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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.: R13-2999
Plant ID No.: 103-00052
Applicant: EQT Production Company
Facility Name: Big57/Big176 Meter Site
Location: Wetzel County
NAICS Code: 211111
Application Type: Construction
Received Date: October 9, 2012
Engineer Assigned: Joe Kessler
Fee Amount: \$2,000
Date Received: November 16, 2012
Complete Date: November 26, 2012
Due Date: February 24, 2013
Applicant Ad Date: October 24, 2012
Newspaper: *Wetzel Chronicle*
UTM's: Easting: 539.1 km Northing: 4,378.3 km Zone: 17
Description: Permit for construction and operation of a 38 mmscf/day Glycol Dehydration Unit.

DESCRIPTION OF PROCESS/MODIFICATIONS

EQT Production Company (EQT) has submitted a permit application for the after-the-fact construction and operation of a 38.0 mmscf/day Glycol Dehydration Unit (GDU) located near Smithfield, Wetzel County, WV. The facility began operation on June 15, 2012.

Glycol dehydration is a liquid desiccant system used for the removal of water from natural gas. Lean, water-free glycol is fed to the top of an absorber (known as a "contactor tower") 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 further processing or transportation.

After leaving the absorber, the glycol stream - now referred to as "rich" glycol - is fed to a flash vessel where hydrocarbon vapors are removed and used in the reboiler as a fuel. Any excess

flash tank off gas is sent to the combustor for control. Any liquid hydrocarbons produced in the flash tank are skimmed from the glycol. After leaving the flash vessel, the rich glycol is heated in a heat-exchanger and fed to the glycol regenerator column. The regenerator column consists of a column, an overhead condenser, and a 0.31 mmBtu/hr gas-fired reboiler (S002). The glycol is thermally regenerated to remove excess water and regain the high purity. The hydrocarbons produced in the glycol regenerator process (S001) are sent to the combustor (C001) for control (95% minimum combustion efficiency). The hot, lean glycol is cooled by the heat-exchanger and is then fed to a pump where it is sent to the glycol absorber for reuse. The emission points associated with this process are the combustor (E001) and the combustion exhaust of the reboiler (E002). The new GDU will use triethylene glycol (TEG).

SITE INSPECTION

On December 5, 2012, the writer conducted an inspection of the Big57/Big176 Meter Site. The facility is located at the junction of County Route (CR) 15 (North Fork Road) and CR 80 (Shuman Hill Road) approximately 3.6 miles north of Smithfield, Wetzel County, WV. While the location is very rural in nature, there was an occupied residence directly south of the facility along CR 80. The GDU was in operation at the time of the site inspection. No opacity was visible from any of the units and no noticeable smell was detected. The following is a picture of the Big57/Big176 Meter Site taken on the day of the inspection:



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Directions: [Latitude: 39.55320, Longitude: -80.54511] From the junction of WV State Route (SR) 20 (Galmish Road) and County Route 15 (North Fork Road) in Pine Grove, travel east on CR 15 for approximately 11.8 miles (3.6 miles after the CR 15/CR 19 junction) to the CR 15 and CR 80 (Shuman Hill Road) junction. Turn right onto CR 80 and the facility is located immediately on the right.

AIR EMISSIONS AND CALCULATION METHODOLOGIES

Glycol Regenerator Column Emissions

VOC, Hazardous Air Pollutant (HAP), and methane emissions from the glycol regenerator (S001), as controlled by the combustor (C001), are based on the emissions calculation program GRI-GLYCalc Version 4.0. GRI-GLYCalc is a well-known program for estimating air emissions from glycol units using triethylene glycol (TEG). Included in the application is a copy of the appropriate GLY-Calc analysis sheets. A gas analysis from a local well was used to provide inputs to GLY-Calc and was included in the permit application. A minimum hydrocarbon flare combustion efficiency of 95% was used to determine the controlled emission rate. EQT included a 10% safety factor on the VOC/HAP emissions from the GDU. For the purposes of the GLYCalc analysis, all flash tank off gases were estimated to be controlled at the combustor.

Additionally, small amounts of emissions are created from the combustion of the hydrocarbons (in the waste gas) at the combustor. These emissions were based on emission factors from AP-42 Section 1.4. (AP-42 is a database of emission factors maintained by USEPA). The combustor's maximum design heat input (MDHI) of 0.50 mmBtu/hr and is used in the calculations.

