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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-3354
Plant ID No.:	017-00163
Applicant:	Antero Midstream LLC (Antero)
Facility Name:	South Canton Compressor Station
Location:	West Union, Doddridge County
NAICS Code:	221210 (Natural Gas Distribution)
Application Type:	Construction
Received Date:	January 6, 2017
Engineer Assigned:	Jerry Williams, P.E.
Fee Amount:	$4,500.00
Date Received:	January 6, 2017
Complete Date:	January 31, 2017
Due Date:	May 1, 2017
Applicant Ad Date:	January 13, 2017
Newspaper:	*The Doddridge Independent*
UTM's:	Easting: 516.949 km Northing: 4,353.883 km Zone: 17
Latitude:	39.334203
Longitude:	-80.803337
Description:	Construction and operation of a natural gas compressor station.

DESCRIPTION OF PROCESS

The following process description was taken from Permit Application R13-3354:

Gas from surrounding pipelines enters the facility through receivers and associated slug catcher. From there, the gas is metered and routed through a scrubber and filter separator. Any produced liquids from the scrubber or separator are sent to a 500 bbl settling tank (T04). Gas from the filter separator is sent to one (1) of twelve (12) 2,500 hp Caterpillar G3608 lean burn compressor engines (C-100 - C-1200). The twelve (12) compressor engines are controlled with oxidation catalysts (1C -12C). Fuel gas for the compressor engines will be treated prior to the engines by a fuel conditioning skid with a 0.5 MMBTU/hr heater (FUEL1). Produced fluids are routed to the settling tank and gas goes to one of the three (3) TEG dehydrators.

Each TEG dehydrator (DEHY1 – DEHY3) contains a flash gas tank and 1.5 MMBtu/hr reboiler. Each dehydrator has a design rate of 150 million standard cubic feet per day. It is being requested that two alternative operating scenarios (AOS) for the dehydrators be permitted at this time, but only one will be implemented.

The first scenario, AOS1, will consist of a flare (FLARE1) as follows.

Within the dehydrator unit, vent gas from the flash gas tank (DFLSH1 - DFLSH3) is routed to the reboiler (DREB1 - DREB3) and used as fuel. In the case where the flash tank gas cannot be used by the reboiler due to excess gas or the reboiler being offline, the gas will be sent to the VRUs (VRU-100 and VRU-200) via the storage tanks (T01 - T07) and thus controlled by 98%. Emissions from each reboiler are routed to the atmosphere. The dehydrator still vents are controlled by a flare with at least 98% control efficiency (FLARE1). Each still vent is also equipped with a BTEX condenser unit.

The second scenario, AOS2, will consist of three (3) thermal oxidizers (TO-1 - TO-3) as follows.

Within the dehydrator unit, both vent gas from the flash gas tank (DFLSH1 - DFLSH3) and vent gas from the still vents will be routed to a thermal oxidizer (TO-1 - TO-3) with a control efficiency of 98%. Each dehydrator will have a dedicated thermal oxidizer, but will not be equipped with a BTEX condenser unit. Emissions from each reboiler are routed to the atmosphere.

In either AOS, produced fluids from the dehydrators (DEHY1 - DEHY3) are routed to the settling tank (T04). The dry gas from the dehydration process is either routed to a fuel gas scrubber, metered, and routed to the compressors as fuel gas or metered and sent to plant discharge.

All produced fluids enter one (1) 500 bbl settling tank (T03) where the fluids settle out as either condensate or produced water. The produced water goes to three (3) 400 bbl produced water tanks (T01 – T03) and the condensate goes to three (3) 400 bbl condensate tanks (T05 – T07). Flashing only occurs at the settling tank as the fluids stabilize in the settling tank before going to the other storage tanks. All seven (7) tanks are connected to a vapor recovery unit (VRU-100) where tank vapors are collected and recycled back into the gas system right before the initial filter scrubber. A second vapor recovery unit (VRU-200) is also connected to the tanks as a backup unit. The produced fluids are trucked out via tanker trucks as needed (LDOUT1). The anticipated production is 300 bbl per day of condensate and 90 bbl per day of produced water.

The facility will likely operate off of grid electricity; however, one (1) natural gas engine generator rated at 649 hp will supply power to the facility (GEN1) in the case the grid power is down or not available. The generator will be permitted at 8,760 hours per year of operation for maximum operational flexibility.

Fugitive emissions from component leaks and emissions from pigging venting or blowdown events (VENT1) also occur.

There will also be small storage tanks located at the facility. A list of the tanks and their capacity is in the table listed below.

