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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-3106
Plant ID No.:	017-00060
Applicant:	Antero Resources Corporation
Facility Name:	New Milton Compressor Station
Location:	Near New Milton, Doddridge County
NAICS Code:	486210
Application Type:	Construction
Received Date:	July 22, 2013
Engineer Assigned:	Joe Kessler
Fee Amount:	$4,500
Date Received:	July 30, 2013 ($2,000); August 8, 2013 ($2,500)
Complete Date:	August 22, 2013
Due Date:	November 20, 2013
Applicant's Ad Date:	July 23, 2013
Newspaper:	*The Herald Record*
UTM's:	Easting: 526.978 km Northing: 4,342.232 km Zone: 17
Latitude/Longitude:	39.22896/-80.68743
Description:	Construction of a natural gas compressor station.

DESCRIPTION OF PROCESS

Antero Resources Corporation (Antero) is proposing to construct a natural gas compressor station to be located approximately 0.30 miles west of New Milton, Doddridge County, WV. The proposed New Milton Compressor Station will consist of six (6) Waukesha, L7044 GSI 4-Stroke Rich Burn (4SRB) 1,680 horsepower (hp) compressor engines, two (2) 2.28 mmBtu/hr Capstone C200 NG 200kWe Microturbines, two (2) Valerus, GLY-GCR-1.5MM 60 mmscf/day triethylene glycol (TEG) dehydration units (GDUs), one (1) 0.5 mmBtu/hr fuel gas pre-heater, and eleven (11) storage tanks.

Raw natural gas produced in area wells will enter into the facility and, after passing through a slug catcher to removed condensate/produced water, will be compressed by the engines. All of the condensate and produced water that enters the station from pigging or drops out in vessels is routed to a tank battery (five 16,800 gallon tanks). The combined liquids are directed to a settling tank (T03) for natural separation and then directed to homogenous tanks for storage (Tanks T01 and

T02 will hold produced water and Tanks T04 and T05 will hold condensate). There are six (6) smaller 1,000 gallon tanks (T6 through T11) used for bulk storage (one for a compressor skid settling tank, one for bulk TEG storage, one for bulk lube oil storage, one for waste oil storage and one for bulk coolant storage). Vapors from the condensate/produced water storage tanks (working/breathing/ flashing) will be captured by one of the two Vapor Recovery Units (VRUs: C-08 and C-09) and recycled back into facility for further processing. Any emissions from the miscellaneous tanks are, based on the vapor pressures of the materials stored, considered insignificant.

The gas, compressed in the engines (CE-01 through CE-06), is directed to two coalescing filter separators and then allowed to pass through the GDUs (RBV-1 and RBV-2) where it is dehydrated to the desired level. The compressor engines are each controlled (NO_x, CO, VOCs, and formaldehyde) by an EMIT Technologies Model ELH-4200T-1616F-65CEE-361 catalytic converter (C-02 through C-07).

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 flare (C-01) for destruction. 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 where flashed hydrocarbon vapors are captured by the VRU and recycled back into facility for further processing. Any liquid hydrocarbons removed in the flash tank are sent to the storage tanks. After leaving the flash vessel, 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) 1.5 mmBtu/hr natural gas-fired reboilers (RBV-1, RBV-2). 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. A 0.5 mmBtu/hr direct-fired gas heater (HTR-1) will be used in the fuel gas system to prevent the formation of hydrates and to minimize condensate dropout from the pressure reduction. Lastly, the process gas is sent through small vertical conditioning scrubbers and final custody transfer metering before leaving the compressor station.

Additionally, the facility will utilize a truck loadout (EPLOR) to remove condensate and produced water from the site (estimated to be a maximum of 76,797 gallons/year). Emissions from the truck rack will be uncontrolled. Two 200 kWe uncontrolled Microturbines (GEN-1 and GEN-2) will be used to produce primary and backup power, respectively for the facility.

