



west virginia department of environmental protection

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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.: G70-A113
Plant ID No.: 017-00068
Applicant: EQT Production Company (EQT)
Facility Name: WEU-6 Pad
Location: Near West Union, Doddridge County
NAICS Code: 211111
Application Type: Modification
Received Date: November 21, 2015
Engineer Assigned: David Keatley
Fee Amount: \$1,500
Date Received: December 3, 2015
Complete Date: April 1, 2015
Due Date: May 16, 2015
Applicant Ad Date: November 25, 2014
Newspaper: *The Herald Record*
UTM's: Easting: 521.2 km Northing: 4,349.0 km Zone: 17
Description: Permit registration G70-A113 will supersede and replace permit R13-3130. EQT proposes to install and operate: two (2) 400-bbl condensate tanks, one (1) 11.66 mmBtu/hr combustor, One (1) 140-bbl sand separator tank, and three (3) 1.54 mmBtu/hr line heaters.

DESCRIPTION OF PROCESS

This facility is a natural gas production facility. Raw natural gas from the six (6) natural gas wells pass through six (6) 1.54 mmBtu/hr line heaters (S005-S007 and S012-S014) to keep lines from freezing and promote phase separation. After being heated by the line heaters a separator will separate the natural gas from the produced liquids. Natural gas from the separator will exit the facility via pipeline. Liquids from six (6) 16,800-gallon produced liquids tanks (S001-S004 and S010-S011). Working, breathing, and flashing losses from the produced liquid tanks shall be captured and sent to two (2) 11.67-mmBtu/hr LEED enclosed vapor combustor for control. The combustors will have a

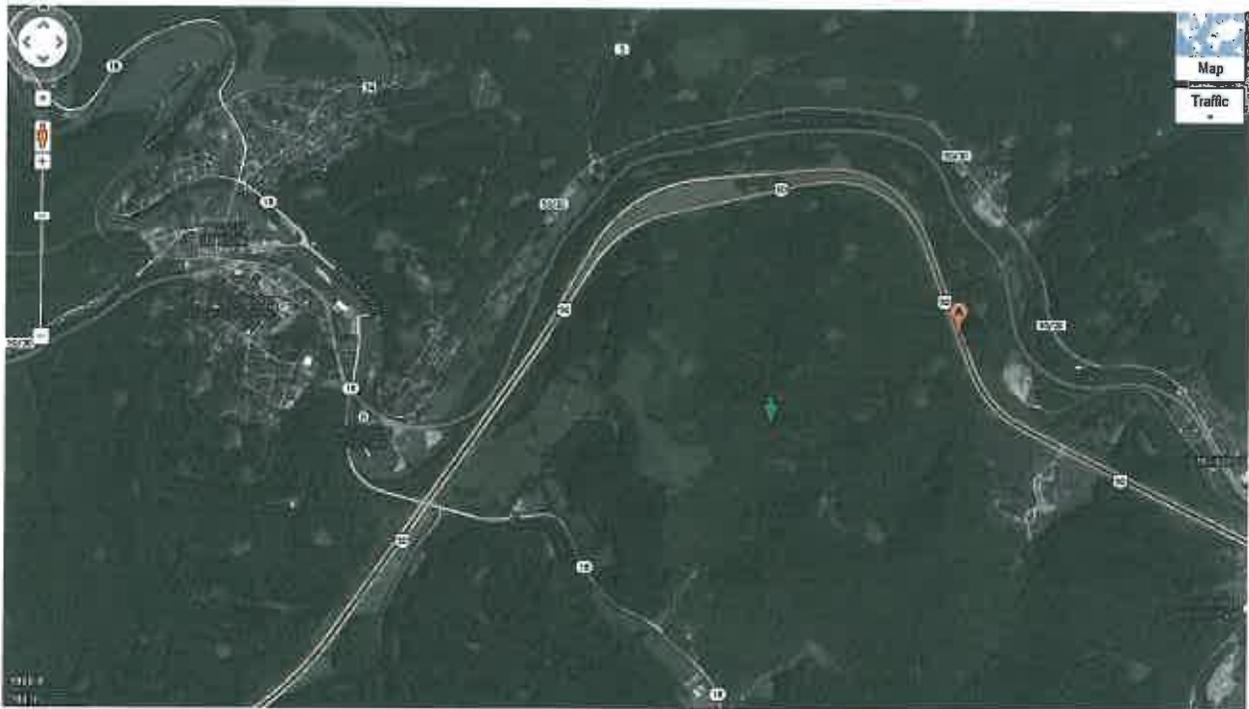
minimum hydrocarbon destruction efficiency of at least 98.0%.