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

Table 1: GDU PTE

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
CO	0.080 lb/mmBtu	AP-42, Table 1.4-1	0.05	0.21
NO _x	0.095 lb/mmBtu	AP-42, Table 1.4-1	0.04	0.18
PM _{2.5} /PM ₁₀ /PM	0.007 lb/mmBtu	AP-42, Table 1.4-1	<0.01	0.02
SO ₂	0.001 lb/mmBtu	AP-42, Table 1.4-1	~0.00	~0.00
VOC	n/a	GLYCalc Results	0.62	2.72
<i>Hexane</i>	<i>n/a</i>	<i>GLYCalc Results</i>	<i>0.001</i>	<i>0.01</i>
<i>Benzene</i>	<i>n/a</i>	<i>GLYCalc Results</i>	<i>0.004</i>	<i>0.02</i>
<i>Toluene</i>	<i>n.a</i>	<i>GLYCalc Results</i>	<i>0.014</i>	<i>0.06</i>

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
Ethyl-benzene	n/a	GLYCalc Results	0.009	0.04
Xylene	n/a	GLYCalc Results	0.013	0.06
Total HAPs →			0.04	0.18
CH ₄	n/a	GLYCalc Results	n/a	11.16
CO ₂ e ⁽¹⁾	n/a	n/a	n/a	234.41

- (1) 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.

Reboiler Exhaust Emissions

Combustion exhaust emissions from the 0.31 mmBtu/hr waste gas-fired reboiler (S002) were based on the emission factors provided for natural gas combustion as given in AP-42 Section 1.4. Hourly emissions were based on the maximum design heat input (MDHI) of the unit (0.31 mmBtu/hr) and annual emissions were based on an annual operation of 8,760 hours. A natural gas heat content value of 1,050 Btu/ft³ was used in the calculations.

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.

Emissions Summary

The aggregate emissions associated with the Big57/Big176 Meter Site is given in the following tables:

Table 2: Facility-Wide Aggregate Hourly (lb/hr) Criteria Pollutant PTE Summary.

Source	CO	NO _x	PM ⁽¹⁾	SO ₂	VOCs	HAPs
Combustor ⁽¹⁾	0.05	0.04	<0.01	~0.00	0.62	0.04
Reboiler	0.03	0.03	~0.00	~0.00	0.48 ⁽³⁾	0.02 ⁽³⁾
Equipment Leaks	0.00	0.00	0.00	0.00	0.51	0.00
Facility-Wide Totals →	0.08	0.07	0.01	0.00	1.61	0.06

- (1) Conservatively, all particulate matter emissions are assumed to be less than 2.5 microns. Includes condensables.
(2) Includes both pass-through emissions generated by regenerator column/flash tank and products of combustion.
(3) These emissions represent pass-through emissions from using flash tank off-gas as a fuel and controlling hydrocarbon emissions at 95.0%.

Table 3: Facility-Wide Aggregate Annual (ton/yr) Criteria Pollutant/GHG PTE Summary.

Source	CO	NO _x	PM ⁽¹⁾	SO ₂	VOCs	HAPs	CO ₂ e ⁽²⁾
Combustor ⁽³⁾	0.21	0.18	0.02	~0.00	2.72	0.18	234.41
Reboiler	0.11	0.13	0.01	~0.00	2.11 ⁽⁴⁾	0.02 ⁽⁴⁾	157.71
Equipment Leaks	0.00	0.00	0.00	0.00	2.25	0.00	196.50
Facility-Wide Totals →	0.32	0.31	0.03	0.00	7.08	0.20	588.62

- (1) Conservatively, all particulate matter emissions are assumed to be less than 2.5 microns. Includes condensables.
- (2) 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.
- (3) Includes both pass-through emissions generated by regenerator column/flash tank and products of combustion.
- (4) These emissions represent pass-through emissions from using flash tank off-gas as a fuel and controlling hydrocarbon emissions at 95.0%.

Table 4: Facility-Wide Aggregate Annual (ton/yr) HAP PTE Summary⁽¹⁾

Source	Hexane	Benzene	Toluene	Ethyl-benzene	Xylene	Total HAPs
Combustor ⁽²⁾	0.01	0.02	0.06	0.04	0.06	0.19
Reboiler ⁽³⁾	0.01	~0.00	~0.00	~0.00	~0.00	0.02
Equipment Leaks	0.00	0.00	0.00	0.00	0.00	0.00
Facility-Wide Totals →	0.02	0.02	0.06	0.04	0.06	0.20

- (1) As the PTE of all individual HAPs is less than 10 TPY and the PTE of total HAPs is less than 25 TPY, the OXF-131 natural gas production facility is defined as a minor source of HAPs for purposes of 40 CFR 61, 40CFR63, and Title V.
- (2) Includes both pass-through emissions generated by regenerator column/flash tank and products of combustion.
- (3) These emissions represent pass-through emissions from using flash tank off-gas as a fuel and controlling hydrocarbon emissions at 95.0%.