SITE INSPECTION

On September 18, 2013, the writer conducted an inspection of the proposed location of the New Milton Compressor Station. The proposed New Milton site is located in a rural area of Doddridge County approximately 0.30 miles west of New Milton, WV east of State Route (SR) 18. The writer was accompanied on the inspection by Mr. Don Grey, Environmental and Regulatory Manager with Antero. Observations from the inspection include:

- The proposed facility will lie atop a hill approximately 0.30 miles west of New Milton, WV east of SR 18 in Doddridge County. The area is mountainous and rural in nature with scattered homes and farms within several miles of the proposed location. Much natural gas construction activity (pipelines, well-heads, etc.) is located in the County;

- At the time of the inspection, Antero was in the process of building an access road to the top of the hill where the compressor station will sit. No emission units were visible at the proposed site; and

- The occupied dwelling located nearest to the proposed site is approximately 0.25 miles north of the proposed site at the base of the hill.

Directions: [Latitude: 39.22896, Longitude: -80.68743] From the intersection of United States (US) Route 50 and SR 18, travel south on SR 18 for approximately 7.5 miles to the access road on the left. Follow the access road for 1.0 miles to the compressor station at the top of the hill.

AIR EMISSIONS AND CALCULATION METHODOLOGIES

Compressor Engines

Potential emissions from each of the six (6) Waukesha, L7044 GSI 4SRB 1,680 hp compressor engines (10E through 16E) were based on post-control emission factors provided by the catalytic converter vendor, the engine vendor, as given in AP-42, Section 3.2 (AP-42 is a database of emission factors maintained by USEPA), and as given in 40 CFR 98, Subpart C. Hourly emissions were based on the (as calculated using a fuel heat rating of 8,324 Btu/hp-hr) maximum design heat input (MDHI) of the engines of 13.98 mmBtu/hr and the maximum hp rating. Annual emissions were based on 8,760 hours of operation per year. The following table details the potential-to-emit (PTE) of each compressor engine:

Table 1: Per-Compressor Engine PTE

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
$CO^{(1)}$	0.30 g/hp-hr (controlled)	Catalyst Vendor	1.11	4.87
$NO_X{}^{(1)}$	0.15 g/hp-hr (controlled)	Catalyst Vendor	0.56	2.43
$PM_{2.5}{}^{(2)}$	19.41×10^{-3} lb/mmBtu	AP-42, Table 3.2-3	0.27	1.19
$PM_{10}{}^{(2)}$	19.41×10^{-3} lb/mmBtu	AP-42, Table 3.2-3	0.27	1.19

PM(2)	19.41 x 10^{-3} lb/mmBtu	AP-42, Table 3.2-3	0.27	1.19
SO_2	5.88 x 10^{-4} lb/mmBtu	AP-42, Table 3.2-3	0.01	0.04
VOCs(1)	0.22 g/hp-hr (controlled)	Catalyst Vendor	0.81	3.57
Total HAPs	Various	AP-42, Table 3.2-3	0.20	0.89
Formaldehyde(1)	0.01 g/hp-hr (controlled)	Catalyst Vendor	0.04	0.16
CH_4	1.51 g/hp-hr	Engine Vendor	5.59	24.50
N_2O	1.00 x 10^{-4} kg/mmBtu	40 CFR Part 98, Subpart C, Table C-2	0.00	0.01
CO_2	460 g/hp-hr	Engine Vendor	1,703.73	7,462.35
CO_2e(3)	n/a	n/a	n/a	7,980.94

(1) Based on post-control emission factor provided by the catalytic converter vendor.
(2) Includes condensables.
(3) Based on multiplying the mass amount of emissions for each of the six greenhouse gases by the gas's associated global warming potential published at Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials. Used to determine major source status of facilities under 45CSR14.

Microturbines

Emissions from the two (2) 2.28 mmBtu/hr Capstone C200 NG 200kWe Microturbines (16E and 17E) were based on the emission factors provided by the vendor. Hourly emissions were based on the maximum electrical output and annual emissions were based on an annual operation of 8,760 hours. All emissions were increased by 20% to account for the possibility of "richer gas." The PTE generated by each microturbine and the emission factor/emission factor source are given in the following table:

Table 2: Per-Microturbine PTE(1)

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
NO_X	0.40 lb/MWe-hr	Vendor Information	0.10	0.50
CO	1.10 lb/MWe-hr	Vendor Information	0.26	1.16
VOC	0.10 lb/MWe-hr	Vendor Information	0.02	0.11
CO_2	1,330 lb/MWe-hr	Vendor Information	319.20	1,398.10
CO_2e	n/a	n/a	n/a	1,398.10

(1) Final emissions increase by 20% to account for potentially richer gas burned.