Tank ID	Storage Tank Description	Storage Tank Capacity (gal)
TK-100	Compressor Skid Oily Water Tank	2,000
TK-101	Used Oil Tank	4,000
TK-102	TEG Make-Up Tank	1,000
TK-103	Compressor Coolant Tank	2,000
TK-104	Engine Lube Oil Tank	2,000
TK-105	Compressor Lube Oil Tank	2,000

SITE INSPECTION

A site inspection was conducted on January 18, 2017 by Doug Hammell of the DAQ Enforcement Section. According to Mr. Hammell, the site is suitable for the proposed facility. The closest home is approximately 800 feet away but is in the process of being acquired by Antero and will be removed. There is a gated residential community approximately 0.5 miles from the proposed facility. No site work has taken place.

Directions as given in the permit application are as follows:

From the intersection of U.S. 50 and WV-18 near West Union, head north (northwest) on WV-18N for 0.5 miles. Take a right on Main Street and then a left on Davis Street. In 0.2 miles at the round-a-bout, keep to the right to stay on Davis Street. After 0.2 miles, turn right onto WV-18N/ Sisterville Pike and drive 5.1 miles. Turn right on Nutter Fork (Rte. 28) and drive 0.8 miles. The facility is on the left.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Emissions associated with this facility consist of the equipment listed in the following table and fugitive emissions. Fugitive emissions for the facility are based on calculation methodologies presented in EPA Protocol for Equipment Leak Emission Estimates and 40CFR98 Subpart W. The following table indicates which methodology was used in the emissions determination:

Emission Unit ID#	**Process Equipment**	**Calculation Methodology**
C-100 – C-1200	2,500 hp Caterpillar G3608 Reciprocating Internal Combustion Engine (RICE) w/ Oxidation Catalyst	Manufacturer's Data, EPA AP-42 Emission Factors
GEN1	649 hp PSI Industrial NG Generator	EPA Certification, EPA AP-42 Emission Factors
FUEL1	0.5 MMBTU/hr Fuel Conditioning Heater	EPA AP-42 Emission Factors
DEHY1 – DEHY3	150 mmscfd TEG Dehydrator Still Vent w/ Flare or Thermal Oxidizer	GRI-GlyCalc 4.0
DREB1 – DREB3	1.5 MMBtu/hr TEG Dehydrator Reboiler	EPA AP-42 Emission Factors
DFLSH1 – DFLSH3	Dehydrator Flash Tank controlled by Reboiler or Thermal Oxidizer	Engineering Estimate
T01 – T03	400 bbl (16,800 gal) Condensate Storage Tanks	EPA Tanks 4.09d
T04	500 bbl (21,000 gal) Condensate/Produced Water Settling Tank	EPA Tanks 4.09d and ProMax Simulation (Flashing)
T05 – T07	400 bbl (16,800 gal) Produced Water Storage Tanks	EPA Tanks 4.09d
TK-100	2,000 gal Compressor Skid Oily Water Tank	Negligible
TK-101	4,000 gal Used Oil Tank	Negligible
TK-102	1,000 gal TEG Make-Up Tank	Negligible
TK-103	2,000 gal Compressor Coolant Tank	Negligible
TK-104	2,000 gal Engine Lube Oil Tank	Negligible
TK-105	2,000 gal Compressor Lube Oil Tank	Negligible
LDOUT1	390 bbl/day (16,380 gal/day) Product Loadout Rack	EPA AP-42 Emission Factors
FLARE1	4.8 MMBTU/hr Flare Control Device	EPA AP-42 Emission Factors/ Engineering Estimate
TO-1	6.0 MMBTU/hr Thermal Oxidizer Control Device	EPA AP-42 Emission Factors/ Engineering Estimate
TO-2	6.0 MMBTU/hr Thermal Oxidizer Control Device	EPA AP-42 Emission Factors/ Engineering Estimate
TO-3	6.0 MMBTU/hr Thermal Oxidizer Control Device	EPA AP-42 Emission Factors/ Engineering Estimate
VRU-100	Vapor Recovery Unit #1	Electric Driven
VRU-200	Vapor Recovery Unit #2	Electric Driven

The following table indicates the control device efficiencies that are required for this facility:

Emission Unit	Pollutant	Control Device	Control Efficiency
2,500 hp Caterpillar G3608 RICE w/ Oxidation Catalyst (C-100 – C-1200)	Carbon Monoxide	Oxidation Catalyst	0.16 g/bhp-hr
	Volatile Organic Compounds		0.27 g/bhp-hr
	Formaldehyde		0.02 g/bhp-hr
150 mmscfd TEG Dehydrator Still Vents (DEHY1 – DEHY3)	Volatile Organic Compounds	Flare (AOS1)	98 %
	Hazardous Air Pollutants		98 %
150 mmscfd TEG Dehydrator Still Vents (DEHY1 – DEHY3)	Volatile Organic Compounds	Thermal Oxidizers (AOS2)	98 %
	Hazardous Air Pollutants		98 %
150 mmscfd TEG Dehydrator Flash Tanks (DFLSH1 – DFLSH3)	Volatile Organic Compounds	Recycled Reboiler/ Condenser w VRU backup	98 %
	Hazardous Air Pollutants		98 %
Product Tanks (T01 – T07)	Volatile Organic Compounds	Vapor Recovery Units	98 %
	Hazardous Air Pollutants		98 %

