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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	G70-A073B
Plant ID No.:	095-00045
Applicant:	Antero Resources Corporation
Facility Name:	Weigle East Pad
Location:	Middlebourne, Tyler County
NAICS Code:	211111
Application Type:	Class II Administrative Update
Received Date:	September 21, 2015
Engineer Assigned:	Roy F. Kees, P.E.
Fee Amount:	$300.00
Date Received:	September 23, 2015
Complete Date:	October 27, 2015
Due Date:	December 12, 2015
Applicant Ad Date:	September 30, 2015
Newspaper:	*Tyler Star News*
UTM's:	Easting: 512.664 km Northing: 4,368.527 km Zone: 17S
Description:	Application for the administrative update of a natural gas well pad consisting of an addition of one (1) high pressure VRU engine, one (1) thermoelectric generator, and fourteen (14) line heaters.

DESCRIPTION OF PROCESS

A mixture of condensate, water, and entrained gas from the seven permitted wells enters the facility through a series of line heaters (LH001-LH014) and gas production units (H001 through H014) which are 3-phase separators where the gas, condensate, and produced water are separated. The GPUs are fueled by a slip stream of the separated gas.

The gas from the 3 phase separators is sent to the sales gas line. The condensate from the 3-phase separator is sent to a low pressure 2-phase separator where flashing emissions are recovered and sent to the sales gas lines through the high pressure VRU driven by gas fueled engines (ENG001, ENG002 & ENG005). The condensate then flows to the vapor recovery towers (VRT001-004) where gas is further separated. Gas from the

VRTs is recovered via the low pressure VRU driven by gas fueled engines (ENG003-004) and sent to the sales gas line through the high pressure compressor. The condensate from the VRTs flows to the condensate storage tanks (TANKSCOND001-010). The water from the 3 phase separator is sent to the produced water tanks (TANKPW001-002).

The facility has ten tanks (TANKCOND001-010) on site to store condensate and two tanks (TANKSPW001-002) to store produced water prior to removal from the site. Flashing, working, and breathing losses from the tanks are sent to the enclosed combustors (EC001-EC004) to control emissions. The facility will utilize up to four Cimmaron Model No. 48" HV ECD enclosed combustors designed to operate at 8,760 hours per year. The enclosed combustor will incorporate an automatic re-ignition system in the event the enclosed combustor is extinguished. A thermocouple will be used to monitor the presence of a pilot flame.

Condensate and produced water are transported off-site on an as-needed basis via tanker truck. The maximum annual throughput will increase to 42,924,000 gallons per year and 85,848,000 gallons per year for condensate and produced water, respectively. Truck loading connections are in place to pump condensate and produced water (L001 & L002) from the storage tanks into tanker trucks. Emissions from the loading operations are vented to the atmosphere.

Emissions from the facility's emission sources were calculated using the extended analysis of the condensate and produced water from Seaborne No. 1H, one of the wells in the Vogt Pad. These extended analysis are considered representative of the materials from Hamilton, being in the same Marcellus rock formation. The flashing, working & breathing losses from the tanks are sent to the enclosed combustors. The enclosed combustors that will be used to control tank emissions is designed to achieve a VOC destruction efficiency of 98%.

SITE INSPECTION

On October 1, 2014, James Jarrett of DAQ's Compliance and Enforcement section conducted a site inspection of the site. The site is being prepared for drilling of natural gas wells. There were no GPUs or permanent production storage tanks on-site. The unpaved road distance is 1.0 miles per trip (from gate to center of well pad). The closest residence is ~1,900 feet to the North from the well site.

Directions to the facility are as follows:

From Middlebourne, travel on WV-18 south for 3.7 miles. Turn right onto Lemasters Bridge Road (Rt. 18/14) for 0.3 miles then turn right and continue for ~0.5 miles to the site.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Maximum controlled point source emissions listed below were calculated by Antero and reviewed for accuracy by the writer. Heater treater and combustor emissions were calculated using AP-42 emission factors. Engine emissions were calculated using manufacturer data as well as AP-42. Storage tank and loading emissions were calculated using ProMax, TANKS 4.0.9 and AP-42.

Emission Unit	Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (tpy)
H001-H014 (14) 1.50 mmBtu/hr Heater Treaters (Combined)	Nitrogen Oxides	1.72	7.55
	Carbon Monoxide	1.45	6.34
	Volatile Organic Compounds	0.10	0.42
	Sulfur Dioxide	0.01	0.05
	Particulate Matter-10	0.13	0.57
LH001-LH014 (14) 2.0 mmBtu/hr Line Heaters (Combined)	Nitrogen Oxides	2.30	10.06
	Carbon Monoxide	1.93	8.45
	Volatile Organic Compounds	0.13	0.55
	Sulfur Dioxide	0.01	0.06
	Particulate Matter-10	0.18	0.77
	CO_2e (All Heaters)	4,852.50	21,253.94
TEG001 (11) 0.02 mmBtu/hr TE Generator	Nitrogen Oxides	<0.01	0.01
	Carbon Monoxide	<0.01	0.01
TANKCOND0 01-010 (10) 400 bbl Condensate Tanks (Combined)	Volatile Organic Compounds	8.11	35.54
	Total HAPs	0.51	2.23