Glycol Regenerator Column

Controlled VOC, Hazardous Air Pollutant (HAP), and methane emissions from the glycol regenerator still vents (19E and 21E) are based on ProMax Simulation Software. ProMax software is chemical process simulator for design and modeling of amine gas treating and glycol dehydration units. 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 noted above, the uncontrolled

emissions from the GDU Still Vent are sent to a flare for control. Therefore, a minimum hydrocarbon destruction efficiency of 98% was used to determine the controlled emission rate. An electronic copy (Excel File) of the ProMax run was submitted to the DAQ to verify the accuracy of the GDU emissions. Annual emissions were based on 8,760 hours of operation per year.

The PTE of emissions generated by each glycol regenerator (as controlled) and the emission factor/emission factor source are given in the following table:

Table 3: Per-GDU PTE

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
VOC	**n/a**	**ProMax Results**	**1.10**	**4.83**
n-Hexane	*n/a*	*ProMax Results*	*0.03*	*0.15*
Benzene	*n/a*	*ProMax Results*	*0.02*	*0.10*
Toluene	*n.a*	*ProMax Results*	*0.12*	*0.52*
Ethyl-benzene	*n/a*	*ProMax Results*	*0.01*	*0.07*
Xylene	*n/a*	*ProMax Results*	*0.17*	*0.73*
		Total HAPs ➜	**0.35**	**1.55**
CH_4 (1)	n/a	ProMax Results	1.72	7.55
CO_2e	**n/a**	**n/a**	**n/a**	**158.61**

(1) Based on process stream #52 of the ProMax Simulation.

Flare Combustion Exhaust Emissions

Emissions created from the combustion of the hydrocarbons (coming from the GDU Still Vents) at the flare were based on information provided by the flare vendor (and for CO_2 emissions, as calculated by ProMax Simulation Software) and increased 20% as the specific flare "[has] not [been] purchased yet."

Reboiler Combustion Exhaust Emissions

Combustion emissions from each 1.50 mmBtu/hr reboiler (18E and 20E) were based on the emission factors provided for natural gas combustion as given in AP-42 Section 1.4 and as given in 40 CFR 98, Subpart C. Hourly emissions were based on the MDHI of the units (1.50 mmBtu/hr) and annual emissions were based on an annual operation of 8,760 hours. A natural gas heat content value of 1,094 Btu/ft^3 was used in the calculations.

The PTE generated by the reboilers' combustion exhaust and the emission factor/emission factor source are given in the following table:

Table 4: Per-Reboiler Combustion Exhaust PTE

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
NO_X	100 lb/mmscf	AP-42, Table 1.4-1	0.14	0.60
CO	84 lb/mmscf	AP-42, Table 1.4-1	0.12	0.50
VOC	5.5 lb/mmscf	AP-42, Table 1.4-2	0.01	0.03
PM(1)	7.6 lb/mmscf	AP-42, Table 1.4-2	0.01	0.05
SO_2	0.6 lb/mmscf	AP-42, Table 1.4-2	0.00	0.00
CH_4	1.0×10^{-3} kg/mmBtu	40 CFR Part 98, Subpart C, Table C-2	0.00	0.01
N_2O	1.0×10^{-4} kg/mmBtu	40 CFR Part 98, Subpart C, Table C-2	0.00	0.00
CO_2	53.02 kg/mmBtu	40 CFR Part 98, Subpart C, Table C-2	175.34	767.97
CO_2e	n/a	n/a	n/a	768.72

(1) All PM emissions are assumed to be$PM_{2.5}$ or less and include condensables.

Fuel Gas Pre-Heater

Combustion emissions from the 0.50 mmBtu/hr Fuel Gas Pre-Heater (34E) were based on the emission factors provided for natural gas combustion as given in AP-42 Section 1.4 and as given in 40 CFR 98, Subpart C. Hourly emissions were based on the MDHI of the unit (0.50 mmBtu/hr) and annual emissions were based on an annual operation of 8,760 hours. A natural gas heat content value of 1,094 Btu/ft^3 was used in the calculations.