Produced liquids from the produced liquids tanks will be loaded into trucks and taken off site. Emissions from the truck loading are uncontrolled but mitigated by using submerged fill methods. The two (2) 0.013 mmBtu/hr thermoelectric generators (S008 & S009) are used to provide small amounts of electricity for switching/monitoring purposes when the facility is unable to generate sufficient solar power.

SITE INSPECTION

A site inspection of the facility was attempted by Steven R. Pursley on February 06, 2014. However, the access road was impassable due to recent snows. The road will likely remain impassable (unless improvements are made) for several weeks until the ground dries. To get to the well pad from Charleston take I-77 north to exit 176. Go east on US Route 50 approximately 43.2 miles. Take a right on Co. Rt. 18. Go approximately 1000 feet and turn left on the access road beside a greenhouse. Facility is located across US Route 50 from the town of West Union.

The following is a screen capture from Google Maps of the area:



ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

EQT included in Attachment N of the permit application air emissions calculations for the equipment and processes at the WEU-6 natural gas production facility. The following will summarize the calculation methodologies used by EQT to calculate the potential-to-emit (PTE) of the proposed facility.

Gas-Fired Line Heaters

Criteria Pollutant emissions from the natural gas-fired line heaters (E012-E014) were based on the emission factors provided for natural gas combustion as given in AP-42 (AP-42 is a database of emission factors maintained by USEPA) Section 1.4. Emissions of Greenhouse Gases (GHGs) were based on Tables C-1 and C-2 of 40 CFR 98 - Federal GHG Reporting Rule.

Hourly emissions were based on the maximum design heat input (MDHI) of each unit and annual emissions were based on an annual operation of 8,760 hours. A heat content of the gas of 1,050 Btu/scf was used in the calculations.

Storage Tanks

Working and breathing emissions from the six (6) condensate/produced-water storage tanks were based on the TANKS 4.0.9d program as provided under AP-42, Section 7. Emissions from flashing in the tanks were calculated using E&P Tanks a chemical process simulation software. Input and summary sheets for both programs were included in the permit application. As all uncontrolled emissions from the storage tanks are routed to the vapor combustor for control, the controlled emissions from the tanks are based on the vapor combustor's minimum 98% control efficiency. An annual throughput of 38.7 bbl/day (hydrocarbon fraction only) of condensate/produced-water was used in the calculations. This is based on the maximum, historical condensate/produced-water production for another well in the area.

Truck Loading

Air emissions from condensate truck loading operations 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 5.2-1. 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 14,680,008 gallons per year of produced liquids. As no maximum hourly pumping rate was provided, hourly emissions were based on 1,000 hours of loading per year.

Fugitives

EQT based their fugitive equipment leak calculations on emission factors taken from the document EPA-453/R-95-017 - "Protocol for Equipment Leak Emission Estimates." Emission factors were taken from Table 2-4 and no control efficiency, as based on a Leak Detection and Repair (LDAR) protocol, was applied. Emissions of Greenhouse Gases (GHGs) were based on Subpart W of 40 CFR 98 - Federal GHG Reporting Rule.

Vapor Combustor

The vapor combustor will receive captured vapors from the storage tanks. The amount of emissions received is determined by the calculation methodologies described above. A 98% control efficiency was applied to the uncontrolled VOC/HAP/methane emissions received by the vapor combustor to determine the amount of pass-through emissions of the combustor. The emissions of NO_x, CO, particulate matter, SO₂, and GHGs from the combustion of the vapors were based on emission factors taken from AP-42 Section 1.4 (natural gas combustion) and the MDHI of the unit.