TANKPW001-002 (2) 400 bbl Produced Water Tanks (Combined)	Volatile Organic Compounds	0.15	0.68
	Total HAPs	<0.01	0.02
ENG001-002, ENG005 (3) 72 hp Zenith ZPP428 Compressors	Nitrogen Oxides	0.96	4.19
	Carbon Monoxide	1.56	6.84
	Volatile Organic Compounds	0.07	0.29
	Sulfur Dioxide	<0.01	0.01
	Particulate Matter - 10	0.02	0.09
	Formaldehyde	0.05	0.20
ENG003-004 (2) 98 hp Zenith ZPP644 Compressors	Nitrogen Oxides	0.87	3.80
	Carbon Monoxide	1.42	6.21
	Volatile Organic Compounds	0.06	0.25
	Sulfur Dioxide	<0.01	<0.01
	Particulate Matter - 10	0.02	0.08
	Formaldehyde	0.04	0.17
L001 Cond. Loading	Volatile Organic Compounds	16.42	34.96
	Total HAPs	0.08	0.17
L002 P.W. Loading	Volatile Organic Compounds	<0.01	0.01
	Total HAPs	<0.01	<0.01
Combustor EC001-004	Nitrogen Oxides	0.50	2.20
	Carbon Monoxide	0.42	1.85
Fugitives F001	Volatile Organic Compounds	5.21	22.80
	Total HAPs	0.52	2.27

The total facility potential to emit (PTE) is shown in the following table:

Pollutant	Facility Wide Emissions (tons/year)
Nitrogen Oxides	27.81
Carbon Monoxide	29.69
Volatile Organic Compounds	95.49
Particulate Matter-10/2.5	6.29
Sulfur Dioxide	0.12
Total HAPs	5.45
Carbon Dioxide Equivalent	31,146.08

REGULATORY APPLICABILITY

The proposed Antero natural gas production facility is subject to substantive requirements in the following state and federal air quality rules and regulations: 45CSR2, and 45CSR13. Each applicable rule (and ones that have reasoned 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

The Heater Treaters (H001-H014), Line Heaters (LH001-LH014) and TE Generator (TEG001) have been determined to 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 unit is less than 10 mmBtu/hr, it 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 line heaters are 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.

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 four (4) combustors at the facility. The combustors are subject to section 4, emission standards for incinerators. The combustors have an allowable emission rate of 0.65 pounds of particulate matter per hour (assuming a natural gas density of 0.044 lb/ft^3). The combustors have negligible amounts of particulate matter emissions per hour. Therefore, the facility's combustors should demonstrate compliance with this section. The facility will demonstrate compliance by maintaining records of the amount of natural gas consumed by the combustors and the hours of operation. The

facility will also monitor the flame of the combustors and record any malfunctions that may cause no flame to be present during operation.

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 changes to the Weigle East natural gas production facility will have a potential to emit a regulated pollutant less than six (6) lbs/hour and ten (10) TPY and, therefore, pursuant to §45-13-2.24, the facility will qualify for a Class II Administrative Update 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 registration under 45CSR13 for the construction and operation of the natural gas production 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 September 30, 2015 in *The Tyler Star News*.

45CSR22 Air Quality Management Fee Program

The Weigle East Facility is not subject to 45CSR30. The facility is subject to 40CFR60 Subpart OOOO, however they are exempt from the obligation to obtain a permit under 40 CFR part 70 or 40 CFR part 71, provided they are not required to obtain a permit for a reason other than their status as an area source, therefore, the facility is not subject and will pay its annual fees through the Rule 22 program.

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

40CFR60.4230 states that a source that commenced construction after June 12, 2006 whose SI ICE was less than 500 hp and was manufactured on or after July 1, 2008 is subject to this rule. Antero has proposed to install three (3) certified 72 HP SI ICE and two (2) certified 98 HP SI ICE. Since the SI ICEs that Antero will install was manufactured in 2013, Antero is subject to this rule.

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

Subpart OOOO applies to facilities that commence construction, reconstruction, or modification after August 23, 2011 (October 15, 2012 for well completions). Since the Weigle East pad will begin operation after August 23, 2011 it is subject to the requirements of Subpart OOOO. The tanks at the Weigle East facility will utilize a combustor, therefore the tanks will not have the potential to emit more than 6 tpy of VOC's, therefore the tanks will not be subject to the rule. The site will also include pneumatic controllers that were ordered and installed after August 23, 2011, therefore the controllers will be subject to the applicable provisions of Subpart OOOO. The proposed controllers have a bleed rate of 6.6 scf/day. The gas wells at the Weigle East pad will also be affected facilities subject to Subpart OOOO.

