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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Entire Document
NON-CONFIDENTIAL

Application No.:	R13-3285A
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:	Modification
Received Date:	July 1, 2016
Engineer Assigned:	Joe Kessler
Fee Amount:	$4,500
Date Received:	July 5, 2016
Complete Date:	August 16, 2016
Due Date:	November 14, 2016
Applicant's Ad Date:	July 20, 2016
Newspaper:	*The Pennsboro News*
UTM's:	508.091 km Easting • 4,341.658 km Northing • Zone 17
Latitude/Longitude:	39.22418/-80.90627
Description:	Modification primarily to: (1) Replace the thirteen (13) permitted Waukesha 7044 GSI compressor engines with eight (8) Caterpillar G3608 engines, (2) Installation of a new fuel conditioning heater, (3) Increase the Glycol Dehydrator Units throughput each to 110 mmscf/day, and (4) Revision of the dehydrator flash tank control efficiency.

DESCRIPTION OF PROCESS/MODIFICATIONS

Existing (As-Permitted) Facility

On May 25, 2016, Antero Midstream LLC (Antero) received Permit Number R13-3285 for the construction of the Lafferty Compressor Station located approximately 5.4 miles southeast of Pennsboro, WV just east of White Oak Road (County Route 10/4). The Lafferty Compressor Station currently is permitted for 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.

In the existing as-permitted facility, 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.

Proposed Modifications

Antero is now proposing to modify the existing facility by:

- Replacing the thirteen (13) permitted Waukesha compressor engines with eight (8) Caterpillar G3608 4-Stroke Lean Burn (4SLB) 2,500 hp compressor engines (C-2100 through C-2170) that will each utilize an EMIT Technologies RT-3615-H oxidation catalyst (1C through 8C) for control of CO (~95%), VOCs (~56%), and formaldehyde (~81%);

- Installing a 0.50 mmBtu/hr fuel conditioning heater (FUEL1) to condition/treat fuel gas for the compressor engines prior to the engines to allow more complete combustion;

- Increasing the throughput of each GDU to 110 mmscf/day;

- Revising of the dehydrator flash tank control efficiency to 98% based on the use of a VRU/VRU backup on flash gases not combusted in the reboiler; and

- Updating the facility-wide fugitive emissions based on 52 pigging events per year.

SITE INSPECTION

On March 30, 2016, the writer conducted an inspection of the proposed location of the Lafferty Compressor Station (the facility has not yet been inspected by the DAQ Compliance/Enforcement Section.). 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;

- The occupied dwelling located nearest to the proposed site is approximately 0.25 miles west of the proposed site along White Oak Road; and

- *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 revised facility-wide air emissions calculations for the equipment and processes at the Lafferty Compressor Station. The following will summarize only the calculation methodologies used by Antero to calculate the potential-to-emit (PTE) of equipment and processes modified or added as part of this permitting action.

Compressor Engines

Potential emissions from each of the eight (8) Caterpillar G3608 4SLB 2,500 hp compressor engines (1E through 8E) 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 6,850 Btu/hp-hr) maximum design heat input (MDHI) of the engines of 17.13 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 (CO, VOCs, and formaldehyde) by an EMIT Technologies RT-3615-H oxidation catalyst (~95%, ~56%, and ~81%, 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)	0.16 g/hp-hr (controlled)	Catalyst/Engine Vendor	0.88	3.86
NO_X	0.30 g/hp-hr	Engine Vendor	1.65	7.24
$PM_{2.5}/PM_{10}/PM$(2)	9.91×10^{-3} lb/mmBtu	AP-42, Table 3.2-2	0.17	0.74
SO_2	5.88×10^{-4} lb/mmBtu	AP-42, Table 3.2-2	0.01	0.04
VOCs(1)	0.28 g/hp-hr (controlled)	Catalyst/Engine Vendor	1.54	6.76
Total HAPs	Various	AP-42, Table 3.2-2	0.39	1.69
Formaldehyde(1)	0.03 g/hp-hr (controlled)	Catalyst/Engine Vendor	0.17	0.72

(1) Based on control percentages provided by the oxidation catalyst vendor (to be conservative, Antero used data from non-premium catalyst sheet for CO and HCHO emissions even though they will utilize premium grade catalyst). VOC emissions based on NMNEHC + CH_2O emission factors.