The PTE generated by the Fuel Gas Pre-Heater exhaust and the emission factor/emission factor source are given in the following table:

Table 5: Fuel Gas Pre-Heater Exhaust PTE

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
NO_X	100 lb/mmscf	AP-42, Table 1.4-1	0.05	0.20
CO	84 lb/mmscf	AP-42, Table 1.4-1	0.04	0.17
VOC	5.5 lb/mmscf	AP-42, Table 1.4-2	0.00	0.01
PM(1)	7.6 lb/mmscf	AP-42, Table 1.4-2	0.00	0.02
SO_2	0.6 lb/mmscf	AP-42, Table 1.4-2	~0.00	~0.00
CH_4	1.0×10^{-3} kg/mmBtu	40 CFR Part 98, Subpart C, Table C-2	0.00	0.01
N_2O	1.0×10^{-4} kg/mmBtu	40 CFR Part 98, Subpart C, Table C-2	0.00	0.00
CO_2	53.02 kg/mmBtu	40 CFR Part 98, Subpart C, Table C-2	58.45	256.01
CO_2e	n/a	n/a	n/a	256.51

(1) All PM emissions are assumed to be$PM_{2.5}$ or less and include condensables.

Storage Tanks

Antero provided an estimate of the uncontrolled emissions produced from the five (5) 16,880 gallon (22E through 26E) produced water and condensate storage tanks using the TANKS 4.09d program (working/breathing losses) as provided under AP-42, Section 7 and using ProMax Simulation Software (flashing losses). However, as noted above, emissions from the tanks shall be routed to a VRU for control. The VRU will capture and recycle all the vapors back into the into compressor engines for transportation into the production line. Therefore, the PTE from these tanks shall be zero. Based on the size of tanks and the material stored, potential emissions from the other bulk material storage tanks will be nominal.

Fugitives

Antero calculated three sources of fugitive emissions at the proposed New Milton Compressor Station: equipment leaks, maintenance and emergency events, and truck loadouts.

Equipment Leaks

Antero based their VOC and methane 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.

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 (144 events/year), station emergency shutdowns (2 events/year), and "pigging" events (52 events/year). Methane/VOC by-weight percentages (66%/14%) of the natural gas (as tested) were also used in the calculations.

Truck Loadouts

Air emissions from condensate truck loading operations (EPLOR) occur as fugitive emissions generated by displacement of vapors when loading trucks. The emission factor used to generate the VOC emissions is based on Equation (1) of AP-42 Section 5.2-4. In this equation, EQT used variables specific to the liquids loaded and to the method of loading - in this case "submerged filling - dedicated normal service." Additionally, worst-case annual emissions were based on a maximum loading rate of 3,225,474 gal/year of condensate. As no maximum hourly pumping rate was provided, hourly emissions were based on 1,000 hours of loading per year (3,225 gal/hour).

Emissions Summary

Based on the above estimation methodologies, which are determined to be reasonable, the PTE of the proposed New Milton Compressor Station is given in the following tables:

Table 6: Facility-Wide Aggregate Hourly (lb/hr) Criteria Pollutant PTE Summary.

Source	Emission Point	CO	NO_x	PM[(1)]	SO_2	VOCs	HAPs
Compressor Engine	10E	1.11	0.56	0.27	0.01	0.81	0.20
Compressor Engine	11E	1.11	0.56	0.27	0.01	0.81	0.20
Compressor Engine	12E	1.11	0.56	0.27	0.01	0.81	0.20
Compressor Engine	13E	1.11	0.56	0.27	0.01	0.81	0.20
Compressor Engine	14E	1.11	0.56	0.27	0.01	0.81	0.20
Compressor Engine	15E	1.11	0.56	0.27	0.01	0.81	0.20
Microturbine	16E	0.26	0.10	~0.00	~0.00	0.02	~0.00
Microturbine	17E	0.26	0.10	~0.00	~0.00	0.02	~0.00
Reboiler Exhaust	18E	0.12	0.14	0.01	~0.00	0.01	~0.00
GDU Still Vent	1E	0.00	0.00	0.00	0.00	1.10	0.35
Reboiler Exhaust	20E	0.12	0.14	0.01	~0.00	0.01	~0.00
GDU Still Vent	1E	0.00	0.00	0.00	0.00	1.10	0.35
Flare Combustion	1E	3.17	0.37	~0.00	~0.00	~0.00	~0.00
Fuel Gas Heater	34E	0.04	0.05	~0.00	~0.00	~0.00	~0.00
Equipment Leaks	Fugitive	0.00	0.00	0.00	0.00	1.23	0.00
Plant Events[(2)]		0.00	0.00	0.00	0.00	n/a	0.00
Truck Loading		0.00	0.00	0.00	0.00	22.96	0.00
Facility-Wide Totals ➜		**10.63**	**4.26**	**1.64**	**0.06**	**31.31**	**1.90**