The total facility PTE (including fugitives) would occur under AOS2. The operating conditions for AOS2 for the South Canton Compressor Station is shown in the following table:

Pollutant	R13-3354 PTE (tons/year)
Nitrogen Oxides	101.47
Carbon Monoxide	90.52
Volatile Organic Compounds	155.70
Particulate Matter-10	10.58
Sulfur Dioxide	0.56
Formaldehyde	6.29
Total HAPs	18.41
Carbon Dioxide Equivalent	166,561

Maximum detailed controlled point source emissions were calculated by Antero and checked for accuracy by the writer and are summarized in the table on the following two (2) pages.

Antero Midstream LLC – South Canton Compressor Station AOS1 (R13-3354)

Emission	Source	NO_x		CO		VOC		PM-10		SO_2		Formaldehyde		Total HAPs		CO2e
Point ID#		lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	ton/year
1E	Compressor Engine #1	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
2E	Compressor Engine #2	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
3E	Compressor Engine #3	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
4E	Compressor Engine #4	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
5E	Compressor Engine #5	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
6E	Compressor Engine #6	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
7E	Compressor Engine #7	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
8E	Compressor Engine #8	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
9E	Compressor Engine #9	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
10E	Compressor Engine #10	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
11E	Compressor Engine #11	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
12E	Compressor Engine #12	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
13E	NG Engine Generator	1.43	6.27	2.86	12.53	1.00	4.39	0.11	0.47	0.003	0.01	0.11	0.50	0.18	0.78	2841
30E	Fuel Conditioning Heater	0.05	0.21	0.04	0.18	0.0027	0.01	0.0037	0.02	0.00029	0.0013	0.00004	0.00002	0.0009	0.004	257
16E	Dehydrator Reboiler	0.15	0.64	0.12	0.54	0.01	0.04	0.01	0.05	0.001	0.004	0.0001	0.0005	0.003	0.01	771
19E	Dehydrator Reboiler	0.15	0.64	0.12	0.54	0.01	0.04	0.01	0.05	0.001	0.004	0.0001	0.0005	0.003	0.01	771
22E	Dehydrator Reboiler	0.15	0.64	0.12	0.54	0.01	0.04	0.01	0.05	0.001	0.004	0.0001	0.0005	0.003	0.01	771
31E	Flare Combustion	0.33	1.46	1.78	7.80	3.93	17.16	0.0005	0.002	0.00004	0.00016	0	0	0.39	1.65	3415
26E	Settling Storage Tank	0	0	0	0	1.64	7.18	0	0	0	0	0	0	0.04	0.17	53
23E-25E	Condensate Storage Tanks	0	0	0	0	0.06	0.28	0	0	0	0	0	0	0.002	0.01	0
27E-29E	Produced Water Storage Tanks	0	0	0	0	0.00	0.00	0	0	0	0	0	0	0.00	0.00	0
35E	Product Loadout Rack	0	0	0	0	59.72	12.45	0	0	0	0	0	0	1.41	0.29	93
BD	Compressor Blowdowns	0	0	0	0	NA	8.44	0	0	0	0	0	0	NA	0.17	791
SSM	Startup/Shutdown Events	0	0	0	0	NA	5.28	0	0	0	0	0	0	NA	0.11	495
PIG	Pigging Events	0	0	0	0	NA	7.42	0	0	0	0	0	0	NA	0.15	694
Total Point Source		**22.09**	**96.77**	**15.64**	**68.49**	**85.55**	**146.72**	**2.19**	**9.62**	**0.13**	**0.56**	**1.44**	**6.29**	**5.40**	**18.20**	**158680**
Fugitive	Component Leaks	0	0	0	0	2.04	8.94	0	0	0	0	0	0	0.04	0.19	177
Fugitive	Dust	0	0	0	0	0	0	0.21	0.90	0	0	0	0	0	0	0
Total Fugitive		**0**	**0**	**0**	**0**	**2.04**	**8.94**	**0.21**	**0.90**	**0**	**0**	**0**	**0**	**0.04**	**0.19**	**177**
Total Sitewide		**22.09**	**96.77**	**15.64**	**68.49**	**87.59**	**155.66**	**2.40**	**10.52**	**0.13**	**0.56**	**1.44**	**6.29**	**5.44**	**18.39**	**158857**

Antero Midstream LLC – South Canton Compressor Station AOS2 (R13-3354)