(2) Includes condensables.

Glycol Regenerator Column/GDU Flash Tank Emissions

Revised 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 98% DRE of hydrocarbons in the reboiler (with a VRU/VRU backup system in the event of reboiler downtime).

New Fuel Conditioning Heater Emissions

Combustion emissions from the new natural gas-fired 0.50 mmBtu/hr fuel conditioning heater (28E) 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 unit 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 as well as a heater efficiency rate of 80%.

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 (revised upward to 52 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 revised calculations as submitted in Attachment N of the permit application, the post-modification facility-wide PTE of the Lafferty Compressor Station is given in Attachment A. The following table lists the change in facility-wide PTE at the Lafferty Compressor Station from the changes proposed herein:

Table 2: Change in Facility-Wide Post-Modification PTE

Source	CO	NO_x	PM[1]	SO_2	VOCs	HAPs
R13-3285	84.24	77.06	15.64	0.62	80.64	13.62
R13-3285A	47.88	63.62	6.24	0.45	91.65	15.32
Change in Emissions→	**(36.36)**	**(13.44)**	**(9.40)**	**(0.17)**	**11.01**	**1.70**

(1) All particulate matter emissions are assumed to be less than 2.5 microns. Includes condensables.

REGULATORY APPLICABILITY

This section will address the potential regulatory applicability/non-applicability of substantive state and federal air quality rules relevant to the emission units/sources added or modified at the Lafferty Compressor Station.

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.

The new fuel conditioning heater has been determined to meet the definition of a "fuel burning unit" under 45CSR2 and is, therefore, subject to the applicable requirements therein. However, pursuant to the exemption given under §45-2-11, as the MDHI of the fuel conditioning heater is less than 10 mmBtu/hr, the unit is 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 heater is subject to an opacity limit of 10%. Proper maintenance and operation of the unit (and the use of natural gas as fuel) should keep the opacity of the unit well below 10% during normal operations.

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.

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 fuel conditioning heater has 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 fuel conditioning heater is less than 10 mmBtu/hr, the unit is 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 modification of the Lafferty Compressor Station does have the potential to increase a regulated pollutant (see Table 2 above) but does not, however, have the potential to increase the facility-wide PTE of any regulated pollutant in excess of the thresholds that would, pursuant to §45-13-2.17, define the changes as a "modification" under 45CSR13. Therefore, the proposed changes would normally be eligible to be reviewed as a Class II Administrative Update. However, Antero voluntarily submitted the application as a modification and it was reviewed as such. Pursuant to §45-13-5.1, "[n]o person shall cause, suffer, allow or permit the construction, modification, relocation and operation of any stationary source to be commenced without . . . obtaining a permit to construct."

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 July 20, 2016 in *The Pennsboro News* and the affidavit of publication for this legal advertisement was submitted on August 5, 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 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 revised post-modification facility-wide PTE of the 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 - (NON APPLICABILITY)

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 modified 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 A) 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.

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

Antero's eight (8) Caterpillar G3608 4SLB 2,500 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 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: Caterpillar G3608 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	0.30	0.00%	0.30	Yes
CO	2.0	2.62	93.89%	0.16	Yes
VOC	0.7	0.41	31.71%	0.28	Yes

(1) Based on the revised 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 Caterpillar G3608 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.

40CFR60 Subpart OOOOa: Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution for which Construction, Modification or Reconstruction Commenced after September 18, 2015

EPA published its New Source Performance Standards (NSPS) and air toxics rules for the oil and gas sector on August 16, 2012. EPA published amendments to the Subpart on September 23, 2013 and June 3, 2016. 40 CFR 60, Subpart OOOOa establishes emission standards and compliance schedules for the control of the pollutant greenhouse gases (GHG). The greenhouse gas standard in this subpart is in the form of a limitation on emissions of methane from affected facilities in the crude oil and natural gas source category that commence construction, modification or reconstruction after September 18, 2015. This subpart also establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO_2) emissions from affected facilities that commence construction, modification or reconstruction after September 18, 2015. The effective date of this rule is August 2, 2016.

