart ZZZZ by meeting the requirements of 40 CFR 60, Subpart JJJJ. Compliance with Subpart JJJJ is discussed above.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

This section provides an analysis for those regulated pollutants that may be emitted from the proposed Lafferty Compressor Station and that are not classified as "criteria pollutants." Criteria pollutants are defined as Carbon Monoxide (CO), Lead (Pb), Oxides of Nitrogen (NO_x), Ozone, Particulate Matter (PM_{10} and $PM_{2.5}$), and Sulfur Dioxide (SO_2). These pollutants have National Ambient Air Quality Standards (NAAQS) set for each that are designed to protect the public health and welfare. Other pollutants of concern, although designated as non-criteria and without national concentration standards, are regulated through various federal and programs designed to limit their emissions and public exposure. These programs include federal source-specific Hazardous Air Pollutants (HAPs) limits promulgated under 40 CFR 61 (NESHAPS) and 40 CFR 63 (MACT). Any potential applicability to these programs were discussed above under REGULATORY APPLICABILITY.

The majority of non-criteria regulated pollutants fall under the definition of HAPs which, with some revision since, were 188 compounds identified under Section 112(b) of the Clean Air Act (CAA) as pollutants or groups of pollutants that EPA knows or suspects may cause cancer or other serious human health effects. The following table lists each HAP identified by Antero with a facility-wide PTE above 0.05 TPY (100 lbs/year) and the associated carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)):

Table 4: Potential HAPs - Carcinogenic Risk

HAPs	Type	Known/Suspected Carcinogen	Classification
Acetaldehyde	VOC	Yes	B2 - Probable Human Carcinogen
Acrolein	VOC	No	Inadequate Data
Formaldehyde	VOC	Yes	B1 - Probable Human Carcinogen
Methanol	VOC	No	No Assessment Available
Biphenyl	VOC	Yes	Suggestive Evidence of Carcinogenic Potential
n-Hexane	VOC	No	Inadequate Data
Benzene	VOC	Yes	Category A - Known Human Carcinogen
Toluene	VOC	No	Inadequate Data
Ethylbenzene	VOC	No	Category D - Not Classifiable
Xylenes	VOC	No	Inadequate Data

All HAPs have other non-carcinogenic chronic and acute effects. These adverse health affects may be associated with a wide range of ambient concentrations and exposure times and are

influenced by source-specific characteristics such as emission rates and local meteorological conditions. Health impacts are also dependent on multiple factors that affect variability in humans such as genetics, age, health status (e.g., the presence of pre-existing disease) and lifestyle. As stated previously, *there are no federal or state ambient air quality standards for these specific chemicals.* For a complete discussion of the known health effects of each compound refer to the IRIS database located at *www.epa.gov/iris*.

AIR QUALITY IMPACT ANALYSIS

The estimated maximum emissions of the proposed facility are less than applicability thresholds that would define the proposed facility as "major" under 45CSR14 and, therefore, no air quality impacts modeling analysis was required. Additionally, based on the nature and location of the proposed source, an air quality impacts modeling analysis was not required under §45-13-7.

MONITORING, COMPLIANCE DEMONSTRATIONS, REPORTING, AND RECORDING OF OPERATIONS

The draft permit contains extensive and detailed monitoring, compliance demonstration, and record-keeping requirements (MRR) on all emission units primarily based on the applicable requirements contained in the recently issued G35-C General Permit. The requirements are given under Section 4.2 (and some additional record-keeping and reporting requirements under Section 4.3 and 4.4, respectively) of the draft permit and may be reviewed at that location.

PERFORMANCE TESTING OF OPERATIONS

The draft permit contains performance testing requirements primarily based on the applicable requirements contained in the recently issued G35-C General Permit. The requirements are given under Section 4.3 of the draft permit and may be reviewed at that location.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that compliance with all applicable state and federal air quality regulations will be achieved. Therefore, I recommend to the Director the issuance of a Permit Number R13-3285 to Antero Midstream LLC for the proposed construction and operation of the Lafferty Compressor Station located near Pennsboro, Ritchie County, WV.

Joe Kessler, PE
Engineer

4/12/16
Date

Attachment A: Facility-Wide PTE

Antero Midstream LLC: Lafferty Compressor Station

Permit Number R13-3285: Facility ID 085-00055

Emission Unit	EP ID	CO		NO_x		$PM_{2.5}/PM_{10}/PM$		SO_x		VOC		Formaldehyde		HAPs	
		lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
Compressor Engine	1E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	2E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	3E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	4E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	5E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	6E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	7E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	8E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	9E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	10E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	11E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	12E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Compressor Engine	13E	1.19	5.19	1.26	5.51	0.27	1.18	0.01	0.04	0.70	3.08	0.04	0.19	0.21	0.92
Microturbine	14E	0.66	2.89	0.24	1.05	0.04	0.18	0.02	0.09	0.06	0.26	0.004	0.02	0.01	0.03
Dehy #1 Vent/Flash Tank	15E, 16E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	6.02	0.00	0.00	0.08	0.33
Dehy #1 Reboiler	17E	0.15	0.68	0.18	0.81	0.01	0.06	0.00	0.01	0.01	0.04	~0.00	~0.00	0.00	0.02
Dehy #2 Vent/Flash Tank	18E, 19E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	6.02	0.00	0.00	0.08	0.33
Dehy #2 Reboiler	20E	0.15	0.68	0.18	0.81	0.01	0.06	0.00	0.01	0.01	0.04	~0.00	~0.00	0.00	0.02
Storage Tanks	21E - 25E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.06	9.04	0.00	0.00	0.07	0.31
Catalytic Heater	26E	0.00	0.01	0.00	0.01	~0.00	~0.00	~0.00	~0.00	~0.00	~0.00	~0.00	~0.00	~0.00	~0.00
Flare Combustion	27E	2.86	12.51	0.63	2.75	~0.00	~0.00	~0.00	~0.00	0.33	1.44	~0.00	~0.00	0.07	0.31
Truck Loadout	n/a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.98	6.77	0.00	0.00	0.13	0.02
Fugitive Emissions	n/a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	10.97	0.00	0.00	0.07	0.29
Facility-Wide Total[1] →		***19.29***	***84.24***	***17.61***	***77.06***	***3.57***	***15.64***	***0.15***	***0.62***	***61.79***	***80.64***	***0.52***	***2.49***	***3.24***	***13.62***

(1) No individual HAP has a PTE over 10 TPY. As the PTE of all individual HAPs are less than 10 TPY (formaldehyde is the highest emitted individual HAP) and the PTE of total HAPs is less than 25 TPY, the Lafferty Compressor Station is defined as a minor (area) source of HAPs for purposes of 40 CFR 61, 40CFR63, and Title V.