Emission	Source	NO_x		CO		VOC		PM-10		SO_2		Formaldehyde		Total HAPs		CO_2e
Point ID#		lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	ton/year
1E	Compressor Engine #1	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
2E	Compressor Engine #2	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
3E	Compressor Engine #3	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
4E	Compressor Engine #4	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
5E	Compressor Engine #5	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
6E	Compressor Engine #6	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
7E	Compressor Engine #7	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
8E	Compressor Engine #8	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
9E	Compressor Engine #9	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
10E	Compressor Engine #10	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
11E	Compressor Engine #11	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
12E	Compressor Engine #12	1.65	7.24	0.88	3.86	1.60	7.00	0.17	0.75	0.01	0.04	0.11	0.48	0.28	1.24	12311
13E	NG Engine Generator	1.43	6.27	2.86	12.53	1.00	4.39	0.11	0.47	0.003	0.01	0.11	0.50	0.18	0.78	2841
30E	Fuel Conditioning Heater	0.05	0.21	0.04	0.18	0.0027	0.01	0.0037	0.02	0.00029	0.0013	0.00004	0.00002	0.0009	0.004	257
16E	Dehydrator Reboiler	0.15	0.64	0.12	0.54	0.01	0.04	0.01	0.05	0.001	0.004	0.0001	0.0005	0.003	0.01	771
19E	Dehydrator Reboiler	0.15	0.64	0.12	0.54	0.01	0.04	0.01	0.05	0.001	0.004	0.0001	0.0005	0.003	0.01	771
22E	Dehydrator Reboiler	0.15	0.64	0.12	0.54	0.01	0.04	0.01	0.05	0.001	0.004	0.0001	0.0005	0.003	0.01	771
16E	Thermal Oxidizer	0.47	2.05	2.27	9.95	1.31	5.72	0.0005	0.002	0.00004	0.00016	0	0	0.13	0.55	3706
17E	Thermal Oxidizer	0.47	2.05	2.27	9.95	1.31	5.72	0.0005	0.002	0.00004	0.00016	0	0	0.13	0.55	3706
18E	Thermal Oxidizer	0.47	2.05	2.27	9.95	1.31	5.72	0.0005	0.002	0.00004	0.00016	0	0	0.13	0.55	3706
26E	Settling Storage Tank	0	0	0	0	1.64	7.18	0	0	0	0	0	0	0.04	0.17	53
23E-25E	Condensate Storage Tanks	0	0	0	0	0.06	0.28	0	0	0	0	0	0	0.002	0.01	0
27E-29E	Produced Water Storage Tanks	0	0	0	0	0.00	0.00	0	0	0	0	0	0	0.00	0.00	0
35E	Product Loadout Rack	0	0	0	0	59.72	12.45	0	0	0	0	0	0	1.41	0.29	93
BD	Compressor Blowdowns	0	0	0	0	NA	8.44	0	0	0	0	0	0	NA	0.17	791
SSM	Startup/Shutdown Events	0	0	0	0	NA	5.28	0	0	0	0	0	0	NA	0.11	495
PIG	Pigging Events	0	0	0	0	NA	7.42	0	0	0	0	0	0	NA	0.15	694
Total Point Source		**23.17**	**101.47**	**20.67**	**90.52**	**85.56**	**146.76**	**2.21**	**9.68**	**0.13**	**0.56**	**1.44**	**6.29**	**5.40**	**18.22**	**166384**
Fugitive	Component Leaks	0	0	0	0	2.04	8.94	0	0	0	0	0	0	0.04	0.19	177
Fugitive	Dust	0	0	0	0	0	0	0.21	0.90	0	0	0	0	0	0	0
Total Fugitive		**0**	**0**	**0**	**0**	**2.04**	**8.94**	**0.21**	**0.90**	**0**	**0**	**0**	**0**	**0.04**	**0.19**	**177**
Total Sitewide		**23.17**	**101.47**	**20.67**	**90.52**	**87.60**	**155.70**	**2.42**	**10.58**	**0.13**	**0.56**	**1.44**	**6.29**	**5.44**	**18.41**	**166561**

REGULATORY APPLICABILITY

The following rules apply to this modification:

45CSR2 (Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers)

The purpose of 45CSR2 is to establish emission limitations for smoke and particulate matter which are discharged from fuel burning units. 45CSR2 states that any fuel burning unit that has a heat input under ten (10) million B.T.U.'s per hour is exempt from sections 4 (weight emission standard), 5 (control of fugitive particulate matter), 6 (registration), 8 (testing, monitoring, recordkeeping, reporting) and 9 (startups, shutdowns, malfunctions). However, failure to attain acceptable air quality in parts of some urban areas may require the mandatory control of these sources at a later date.

The individual heat input of the reboilers (DREB1 – DREB3) and heater (FUEL1) are below 10 MMBTU/hr. Therefore, these units are exempt from the aforementioned sections of 45CSR2.

Antero would also be subject to the opacity requirements in 45CSR2, which is 10% opacity based on a six minute block average.

45CSR6 (To Prevent and Control Air Pollution from the Combustion of Refuse)

The purpose of this rule is to prevent and control air pollution from combustion of refuse.