Emissions Summary

Table 1: Maximum Controlled Estimated Regulated Air Emissions

Emission Point	Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (tpy)
C001 and C002 (Combustors)	Nitrogen Oxides	2.23	9.75
	Carbon Monoxide	1.87	8.19
	Volatile Organic Compounds	7.93	34.92
	Sulfur Dioxide	0.01	0.06
	Particulate Matter-10	0.17	0.74
	CO ₂ e	2,787	12,206
E005-E007 E012-E014 Line Heaters (Aggregate Emissions)	Nitrogen Oxides	0.88	3.85
	Carbon Monoxide	0.74	3.23
	Volatile Organic Compounds	0.05	0.21
	Sulfur Dioxide	0.01	0.02
	PM	0.07	0.29
	CO ₂ e	1,081	4,735

E008 - E009 Thermoelectric Generators	Nitrogen Oxides	<0.01	0.02
	Carbon Monoxide	<0.01	0.01
	CO _{2e}	3	13
E016 Liquid Truck Loading	Volatile Organic Compounds	0.17	0.74
	Aggregate HAPs	<0.01	0.02

Table 2: Summarized Estimated Maximum Controlled Facility Wide PTE

Pollutant	Maximum Annual Facility Wide Emissions (tons/year)
Nitrogen Oxides	13.61
Carbon Monoxide	11.43
Volatile Organic Compounds	45.24
Total Particulate Matter	16.06
Sulfur Dioxide	0.08
Benzene	0.01
Ethylbenzene	0.03
Toluene	0.06
Xylenes	0.26
n-Hexane	0.55
Total HAP Emissions	0.95
CO _{2e}	17,638

REGULATORY APPLICABILITY

The following rules and regulations apply to the changes proposed to this facility:

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

The Line Heaters (S012 - S014) have been determined to meet the definition of a "fuel burning unit"s 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 units are less than 10 mmBtu/hr, they 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 line heaters are subject to an opacity limit of 10%. Proper maintenance and operation of the units (and the use of natural gas as fuel) should keep the opacity of the units well below 10% during normal operations.

45CSR4: To Prevent and Control the Discharge of Air Pollutants Into the Open Air Which Causes or Contributes to an Objectionable Odor or Odors

This facility shall not cause the discharge of air pollutants which cause or contribute to an objectionable odor at any location occupied by the public. 45CSR4 states that an objectionable odor is an odor that is deemed objectionable when in the opinion of a duly authorized representative of the Air Pollution Control Commission (Division of Air Quality), based upon their investigations and complaints, such odor is objectionable.

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

EQT has proposed an enclosed combustor for controlling the working/breathing/flashing emissions produced from the condensate/produced-water storage tanks. The vapor combustor meets the definition of an "incinerator" under 45CSR6 and is, therefore, subject to the requirements therein. The substantive requirements applicable to the vapor combustor 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:

$$\text{Emissions (lb/hr)} = F \times \text{Incinerator Capacity (tons/hr)}$$

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

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

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

While particulate matter emissions from the combustor are expected to be nominal, for a conservative estimate, EQT calculated potential particulate matter emissions from the unit based on an emission factor taken from AP-42, Section 1.4. Using this emission factor, the hourly particulate matter emission rate from the combustor is 0.09 lbs/hr. Based on information included in the application, the maximum vapor mass sent to the combustor will be 500 lb/hr (0.25 tons/hour). Based on the above, the aggregate particulate matter limit of the combustor is 1.36 lbs/hr. As the hourly particulate matter emission rate from the combustor is 0.09 lbs/hr, the unit is in compliance with this emission limit.

45CSR6 Opacity Limits for - Section 4.3, 4.4

Pursuant to Section 4.3, and subject to the exemptions under 4.4, the combustor has a 20% limit on opacity during operation. As the primary constituent in the vapors combusted in the unit shall be clean burning methane/ethane, particulate matter emissions from the combustor are expected to be nominal. Therefore, the vapor combustor should easily meet this requirement.

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

45CSR10 has requirements limiting SO₂ emissions from “fuel burning units,” limiting in-stack SO₂ concentrations of “manufacturing processes,” and limiting H₂S concentrations in process gas streams. The only potential applicability of 45CSR10 to the WEU-6 natural gas production facility is the limitations on fuel burning units. Pursuant to the exemption given under §45-10-10.1, as the MDHI of the Line Heaters (S012 - S014) - which have been determined to meet the definition of a “fuel burning unit”s under 45CSR10 - 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

With this application EQT proposes to install an additional flare and with therefore applied for a modification permit.

45CSR22 *Air Quality Management Fee Program*

This facility is a minor source as can be seen in Table 2 and not subject to 45CSR30 since they are exempt from the obligation to obtain a permit under 40 CFR part 70 or 40 CFR part 71. This facility has a maximum horsepower capacity less than 1,000 hp and is a 9M source which is required to pay a \$200 annual fee. Antero is required to keep their Certificate to Operate current.