REGULATORY APPLICABILITY

This section will address the potential regulatory applicability/non-applicability of substantive state and federal air quality rules relevant to the GDU.

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

The GDU Reboiler has been determined to meet the definition of a “fuel burning unit” under 45CSR2 and is, therefore, subject to the applicable requirements therein. However, pursuant to the exemption given under §45-2-11, as the MDHI of the GDU Reboiler is less than 10 mmBtu/hr, the unit is not subject to sections 4, 5, 6, 8 and 9 of 45CSR2. The only remaining substantive requirement is under Section 3.1 - Visible Emissions Standards.

Pursuant to 45CSR2, Section 3.1, the reboiler is subject to an opacity limit of 10%. Proper maintenance and operation of the reboiler (and the use of flash tank off-gases as fuel) should keep

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the opacity of the unit well below 10% during normal operations.

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

EQT has proposed incineration for control of the waste gas produced from Glycol Regeneration. The combustor 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:

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

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

Particulate matter emissions from the combustor are expected to be negligible. However, 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 calculated to be less 0.01 lbs/hr. Based conservatively on the density of methane (0.042265 lb/scf) and the combustor’s maximum hourly flaring rate of 490 scf/hr, the capacity of the combustor is approximately 19.23 lbs/hr (0.01 tons/hr). Based on the above, the particulate matter limit of the flares is 0.05 lbs/hr. As the hourly particulate matter emission rate from both flares is conservatively estimated to be less than 0.01 lbs/hr, the combustor 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 flare has a 20% limit on opacity during operation. Proper design and operation of the combustor should prevent any substantive opacity from the combustor.

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 Big57/Big176 Meter Site is the limitations on fuel burning units. The GDU Reboiler has been determined to meet the definition of

a “fuel burning unit” under 45CSR10. However, pursuant to the exemption given under §45-10-10.1, as the MDHI of the GDU Reboiler is less than 10 mmBtu/hr, the unit is not subject to the limitations on fuel burning units under 45CSR10.

45CSR13: Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation

The construction of the Big57/Big176 Meter Site has, without use of a control device, a maximum emission rate of a regulated pollutant (VOCs in this case) in excess of six (6) lbs/hour and ten (10) TPY and, therefore, pursuant to §45-13-2.24, the facility 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, EQT is required to obtain a permit under 45CSR13 for the construction and operation of the natural gas production facility.

As required under §45-13-8.3 (“Notice Level A”), EQT placed a Class I legal advertisement in a “newspaper of general circulation in the area where the source is . . . located.” The ad ran on October 24, 2012 in the *Wetzel Chronicle* and the affidavit of publication for this legal advertisement was submitted on November 15, 2012.

45CSR14 (NON APPLICABILITY)

The facility-wide PTE of the Big57/Big176 Meter Site (see Table 3 above) 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.

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 facility 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. Therefore, the Big57/Big176 Meter Site is not subject to 45CSR30.

40 CFR 63 Subpart HH: National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities (NON-DELEGATION)

The GDU appears to be subject to the area source (as shown above in Table 4, the individual and aggregate HAP emission rates of the facility define the proposed facility as an “area source” of HAPs) requirements of 40 CFR 63, Subpart HH. However, the DAQ has not been delegated authority from USEPA to enforce the area source requirements of this rule. Therefore, unless otherwise stated, DAQ did not formally determine whether the permittee is subject to an area source air toxics standard requiring Generally Achievable Control Technology (GACT) promulgated after January 1, 2007 pursuant to 40 CFR 63, including the area source air toxics provisions of 40 CFR

63, Subpart HH.

40 CFR 60, Subpart OOOO: Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution - (NON APPLICABILITY)

The Big57/Big176 Meter Site does not include any gas wells, compressor engines, pneumatic controllers, or storage tanks with a PTE of 6 TPY. Therefore, the facility is not subject to any substantive provision of 40 CFR 60, Subpart OOOO.

TOXICITY ANALYSIS OF NON-CRITERIA REGULATED POLLUTANTS

This section provides an analysis for those regulated pollutants that may be emitted from the proposed GDU 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 (PM₁₀), Particulate Matter less than 2.5 microns (PM_{2.5}), and Sulfur Dioxide (SO₂). 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 GDU has the potential to emit the following HAPs: Hexane, Benzene, Toluene, Ethyl-benzene, and Xylene. The following table lists each HAP’s carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)):

Table 3: 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

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 construction does not meet the definition of a “major stationary source” pursuant to 45CSR14 and, therefore, an air quality impact (computer modeling) analysis was not required. Additionally, based on the nature of the construction, modeling was not required under 45CSR13, Section 7.