Antero has one (1) flare (FLARE1) and three (3) thermal oxidizers (TO1 – TO3) at the facility. These units are subject to section 4, emission standards for incinerators. These units have negligible hourly particulate matter emissions. Therefore, these units should demonstrate compliance with this section. The facility will demonstrate compliance by maintaining records of the amount of natural gas consumed by these units and the hours of operation. The facility will also monitor the flame of the flare and record any malfunctions that may cause no flame to be present during operation.

45CSR10 (To Prevent and Control Air Pollution from the Emissions of Sulfur Oxides)

The purpose of 45CSR10 is to establish emission limitations for sulfur dioxide which are discharged from fuel burning units. 45CSR10 states that any fuel burning unit that has a heat input under ten (10) million B.T.U.'s per hour is exempt from sections 3 (weight emission standard), 6 (registration), 7 (permits), and 8 (testing, monitoring, recordkeeping, reporting). However, failure to attain acceptable air quality in parts of some urban areas may require the mandatory control of these sources at a later date.

The individual heat input of the reboilers (DREB1 – DREB3) and heater (FUEL1) are below 10 MMBTU/hr. Therefore, these units are exempt from the aforementioned sections of 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 has 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, meets the definition of a "stationary source" under 45CSR13. 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." Therefore, Antero is required to obtain a permit under 45CSR13 for the construction 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." Additionally, Antero paid the appropriate application fee.

45CSR16 (Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60)

45CSR16 applies to this source by reference of 40CFR60, Subparts JJJJ and OOOOa. These requirements are discussed under that rule below.

45CSR30 (Requirements for Operating Permits)

Antero is subject to 45CSR30. The South Canton Compressor Station has the potential to emit more than major regulatory threshold for NO_x and VOC. Due to this facility's potential to emit over 100 tons per year of criteria pollutant, Antero is required to have an operating permit pursuant to Title V of the Federal Clean Air Act as amended and 45CSR30.

Antero is required to pay the appropriate annual operating fees and submit an annual Certified Emissions Statement.

40CFR60 Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (SI ICE))

40CFR60 Subpart JJJJ establishes emission standards for applicable SI ICE.

The 2,500 hp Caterpillar G3608 RICEs (C-100 – C-1200) were manufactured after the July 1, 2007 date for engines with a maximum rated power capacity greater than or equal to 500 hp. These engines will be subject to the following emission limits: NOx – 1.0 g/hp-hr (5.51 lb/hr); CO – 2.0 g/hp-hr (11.02 lb/hr); and VOC – 0.7 g/hp-hr (3.86 lb/hr). Based on the manufacturer's specifications for these engines, the emission standards will be met.

These engines are not certified by the manufacturer to meet the emission standards listed in 40CFR60 Subpart JJJJ. Therefore, Antero will be required to conduct an initial performance test and conduct subsequent performance testing every 8,760 hours or three (3) years, whichever comes first, to demonstrate compliance.

The 649 hp PSI Industrial generator engine (GEN-1) was manufactured after the July 1, 2007 date for engines with a maximum rated power capacity greater than or equal to 500 hp. This engine will be subject to the following emission limits: NOx – 1.0 g/hp-hr (1.43 lb/hr); CO – 2.0 g/hp-hr (2.86 lb/hr); and VOC – 0.7 g/hp-hr (1.00 lb/hr). Based on the manufacturer's specifications for these engines, the emission standards will be met.

This engine does possess an EPA Certificate of Conformity to meet the emission standards listed in 40CFR60 Subpart JJJJ. Therefore, as long as this engine is operated in a certified manner, Antero is not required to conduct performance testing on this unit.

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. 40CFR60 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.

a. Each well affected facility, which is a single natural gas well.

There are no wells at this facility. Therefore, all requirements regarding gas well affected facilities under 40 CFR 60 Subpart OOOOa would not apply.

b. Each centrifugal compressor affected facility, which is a single centrifugal compressor using wet seals that is located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment. For the purposes of this subpart, your centrifugal compressor is considered to have commenced construction on the date the compressor is installed (excluding relocation) at the facility. A centrifugal compressor located at a well site, or an adjacent well site and servicing more than one well site, is not an affected facility under this subpart.

There are no centrifugal compressors at the South Canton Compressor Station. Therefore, all requirements regarding centrifugal compressors under 40 CFR 60 Subpart OOOOa would not apply.

c. Each 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. For the purposes of this subpart, your reciprocating compressor is considered to have commenced construction on

the date the compressor is installed (excluding relocation) at the facility. A reciprocating compressor located at a well site, or an adjacent well site and servicing more than one well site, is not an affected facility under this subpart.

There are reciprocating internal combustion engines located at the South Canton Compressor Station that were constructed after September 18, 2015. Therefore, the requirements regarding reciprocating compressors under 40 CFR 60 Subpart OOOOa will apply. Antero will be required to perform the following:

- Replace the reciprocating compressor rod packing at least every 26,000 hours of operation or 36 months or installation of a rod packing emissions collection system.