(1) All particulate matter emissions are assumed to be less than 2.5 microns and include condensables.
(2) These events will result in very large short-term emissions that occur very infrequently and are not included here.

Table 7: Facility-Wide Aggregate Annual (ton/yr) Criteria Pollutant/GHG PTE Summary.

Source	Emission Point	CO	NO_x	PM[(1)]	SO_2	VOCs	HAPs[(2)]	CO_2e
Compressor Engine	10E	4.87	2.43	1.19	0.04	3.57	0.89	7,981
Compressor Engine	11E	4.87	2.43	1.19	0.04	3.57	0.89	7,981
Compressor Engine	12E	4.87	2.43	1.19	0.04	3.57	0.89	7,981
Compressor Engine	13E	4.87	2.43	1.19	0.04	3.57	0.89	7,981
Compressor Engine	14E	4.87	2.43	1.19	0.04	3.57	0.89	7,981
Compressor Engine	15E	4.87	2.43	1.19	0.04	3.57	0.89	7,981
Microturbine	16E	1.16	0.50	~0.00	~0.00	0.11	~0.00	1,398
Microturbine	17E	1.16	0.50	~0.00	~0.00	0.11	~0.00	1,398
Reboiler Exhaust	18E	0.50	0.60	0.05	~0.00	0.03	~0.00	769

Source	Emission Point	CO	NO_x	PM[(1)]	SO_2	VOCs	HAPs[(2)]	CO_2e
GDU Still Vent	1E	0.00	0.00	0.00	0.00	4.83	1.55	159
Reboiler Exhaust	20E	0.50	0.60	0.05	~0.00	0.03	~0.00	769
GDU Still Vent	1E	0.00	0.00	0.00	0.00	4.83	1.55	159
Flare Combustion	1E	13.90	1.63	~0.00	~0.00	~0.00	~0.00	612
Fuel Gas Heater	34E	0.17	0.20	0.02	~0.00	0.01	~0.00	257
Equipment Leaks	Fugitive	0.00	0.00	0.00	0.00	5.40	0.00	545
Plant Events		0.00	0.00	0.00	0.00	8.61	0.00	874
Truck Loading		0.00	0.00	0.00	0.00	11.48	0.00	1,165
Facility-Wide Totals →		**46.61**	**18.61**	**7.26**	**0.24**	**56.86**	**8.44**	**55,989**

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

(2) As the PTE of all individual HAPs are less than 10 TPY and the PTE of total HAPs is less than 25 TPY, the proposed New Milton Compressor Station is defined as a minor (area) source of HAPs for purposes of 40 CFR 61, 40CFR63, and Title V.

REGULATORY APPLICABILITY

The proposed New Milton 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 microturbines.

The GDU Reboilers 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 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 are subject to an opacity limit of 10%. Proper maintenance and operation of the reboilers (and the use of 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. 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

Based on information included in the application, the maximum vapor mass sent to the flare will be 823.2 lb/hr (0.41 tons/hour). Based on the above equation, the particulate matter limit of the flare is 2.23 lbs/hr. As the flare is of smokeless design, particulate matter emissions from the flare are expected to be negligible and in compliance with the limit calculated under Section 4.1.

45CSR6 Opacity Limits for - Section 4.3, 4.4

Pursuant to Section 4.3, and subject to the exemptions under 4.4, the flare has a 20% limit on opacity during operation. As the flare is of smokeless design, proper design and operation of the flare should prevent any substantive opacity from the flares.