Compressor Engines

Pursuant to §60.5365a(c), "[e]ach reciprocating compressor affected facility, which is a single reciprocating compressor [not located at a well site]" that is constructed after September 18, 2015 is subject to the applicable provisions of Subpart OOOOa. As the Lafferty Compressor Station is located before the point of custody transfer, the compressor engines are applicable to Subpart OOOOa. The substantive requirements for the engines are given under §60.5385a(a): the engines'

"rod packing" must replaced according to the given schedule and the engine must meet applicable MRR given under §60.5410a(c), §60.5415a(c), and §60.5420a(b).

Fugitive Emissions Components

Pursuant to §60.5365a(j), "[t]he collection of fugitive emissions components at a compressor station, as defined in §60.5430a, is an affected facility." The Leak Detection and Repair (LDAR) requirements for a compressor station are given under §60.5497a.

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 revised (based on new throughput of 110 mmscf/day) 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 located at the Lafferty Compressor Station are each defined as a new stationary RICE (based on information in the permit application) 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 are emitted from the modified 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: 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
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 modified 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.

CHANGES TO R13-3285

The following substantive changes were made to Permit Number R13-3285A:

- The Emissions Units Table 1.0 was revised to reflect the changes evaluated herein;
- The emission limits for the compressor engines were revised under 4.1.2(c) as based on use of the new engines;
- The maximum lean glycol recirculation rate, the daily and annual GDU gas processing limit, and the minimum control percentage were increased under 4.1.5. pursuant to the modifications evaluated herein;
- Emission limits for the new fuel conditioning heater was added under 4.1.7.;
- The number of allowable pigging events was increased to 52 under 4.1.12.; and
- 40 CFR 60, Subpart OOOO language was removed from the permit and replaced with Subpart OOOOa language.

MONITORING, COMPLIANCE DEMONSTRATIONS, REPORTING, AND RECORDING OF OPERATIONS

The draft permit contains extensive and detailed monitoring, compliance demonstration, reporting, 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 various sections of the draft permit (per emission unit grouping) and may be

reviewed at that location. There was no substantive changes to the MRR as a result of the proposed changes evaluated herein.

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. There was no substantive changes to the performance testing requirments as a result of the proposed changes evaluated herein.

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 R13-3285A to Antero Midstream LLC for the proposed modification of the Lafferty Compressor Station located near Pennsboro, Ritchie County, WV.

Joe Kessler, PE
Engineer

9/28/16
Date

Attachment A: Facility-Wide PTE

Antero Midstream LLC: Lafferty Compressor Station

Permit Number R13-3285A: 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	0.88	3.86	1.65	7.24	0.17	0.74	0.01	0.04	1.54	6.76	0.17	0.72	0.39	1.69
Compressor Engine	2E	0.88	3.86	1.65	7.24	0.17	0.74	0.01	0.04	1.54	6.76	0.17	0.72	0.39	1.69
Compressor Engine	3E	0.88	3.86	1.65	7.24	0.17	0.74	0.01	0.04	1.54	6.76	0.17	0.72	0.39	1.69
Compressor Engine	4E	0.88	3.86	1.65	7.24	0.17	0.74	0.01	0.04	1.54	6.76	0.17	0.72	0.39	1.69
Compressor Engine	5E	0.88	3.86	1.65	7.24	0.17	0.74	0.01	0.04	1.54	6.76	0.17	0.72	0.39	1.69
Compressor Engine	6E	0.88	3.86	1.65	7.24	0.17	0.74	0.01	0.04	1.54	6.76	0.17	0.72	0.39	1.69
Compressor Engine	7E	0.88	3.86	1.65	7.24	0.17	0.74	0.01	0.04	1.54	6.76	0.17	0.72	0.39	1.69
Compressor Engine	8E	0.88	3.86	1.65	7.24	0.17	0.74	0.01	0.04	1.54	6.76	0.17	0.72	0.39	1.69
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	1.18	5.16	0.00	0.00	0.09	0.40
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	1.18	5.16	0.00	0.00	0.09	0.40
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
Fuel Conditioning Heater	28E	0.05	0.23	0.06	0.27	<0.01	0.02	0.00	0.00	<0.01	0.02	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	~0.00	~0.00	~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	2.53	11.08	0.00	0.00	0.07	0.29
Facility-Wide Total[(1)] →		***10.91***	***47.88***	***14.49***	***63.62***	***1.43***	***6.24***	***0.10***	***0.45***	***64.34***	***91.65***	***1.36***	***5.78***	***3.66***	***15.32***

(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.