- Demonstrate initial compliance by continuously monitoring the number of hours of operation or track the number of months since the last rod packing replacement.

- Submit the appropriate start up notifications.

- Submit the initial annual report for the reciprocating compressors.

- Maintain records of hours of operation since last rod packing replacement, records of the date and time of each rod packing replacement, and records of deviations in cases where the reciprocating compressor was not operated in compliance.

d. Pneumatic Controllers

- 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 which commenced construction after August 23, 2011, and is located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment and not located at a natural gas processing plant.

- Each pneumatic controller affected facility, which is a single continuous bleed natural gas-driven pneumatic controller which commenced construction after August 23, 2011, and is located at a natural gas processing plant.

All pneumatic controllers at the facility will be air driven. Therefore, there are no applicable pneumatic controllers which commenced construction after September 18, 2015. Therefore, all requirements regarding pneumatic controllers under 40 CFR 60 Subpart OOOOa would not apply.

e. Each 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.

40CFR60 Subpart OOOOa defines a storage vessel as a unit that is constructed primarily of non-earthen materials (such as wood, concrete, steel, fiberglass, or plastic) which provides structural support and is designed to contain an accumulation of liquids or other materials. The following are not considered storage vessels:

- Vessels that are skid-mounted or permanently attached to something that is mobile (such as trucks, railcars, barges or ships), and are intended to be located at a site for less than 180 consecutive days. If the source does not keep or are not able to produce records, as required by §60.5420(c)(5)(iv), showing that the vessel has been located at a site for less than 180 consecutive days, the vessel described herein is considered to be a storage vessel since the original vessel was first located at the site.

- Process vessels such as surge control vessels, bottoms receivers or knockout vessels.

- Pressure vessels designed to operate in excess of 204.9 kilopascals and without emissions to the atmosphere.

The potential for VOC emissions must be calculated using a generally accepted model or calculation methodology, based on the maximum average daily throughput for a 30-day period of production prior to the applicable emission determination deadline specified in this subsection. The determination may take into account requirements under a legally and practically enforceable limit in an operating permit or other requirement established under a federal or state authority. For each storage vessel affected facility that emits more than 6 tpy of VOC, the permittee must reduce VOC emissions by 95% or greater within 60 days of startup.

The storage vessels located at the South Canton Compressor Station are controlled by a VRU which will reduce the potential to emit to less than 6 tpy of VOC. Therefore, Antero is not required by this section to further reduce VOC emissions by 95%. Antero is claiming a control efficiency of 98% for the VRU. In able to claim a control efficiency greater than 95%, Antero is required to meet additional design/function requirements. Antero will be required to perform three (3) of the following additional requirements:

- *Additional sensing equipment.*
- *Properly designed bypass system.*
- *Appropriate gas blanket.*
- *A compressor that is suitable and has the ability to vary the drive speed.*

f. The group of all equipment, except compressors, within a process unit is an affected facility.

- Addition or replacement of equipment for the purpose of process improvement that is accomplished without a capital expenditure shall not by itself be considered a modification under this subpart.

- Equipment associated with a compressor station, dehydration unit, sweetening unit, underground storage vessel, field gas gathering system, or liquefied natural gas unit is covered by §§60.5400a, 60.5401a, 60.5402a, 60.5421a and 60.5422a of this subpart if it is located at an onshore natural gas processing plant. Equipment not located at the onshore natural gas processing plant site is exempt from the provisions of §§60.5400a, 60.5401a, 60.5402a, 60.5421a and 60.5422a of this subpart.

- The equipment within a process unit of an affected facility located at onshore natural gas processing plants and described in paragraph (f) of this section are exempt from this subpart if they are subject to and controlled according to subparts VVa, GGG or GGGa of this part.

The South Canton Compressor Station is not a natural gas processing plant. Therefore, Leak Detection and Repair (LDAR) requirements for onshore natural gas processing plants would not apply.

g. Sweetening units located at onshore natural gas processing plants that process natural gas produced from either onshore or offshore wells.

- Each sweetening unit that processes natural gas is an affected facility; and

- Each sweetening unit that processes natural gas followed by a sulfur recovery unit is an affected facility.

- Facilities that have a design capacity less than 2 long tons per day (LT/D) of hydrogen sulfide (H_2S) in the acid gas (expressed as sulfur) are required to comply with recordkeeping and reporting requirements specified in §60.5423a(c) but are not required to comply with §§60.5405a through 60.5407a and paragraphs 60.5410a(g) and 60.5415a(g) of this subpart.

- Sweetening facilities producing acid gas that is completely reinjected into oil-or-gas-bearing geologic strata or that is otherwise not released to the atmosphere are not subject to §§60.5405a through 60.5407a, 60.5410a(g), 60.5415a(g), and 60.5423a of this subpart.