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 New Milton Compressor Station is the limitations on fuel burning units. The GDU Reboilers 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 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 New Milton Compressor Station has a potential to emit in excess of six (6) lbs/hour and ten (10) TPY of a regulated pollutant 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 July 23, 2013 in *The Herald Record* and the affidavit of publication for this legal advertisement was submitted on August 7, 2013.

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

The New Milton Compressor Station is proposed to be located in Doddridge County, WV. Doddridge 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 (and pursuant to 2.80(e)(1), 100,000 TPY of CO_2e). As given above in Table 7, the facility-wide PTE of the proposed New Milton Compressor Station is less than 250 TPY for all criteria pollutants and less than 100,000 TPY of CO_2e. 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 proposed New Milton 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 Table 7 above) of any regulated pollutant does not exceed 100 TPY (and, in the case of CO_2e, does not exceed 100,000 TPY). Additionally, the facility-wide PTE does not exceed 10 TPY of any individual HAP or 25 TPY of aggregate HAPs.

However, as the 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 New Milton 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." The largest storage tanks proposed for the New Milton Compressor Station are each 16,800 gallons, or 64 m^3. Therefore, Subpart Kb does not apply to any storage tanks at the proposed facility.

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

Pursuant to §60.330(a), 40 CFR 60, Subpart GG applies to "[a]ll stationary gas turbines with a heat input at peak load equal to or greater than 10.7 gigajoules (10 million Btu) per hour, based on the lower heating value of the fuel fired." The microturbines proposed for the New Milton Compressor Station are each rated at 2.28 mmBtu/hr and are not, therefore, subject to Subpart GG.

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

Waukesha, L7044 GSI

Antero's ten (10) Waukesha, L7044 GSI 4SRB 1,680 hp compressor engines proposed for the New Milton 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 $\geq$ 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 8: Waukesha, L7044 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	98.89%	0.15	Yes
CO	2.0	12.80	97.66%	0.30	Yes
VOC	0.7	0.43	48.84%	0.22	Yes

(1) Based on the EMIT Technologies, Inc. Model ELH-4200T-1616F-65CEE-361 catalytic converter specification sheet included in the permit application.

The Waukesha, 7044 LGSI 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 New Milton 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

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 New Milton 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.

Storage Tanks - (CONDITIONAL NON APPLICABILITY)

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" that is constructed after August 23, 2011 and, pursuant to §60.5395 has "VOC emissions equal to or greater than 6 tpy" must meet the control requirements under §60.5395 as of October 15, 2013. The substantive requirement is to "reduce VOC emissions by 95.0 percent or greater." Antero has proposed the use of a closed-loop VRU to eliminate all potential emissions from the proposed storage tanks. Pursuant to §60.5365(e), "[a]ny vapor from the storage vessel that is recovered and routed to a process through a VRU designed and operated as specified in [§60.5365] is not required to be included in the determination of VOC potential to emit for purposes of determining affected facility status, provided you comply with the requirements in paragraphs (e)(1) through (4) of [§60.5365]." Therefore, if the proposed VRU complies with §60.5365(e)(1) through (e)(4), storage tanks are not subject to Subpart OOOO.

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 New Milton Compressor Station - an area source of HAPs (see Table 7) - "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."

As shown in Table 3 above, the maximum aggregate PTE of benzene emissions from the GDU process vents are 0.20 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 New Milton Compressor Station is defined as an area source of HAPs (see Table 7), 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 New Milton 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 New Milton 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), Particulate Matter less than 10 microns (PM_{10}), Particulate Matter less than 2.5 microns ($PM_{2.5}$), 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. As noted above, the proposed New Milton Compressor Station has the potential to emit the following HAPs: Hexane, Benzene, Toluene, Ethyl-benzene, Xylene, and Formaldehyde. The following table lists each HAP's carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)):

Table 9: Potential HAPs - Carcinogenic Risk

HAPs	Type	Known/Suspected Carcinogen	Classification
Hexane	VOC	No	Inadequate Data
Benzene	VOC	Yes	Category A - Known Human Carcinogen
Toluene	VOC	No	Inadequate Data
Ethyl-benzene	VOC	No	Category D - Not Classifiable
Xylene	VOC	No	Inadequate Data
Formaldehyde	VOC	Yes	B1 - Probable Human Carcinogen

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 45CSR13, Section 7.