Non Applicability Determinations

45CSR10: To Prevent and Control Air Pollution from the Emission of Sulfur Oxides

Pursuant to the exemption given under §45-10-10.1, as the MDHI of the Heater Treaters (H001-H014), Line Heaters (LH001-LH014) and TE Generator (TEG001) are less than 10 mmBtu/hr, the units are not subject to the substantive sections of 45CSR10.

45CSR14: Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration.

The facility-wide potential-to-emit of the Weigle East natural gas production facility is below the levels that would define the source as "major" under 45CSR14 and, therefore, the construction evaluated herein is not subject to the provisions of 45CSR14.

Classifying multiple facilities as one "stationary source" under 45CSR13, 45CSR14, and 45CSR19 is based on the definition of "Building, structure, facility, or installation" as given in §45-14-2.13 and §45-19-2.12. The definition states:

> "Building, Structure, Facility, or Installation" means all of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control). Pollutant-emitting activities are a part of the same industrial grouping if they belong to the same "Major Group" (i.e., which have the same two (2)-digit code) as described in the Standard Industrial Classification Manual, 1987 (United States Government Printing Office stock number GPO 1987 0-185-718:QL 3).

Weigle East shares the same SIC code as several other well pads owned by Antero in the area. Therefore, the potential classification of the Weigle East facility as one stationary source any other facility depends on the determination if these stations are considered "contiguous or adjacent properties."

"Contiguous or Adjacent" determinations are made on a case by case basis. These determinations are proximity-based, and it is important to focus on this and whether or not it meets the common sense notion of one stationary source. The terms "contiguous" or "adjacent" are not defined by USEPA. Contiguous has a dictionary definition of being in actual contact; *touching along a boundary or at a point.* Adjacent has a dictionary definition of not distant; nearby; *having a common endpoint or border.*

The Weigle East natural gas production facility is not located contiguous with, or directly adjacent to any other Antero facility. The nearest Antero facility (Pierpoint Pad) is approximately 1.06 miles away.

40 CFR 60 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

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 located at the Weigle East facility are each 16,800 gallons, or 63.5 m^3. Therefore, Subpart Kb does not apply to any of the storage tanks.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

This section provides an analysis for those regulated pollutants that may be emitted from the Weigle East natural gas production facility 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 programs designed to limit their emissions and public exposure. These programs include federal source-specific Hazardous Air Pollutants (HAPs) standards 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. Antero included the following HAPs as emitted in substantive amounts in their emissions estimate: Benzene, n-Hexane, Toluene, and Trimethylpentane The following table lists each HAP's carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)):

Potential HAPs - Carcinogenic Risk

HAPs	Type	Known/Suspected Carcinogen	Classification
n-Hexane	VOC	No	Inadequate Data
Benzene	VOC	Yes	Category A - Known Human Carcinogen
Toluene	VOC	No	Inadequate Data
Xylene	VOC	No	Inadequate Data
Trimethylpentane	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 from the proposed Weigle East natural gas production facility are less than applicability thresholds that would define the proposed facility as a "major stationary source" under 45CSR14 and, therefore, no air quality impacts modeling analysis was required. Additionally, based on the nature of the proposed construction, modeling was not required under 45CSR13, Section 7.

MONITORING OF OPERATIONS

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

- For the purposes of demonstrating compliance with maximum limit for the aggregate production of condensate/liquids from the wells set forth in Section 4.0 of the general permit registration, Antero shall be required to monitor and record the monthly and rolling twelve month total of condensate/liquids (in gallons) produced in the wells. Monitoring and recording the monthly and rolling twelve month total of condensate/liquids (in gallons) unloaded from the storage tanks can be used to show compliance with this requirement.

- For the purposes of demonstrating compliance with visible emissions limitations set forth in Section 7.0 of the G70-A general permit, Antero shall be required to:

  (1) Conduct an initial Method 22 visual emission observation on the heater treaters to determine the compliance with the visible emission provisions. Antero shall be required to take a minimum of two (2) hours of visual emissions observations on the line heaters.

  (2) Conduct monthly Method 22 visible emission observations of the heater treater stack to ensure proper operation for a minimum of ten (10) minutes each month the line heaters are in operation.

  (3) In the event visible emissions are observed in excess of the limitations given under Section 7.5 of the G70-A general permit, Antero shall be required to take immediate corrective action.

- Antero shall be required to maintain records of all visual emission observations pursuant to the monitoring required under Section 7.2 of the G70-A general permit including any corrective action taken.

- Antero shall be required to report 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 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.

RECOMMENDATION TO DIRECTOR

Information supplied in the registration application indicates that compliance with all applicable regulations will be achieved. Therefore it is the recommendation of the writer that general permit registration G70-A073B for the update of a natural gas production facility near Middlebourne, Tyler County, be granted to Antero Resources Corporation.

Roy F. Kees, P.E.
Engineer - NSR Permitting

11/4/15
DATE