There are no sweetening units at the South Canton Compressor Station. Therefore, all requirements regarding sweetening units under 40 CFR 60 Subpart OOOOa would not apply.

h. Pneumatic Pumps

The pneumatic pump requirements apply only to natural gas processing facilities and well sites. Therefore, all requirements regarding pneumatic pumps under 40 CFR 60 Subpart OOOOa would not apply to the South Canton Compressor Station.

i. Collection of fugitive emission components.

The rule requires quarterly leak monitoring at natural gas compressor stations. In addition to optical gas imaging (OGI), the rule allows owners/operators to use Method 21 with a repair threshold of 500 ppm as an alternative for finding and repairing leaks. Method 21 is an EPA method for determining VOC emissions from process equipment. The method utilizes a portable VOC monitoring instrument.

40CFR63 Subpart HH (National Emission Standards for Hazardous Air Pollutants for Oil and Natural Gas Production Facilities)

Subpart HH establishes national emission limitations and operating limitations for HAPs emitted from oil and natural gas production facilities located at major and area sources of HAP emissions. The glycol dehydration units at the South Canton Compressor Station are subject to the area source requirements for glycol dehydration units. However, because the facility is an area source of HAP emissions and the actual average benzene emissions from the glycol dehydration units are below 0.90 megagram per year (1.0 tons/year) it is exempt from all requirements of Subpart HH except to maintain records of actual average flowrate of natural gas to demonstrate a continuous exemption status.

40CFR63 Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines)

Subpart ZZZZ establishes national emission limitations and operating limitations for HAPs emitted from stationary RICE located at major and area sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations. The engines (C-100 – C-1200) at the South Canton Compressor Station are subject to the area source requirements for non-emergency spark ignition engines.

The applicability requirements for new stationary RICEs located at an area source of HAPs, is the requirement to meet the standards of 40CFR60 Subpart JJJJ. These requirements were outlined above. The proposed engine meets these standards.

Because these engines are not certified by the manufacturer, Antero will be required to perform an initial performance test within 180 days from startup, and subsequent testing every 8,760 hours or 3 years, whichever comes first.

The following rules do not apply to the facility:

45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants)

45CSR19 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contribute to Nonattainment)

The South Canton Compressor Station is located in Doddridge County, which is an unclassified county for all criteria pollutants, therefore the South Canton Compressor Station is not applicable to 45CSR19.

As shown in the following table, Antero is not a major source subject to 45CSR14 or 45CSR19 review. According to 45CSR14 Section 2.43.e, fugitive emissions are not included in the major source determination because it is not listed as one of the source categories in Table 1. Therefore, the fugitive emissions are not included in the PTE below.

Pollutant	**PSD (45CSR14) Threshold (tpy)**	**NANSR (45CSR19) Threshold (tpy)**	**South Canton PTE (tpy)**	**45CSR14 or 45CSR19 Review Required?**
Carbon Monoxide	250	NA	90.52	No
Nitrogen Oxides	250	NA	101.47	No
Sulfur Dioxide	250	NA	0.56	No
Particulate Matter 2.5	250	NA	9.68	No
Ozone (VOC)	250	NA	146.76	No

40CFR60 Subpart Kb (Standards of Performance for VOC Liquid Storage Vessels)

40CFR60 Subpart Kb does apply to storage vessels with a capacity greater than or equal to 75 cubic meters (19,812.9 gal). The settling tank (T04) is a 21,000 gallon thank. However, it does not apply to storage vessels that are used for petroleum or condensate storage prior to custody transfer.

40CFR60 Subpart KKK (Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants)

40CFR60 Subpart KKK applies to onshore natural gas processing plants that commenced construction after January 20, 1984, and on or Before August 23, 2011. The South Canton Compressor Station is not a natural gas processing facility, therefore, Antero is not subject to this rule.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

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 South Canton Compressor Station is classified as an area source of hazardous air pollutants. Listed below is a description of the primary hazardous air pollutants for this facility.

Acetaldehyde
Acetaldehyde is mainly used as an intermediate in the synthesis of other chemicals. It is common in the environment and may be formed in the body from the breakdown of ethanol. Acute (short-term) exposure to acetaldehyde results in effects including irritation of the eyes, skin, and respiratory tract. Symptoms of chronic (long-term) intoxication of acetaldehyde resemble those of alcoholism. Acetaldehyde is considered a probable human carcinogen (Group B2) based on human cancer studies and animal studies that have shown nasal tumors in rats and laryngeal tumors in hamsters.

Acrolein
Acrolein is primarily used as an intermediate in the synthesis of acrylic acid and as a biocide. It may be formed from the breakdown of certain pollutants in outdoor air or from the burning of organic matter including tobacco, or fuels such as gasoline or oil. It is toxic to humans following inhalation, oral or dermal exposures. Acute (short-term) inhalation exposure may result in upper respiratory tract irritation and congestion. No information is available on its reproductive, developmental, or carcinogenic effects in humans, and the existing animal cancer data are considered inadequate to make a determination that acrolein is carcinogenic to humans.