MONITORING, COMPLIANCE DEMONSTRATIONS, REPORTING, AND RECORDING OF OPERATIONS

The following substantive monitoring, compliance demonstration, and record-keeping requirements (MRR) shall be required:

- For the purposes of demonstrating compliance with the maximum wet gas throughput limit set forth in 4.1.4 of the draft permit, Antero shall be required to monitor and record the daily, monthly and rolling twelve month amounts of the wet gas throughput of each Glycol Dehydration Unit;

- In order to demonstrate compliance with 4.1.5(a), upon request of the Director, the permittee shall demonstrate compliance with the VOC/HAP emissions limits using GLYCalc Version 4.0, ProMax Simulation Software, or another appropriate emissions estimation method upon approval of the Director;

- For the purposes of demonstrating compliance with visible emissions limitations set forth in 4.1.6(d) of the draft permit, Antero shall be required to:

    - Conduct monthly Method 22 visible emission observations of each Reboiler exhaust to ensure proper operation for a minimum of ten (10) minutes each month the units are in operation;

    - In the event visible emissions are observed in excess of the limitations given under 4.1.6(d), Antero shall be required to take immediate corrective action;

    - Maintain records of the visible emission opacity tests conducted per Section 4.2.3.; and

- Any deviation(s) from the allowable visible emission requirement for any emission source discovered during observations using 40CFR Part 60, Appendix A, Method 9 or 22 shall be reported in writing to the Director of the Division of Air Quality as soon as practicable, but in any case within ten (10) calendar days of the occurrence and shall include at least the following information: the results of the visible determination of opacity of emissions, the cause or suspected cause of the violation(s), and any corrective measures taken or planned.

- Operation of the flare shall meet the following Monitoring, Compliance Demonstration and Recordkeeping Requirements:

  - Antero shall be required to maintain records of all startups, shutdowns, and/or malfunctions of the flare. These records shall include the date, time, and duration of each event; and

  - Antero shall be required to maintain records of the date, time, and duration each time the permittee does not detect the presence of a pilot flame in the flare.

- For the purposes of demonstrating compliance with the truck loadout throughput limit set forth in 4.1.10(b) of the draft permit, Antero shall be required to monitor and maintain monthly and rolling twelve month records of the amount of liquids loaded out.

- Any deviation(s) from the flare design and operation criteria in Section 4.1.7. shall be reported in writing to the Director of the Division of Air Quality as soon as practicable, but in any case within ten (10) calendar days of discovery of such deviation.

- Antero shall be required to meet all applicable Monitoring, Compliance Demonstration and Source-Specific Recordkeeping and Reporting Requirements as given under 45CSR2, 45CSR6, 40 CFR 60, Subpart JJJJ, and Subpart OOOO, and 40 CFR 63, Subpart HH and Subpart ZZZZ.

PERFORMANCE TESTING OF OPERATIONS

The following substantive performance testing requirements shall be required:

- At such reasonable time(s) as the Secretary may designate, in accordance with the provisions of 3.3 of the draft permit, Antero shall be required to conduct or have conducted test(s) to determine compliance with the emission limitations established in this permit and/or applicable regulations.

- Antero shall be required to, pursuant to the timing and other requirements of 40 CFR 60, Subpart JJJJ, conduct, or have conducted, performance testing on the compressor engines to determine the emission rates of CO, NO_x, and VOCs. The testing shall, in addition to meeting all applicable requirements under 40 CFR 60, Subpart JJJJ, be in accordance with 3.3.1. of the draft permit. Results of the this performance testing shall, unless granted in writing a waiver by the Director, be used to determine compliance with the CO, NO_x, and

VOC emission limits given under 4.1.2(c) of the draft permit.

- Antero shall be required to meet all applicable Performance Testing Requirements as given under 45CSR2, 40 CFR 60, Subpart JJJJ, and 40 CFR 63, Subpart HH.

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 R13-3106 to Antero Resources Appalachian Corporation for the proposed construction and operation of the New Milton Compressor Station located near New Milton, Doddridge County, WV.

Joe Kessler, PE
Engineer

Date