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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.: G70-A124
Plant ID No.: 103-00098
Applicant: American Energy-Marcellus, LLC
Facility Name: WJ Criswell 405
Location: Wetzel County
NAICS Code: 211111
Application Type: Construction, General
Received Date: December 10, 2014
Engineer Assigned: Steven R. Pursley, PE
Fee Amount: \$1,500.00
Date Received: December 12, 2014
Complete Date: January 16, 2015
Due Date: March 2, 2015
Applicant Ad Date: December 10, 2014
Newspaper: *Wetzel Chronicle*
UTM's: Easting: 532.769 km Northing: 4,384.25 km Zone: 17
Description: General Permit application for a natural gas well pad.

DESCRIPTION OF PROCESS

Condensate, gas and water come from the wellheads to gas production units with 1mmbtu/hr burners, where the first stage of separation occurs. The GPUs separate the well stream flow into a high pressure gas vapor product, while generating a high pressure natural gas stream and condensed liquid stream. In the second stage of separation the liquid stream are routed to the heated low pressure flash separator where condensate and produced water are separated. The flash from the low pressure separators is captured via flash gas compressors driven by a natural gas fire engine and is routed to the sales gas pipeline. Produced water from the separators is sent to three 400 bbl produced water storage tanks. The condensate stabilizer raises the temperature of the condensate and drives off light hydrocarbons. These light hydrocarbons are then transferred under pressure to a natural gas liquids tank on site. The depleted condensate stream is transferred to the three 400 bbl condensate storage tanks. American Energy-Marcellus

(AEM) does not anticipate flash emissions from the condensate storage tanks due to the depletion of the condensate stream.

The natural gas stream will exit the facility for transmission via pipeline. Condensate is transported offsite via truck, and produced water will be transported via pipeline to a storage area for subsequent reuse and/or disposal. Working and breathing losses from the 400 bbl condensate storage tanks and 400 bbl produced water tanks will be routed to an enclosed combustor.

SITE INSPECTION

A site inspection of the facility was performed by the writer on February 11, 2015. The well has already been drilled and fracked. Equipment had been delivered and was being staged but no emission units appeared to have been installed. The pad is in a remote location with the nearest residence approximately 0.5 miles away.

To get to the facility take I-77 north to Parkersburg and get off at exit 179. Take State Route 2 north approximately 43 miles to New Martinsville. Then turn right (east) on State Route 7 and go 17.2 miles. Turn right on Co. Rt. 17 (Barkers Run) and proceed 1.1 miles. Next, turn left on Co. Rt 58 (Hoyt Ridge) and go approximately 2.6 miles and the access road will be on the right. There is a guard shack near the intersection of Co. Rt. 58 and the access road. Proceed 0.4 miles on the access road to the well pad. Below are pictures taken during the site inspection:



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ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

AEM included in Attachment I of the general permit application air emissions calculations for the WJ Criswell 405 Well Pad. The following will summarize the calculation methodologies used by AEM to calculate the potential-to-emit (PTE) of the proposed equipment.

Combustion Sources (except compressor engine):

HAP and Criteria Pollutant emissions from the natural gas-fired GPU burners (1S-3S) the flash separator heater (heater treater) (4S), the condensate stabilizer heater (9S) and the enclosed vapor combustor (13S) were based on the emission factors provided for

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natural gas combustion as given in AP-42 (AP-42 is a database of emission factors maintained by USEPA) Section 1.4 (modeled as uncontrolled small boilers).

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 1,285 Btu/scf was used in the calculations. This is higher than the typical 1,000 - 1,050 btu/scf that is normally used in calculations. However, it is based on a gas analysis of the nearby Hoyt 402 well pad.

Compressor Engine

Emissions of SO₂, PM, and HAPs from the 118 hp Caterpillar Compressor engine were based on AP-42 Chapter 3.2 (for 4 stroke, rich burn engines). Emissions of VOCs, CO and NO_x were based on manufacturer data.

Storage Tanks

Uncontrolled working and breathing losses from the tanks are based on EPA Tanks 4.0.9d software. A control efficiency of 98% was then applied to account for the vapor combustor to arrive at the controlled working and breathing losses. Flash emissions are not expected to be emitted from the condensate storage tanks due to the use of the condensate stabilizer. Condensate from the low pressure separators will be sent to a 1,200 barrel per day condensate stabilizer with a 750,000 btu/hr burner. The stabilization process reduces the vapor pressure of the condensate liquids to prevent the vapor phase when transferring the liquid to storage tanks. AEM performed modeling of the condensate stabilizer at similar operations using E&P tanks. The modeling showed that flash gases are not produced from the condensate storage tanks as a result of the stabilization process.