MONITORING, COMPLIANCE DEMONSTRATIONS, RECORD-KEEPING, AND REPORTING REQUIREMENTS

The following substantive monitoring, compliance demonstration, and record-keeping requirements relevant to the addition of the new GDU shall be required:

- For the purposes of demonstrating compliance with the maximum wet gas throughput limit set forth in 4.1.2. of the draft permit, EQT shall be required to monitor and maintain monthly and rolling twelve month records of the wet gas throughput of the Glycol Dehydration Unit.
- For the purposes of demonstrating compliance with visible emissions limitations set forth in 4.1.4(d) of the draft permit, EQT shall be required to:
 - a. Conduct an initial Method 22 visual emission observation on the reboiler to determine the compliance with the visible emission provisions. The initial test shall be conducted in accordance with 4.3.2 of the draft permit.
 - b. Conduct monthly Method 22 visible emission observations of the reboiler stack to ensure proper operation for a minimum of ten (10) minutes each month the reboiler is in operation.
 - c. In the event visible emissions are observed in excess of the limitations given under 4.1.4(d) of the draft permit, EQT shall be required to take immediate corrective action.
- Operation of the combustor shall meet the following Monitoring, Compliance Demonstration and Source-Specific Recordkeeping Requirements:
 - a. EQT shall be required to maintain records of all startups, shutdowns, and/or malfunctions of the combustor. These records shall include the date, time, and duration

of each event.

- b. EQT 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 combustor.
 - c. For the purposes of demonstrating compliance with visible emissions limitations set forth in 4.1.5(f) of the draft permit, EQT shall be required to:
 - (1) Conduct an initial Method 22 visual emission observation on the combustor to determine the compliance with the visible emission provisions. The initial test shall be conducted in accordance with 4.3.2 of the draft permit.
 - (2) Conduct monthly Method 22 visible emission observations of the combustor stack to ensure proper operation for a minimum of ten (10) minutes each month the vapor combustor is in operation.
 - (3) In the event visible emissions are observed in excess of the limitations given under 4.1.5(f) of the draft permit, EQT shall be required to take immediate corrective action.
- EQT shall be required to maintain records of all visual emission observations pursuant to the monitoring required under 4.2.2. and 4.2.3(c) of the draft permit including any corrective action taken.
 - EQT shall be required to report any deviation(s) from the allowable visible emission requirement for any emission source discovered during observations using 40 CFR 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.

PERFORMANCE TESTING OF OPERATIONS

The following substantive performance testing requirements relevant to the addition of the new GDU 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, EQT 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.
- In order to demonstrate compliance with the opacity requirements of 4.1.4(d) and 4.1.5(f) of the draft permit, EQT shall be required to conduct a Method 22 opacity test for at least two

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hours. This test shall demonstrate no visible emissions are observed for more than a total of 5 minutes during any 2 consecutive hour period using 40CFR60 Appendix A Method 22. EQT shall be required to conduct this test within one (1) year of permit issuance or initial startup whichever is later. The visible emission checks shall determine the presence or absence of visible emissions. At a minimum, the observer must be trained and knowledgeable regarding the effects of background contrast, ambient lighting, observer position relative to lighting, wind, and the presence of uncombined water (condensing water vapor) on the visibility of emissions. This training may be obtained from written materials found in the References 1 and 2 from 40 CFR part 60, appendix A, Method 22 or from the lecture portion of 40 CFR part 60, appendix A, Method 9 certification course.

- In order to demonstrate continuing compliance with 4.1.3 of the draft permit, upon request of the Director, EQT shall be required to demonstrate compliance with the HAP emissions thresholds using GLYCalc Version 4.0 or higher. EQT shall be required to sample in accordance with GPA Method 2166 and analyze the samples utilizing the extended GPA Method 2286 as specified in the GRI-GLYCalc V4 Technical Reference User Manual and Handbook.

RECOMMENDATION TO DIRECTOR

The information provided in permit application R13-2999 indicates that compliance with all applicable air quality regulations will be achieved. Therefore, I recommend to the Director the issuance of Permit Number R13-2999 to EQT Production Company for the after-the-fact construction and operation of the Big57/Big176 Meter Site located near Smithfield, Wetzel County, WV.

Joe Kessler, PE
Engineer

Date

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