Benzene
Benzene is found in the air from emissions from burning coal and oil, gasoline service stations, and motor vehicle exhaust. Acute (short-term) inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidence of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. EPA has classified benzene as a Group A, human carcinogen.

Formaldehyde
Formaldehyde is used mainly to produce resins used in particle board products and as an intermediate in the synthesis of other chemicals. Exposure to formaldehyde may occur by breathing contaminated indoor air, tobacco smoke, or ambient urban air. Acute (short-term) and chronic (long-term) inhalation exposure to formaldehyde in humans can result in respiratory symptoms, and eye, nose, and throat irritation. Limited human studies have reported an association between formaldehyde exposure and lung and nasopharyngeal cancer. Animal inhalation studies have reported an increased incidence of nasal squamous cell cancer. EPA considers formaldehyde a probable human carcinogen (Group B1).

Methanol
Methanol is released to the environment during industrial uses and naturally from volcanic gases, vegetation, and microbes. Exposure may occur from ambient air and during the use of solvents. Acute (short-term) or chronic (long-term) exposure of humans to methanol by inhalation or ingestion may result in blurred vision, headache, dizziness, and nausea. No information is available on the reproductive, developmental, or carcinogenic effects of methanol in humans. Birth defects have been observed in the offspring of rats and mice exposed to methanol by inhalation. EPA has not classified methanol with respect to carcinogenicity.

Methanol is primarily used as an industrial solvent for inks, resins, adhesives, and dyes. It is also used as a solvent in the manufacture of cholesterol, streptomycin, vitamins, hormones, and other pharmaceuticals. Methanol is also used as an antifreeze for automotive radiators, an ingredient of gasoline (as an antifreezing agent and octane booster), and as fuel for picnic stoves. Methanol is also an ingredient in paint and varnish removers. Methanol is also used as an alternative motor fuel.

All HAPs have other non-carcinogenic chronic and acute effects. These adverse health effects 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

Modeling was not required of this source due to the fact that the facility is not subject to 45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants) as seen in the table listed in the Regulatory Discussion Section.

SOURCE AGGREGATION

"Building, structure, facility, or installation" is defined as all the pollutant emitting activities which belong to the same industrial grouping, are located on one or more contiguous and adjacent properties, and are under the control of the same person.

The Source Determination Rule for the oil and gas industry was published in the Federal Register on June 3, 2016 and became effective on August 2, 2016. EPA defined the term "adjacent" and stated that equipment and activities in the oil and gas sector that are under common control will be considered part of the same source if they are located on the same site or on sites that share equipment and are within ¼ mile of each other.

The South Canton Compressor Station will operate under SIC code 4923 (Natural Gas Distribution). There are other compressor stations operated by Antero that share the same two-

digit major SIC code of 49 for natural gas distribution. However, this compressor station is not located on "contiguous or adjacent" property.

"Contiguous or Adjacent" determinations are made on a case by case basis. There is a natural gas production facility (Addie Pad) operating under SIC code 1311, located 0.1 miles from the proposed facility that is under common control of Antero. Therefore, this facility would be considered adjacent.

Because there are no facilities that are under common control, located on contiguous or adjacent properties and operating under the same standard industrial classification code, the emissions from the South Canton Compressor Station should not be aggregated with other facilities in determining major source or PSD status.

MONITORING OF OPERATIONS

Antero will be required to perform the following monitoring:

- Monitor and record quantity of natural gas consumed for all engines and combustion sources.
- Monitor all applicable requirements of 40CFR60 Subparts JJJJ and OOOOa and 40CFR63 Subparts HH and ZZZZ.
- Monitor the presence of the flare pilot flame with a thermocouple or equivalent.

Antero will be required to perform the following recordkeeping:

- Maintain records of the amount of natural gas consumed and hours of operation for all engines and combustion sources.
- Maintain records of testing conducted in accordance with the permit. Said records shall be maintained on-site or in a readily accessible off-site location
- Maintain the corresponding records specified by the on-going monitoring requirements of and testing requirements of the permit.
- Maintain records of the visible emission opacity tests conducted per the permit.
- Maintain a record of all potential to emit (PTE) HAP calculations for the entire facility. These records shall include the natural gas compressor engines and ancillary equipment.
- Maintain records of all applicable requirements of 40CFR60 Subparts JJJJ and OOOOa and 40CFR63 Subparts HH and ZZZZ.
- Maintain records of the flare design evaluation.
- The records shall be maintained on site or in a readily available off-site location maintained by Antero for a period of five (5) years.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that Antero meets all the requirements of applicable regulations. Therefore, impact on the surrounding area should be minimized and it is recommended that the South Canton Compressor Station should be granted a 45CSR13 construction permit for their facility.

Jerry Williams, P.E.
Engineer

Date