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 (published in the Federal Register 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 were not regulated at the federal level. Final amendments to the rule were issued on September 23, 2013. Pursuant to §60.5365(a) each “gas well affected facility, which is a single natural gas well” that is constructed after August 23, 2011 is subject to the applicable provisions of Subpart OOOO as well as “[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.”

Gas Wells - §60.5370

EQT is proposing to drill gas wells at the WEU-6 well-pad and, therefore, these are defined as “affected facilities” under Subpart OOOO and subject to applicable provisions. The substantive requirements for gas wells drilled prior to January 1, 2015 are given under §60.5375(a)(3) of the rule. It requires that flowback emissions (gas produced from the well after fracturing) must be directed to the flow line or a completion combustion device. EQT shall direct all gas from wells during flowback at the WEU-6 site into the flow line. Other requirements pertaining to the gas wells include:

- EQT must maintain a log for each well completion operation at each gas well affected facility. The log must be completed on a daily basis for the duration of the well completion operation and must contain the records specified in §60.5420(c)(1)(iii).
[40CFR§60.5375(b)]
- EQT must demonstrate initial compliance with the standards that apply to gas well affected facilities as required by §60.5410.
[40CFR§60.5375(c)]

- EQT must demonstrate continuous compliance with the standards that apply to gas well affected facilities as required by §60.5415.
[40CFR§60.5375(d)]
- EQT must perform the required notification, recordkeeping and reporting as required by §60.5420.
[40CFR§60.5375(e)]

Storage Tanks - §60.5395 - (non applicability)

Under §60.5395, the requirements for storage tanks take effect on October 15, 2013. The substantive requirement for storage tanks is given under §60.5395(a) of the rule. It requires that for each storage vessel “emitting more than 6 tpy VOC, [the permittee] must reduce VOC emissions by 95.0 percent or greater. . .” Based on a letter from USEPA to the American Petroleum Institute dated September 28, 2012, applicability of storage vessels to Subpart OOOO is based on individual tank PTE - which includes federally enforceable control devices.

The four (4) condensate/produced water storage tanks are each calculated to have a PTE (including controls) of less than 6 TPY of VOCs and, therefore, these storage tanks are not subject requirements under §60.5395.

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. The substantive requirements for pneumatic controllers are given under §60.5390. EQT has indicated in the application, that all subject pneumatic controllers will have a bleed rate of less than 6 scfh and will, therefore, be exempt from the requirements.

The following rules and regulations do not apply to the facility:

40CFR60 Subpart A §60.18 General Control Device and Work Practice Requirements

40CFR60 Subpart A §60.18 contains requirements for control devices when they are used to comply with applicable subparts of 40CFR60 and 40CFR61. The vapor combustor that Antero has proposed is not used to comply with one of these regulations. The purpose of the vapor combustor is to control emissions from the tanks that are routed

to it. However, these tanks are not subject to 40CFR60 Subpart Kb due to their size. In addition 40CFR60.18 refers to flares but makes no mention of enclosed combustion devices. Therefore, Antero is not subject to this regulation.

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 (m³) that is used to store volatile organic liquids (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984.” The storage tanks located at the WEU-6 facility are each 16,800 gallons, or about 64 m³. Therefore, Subpart Kb does not apply to the storage tanks.

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. EQT included the following HAPs as emitted in substantive amounts (at least 20 pounds (0.01 tons) per year) in their emissions estimate: Benzene, n-Hexane, Toluene, Trimethylpentane and Xylene. The following table lists each HAP’s carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)):

Table 4: Potential HAPs - Carcinogenic Risk

HAPs	Type	Known/Suspected Carcinogen	Classification
n-Hexane	VOC	No	Inadequate Data
Benzene	VOC	Yes	Category A - Known Human Carcinogen
Toluene	VOC	No	Inadequate Data
Xylenes	VOC	No	Inadequate Data

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

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that compliance with all state and federal air pollution control requirements will be satisfied. Therefore, I recommend to the Director of Air Quality the issuance of Permit Number G70-A113 to EQT for the modification and operation for their natural gas production facility WEU-6.



David Keatley
Permit Writer - NSR Permitting

April 15, 2015

Date

Fact Sheet G70-A113
EQT Production Company
WEU-6