Fugitive Emissions

Emissions from equipment leaks were based on EPA's protocol for Equipment Leak Emission Estimates (EPA-453/R-95-017).

Loading Emissions

Loading emissions were based on AP-42 Section 5.2. The calculations were based on 2,989,350 gallons per year each of condensate and produced water.

Based on the above methodology, emissions from the facility should be as follows:

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Hourly Emissions (pound per hour)

Source	CO	NO _x	PM ⁽¹⁾	SO ₂	VOCs	HAPs
3 GPU Burners (combined)	0.20	0.23	0.02	0.01	0.01	0.01
Flash Separator Heater	0.07	0.08	0.01	--	0.01	0.01
Condensate Stabilizer Heater	0.05	0.06	0.01	--	0.01	--
Vapor Combustor	1.20	1.43	0.11	0.01	0.08	0.03
Compressor Engine	0.52	0.26	0.02	0.01	0.19	0.03
3 condensate tanks (combined)	--	--	--	--	0.02	0.01
3 prod. water tanks (combined)	--	--	--	--	0.01	--
Fugitive Emissions	--	--	--	--	1.10	0.01
Truck Loading ⁽²⁾	--	--	--	--	17.50	1.36
Facility-Wide Totals →	2.04	2.06	0.17	0.03	18.93	1.46

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

(2) As a maximum hourly pump rate was not provided, hourly emissions based on 1,000 hours/year.

Annual Emissions (tons per year)

Source	CO	NO _x	PM ⁽¹⁾	SO ₂	VOCs	HAPs
3 GPU Burners (combined)	0.86	1.02	0.08	0.01	0.06	0.02
Flash Separator Heater	0.29	0.34	0.03	--	0.02	0.01
Condensate Stabilizer Heater	0.21	0.26	0.02	--	0.01	--
Vapor Combustor	5.27	6.28	0.48	0.04	0.35	0.12
Compressor Engine	2.28	1.14	0.09	0.01	0.80	0.11
3 condensate tanks (combined)	--	--	--	--	0.10	0.01
3 prod. water tanks (combined)	--	--	--	--	0.01	--
Fugitive Emissions	--	--	--	--	4.83	0.06
Truck Loading	--	--	--	--	8.75	0.68
Facility-Wide Totals →	8.91	9.04	0.70	0.06	14.93	1.01

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

REGULATORY APPLICABILITY

The proposed AEM natural gas production facility is subject to substantive requirements in the following state and federal air quality rules:

STATE RULES

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

The Gas Production Units (1S, 2S & 3S) 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 each 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 units 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 Particulate Air Pollution from Combustion of Refuse*

AEM has proposed an enclosed combustor for controlling the working and breathing 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, AEM 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 0.11 lbs/hr. No information was included in the application regarding the maximum vapor mass sent to the combustor. However, based upon similar sized units used elsewhere in the area, the mass sent to the combustor should be approximately 790 lb/hr (0.39 tons/hour). Based on the above, the aggregate particulate matter limit of the combustor is 2.12 lbs/hr. As the hourly particulate matter emission rate from the combustor is 0.11 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.

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 WJ Criswell natural gas production facility has a potential to emit a regulated pollutant 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, AEM 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"), AEM placed a Class I legal advertisement in a "newspaper of general circulation in the area where the source is . . . located." The ad ran on December 10, 2014 in *Wetzel Chronicle* and the affidavit of publication was received by the DAQ on January 16, 2015.

45CSR22 *Air Quality Management Fee Program*

The WJ Criswell 405 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.

FEDERAL RULES

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

Since the engine is a “Non-Emergency SI Natural Gas” engine between 100 and 500 hp it must meet the following emission standards per Table 1 of Subpart JJJJ:

Emission Standards (g/hp-hr)		
NO _x	CO	VOC
1.0	2.0	0.7

AEM based their calculations on manufacturer data which matches these limits. They will have to perform testing in accordance with §60.4243(b)(2) in order to verify that these emissions limits are being met.

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 WJ Criswell-405 pad will begin operation after August 23, 2011 it is subject to the requirements of Subpart OOOO. The tanks at the WJ Criswell-405 facility will utilize an enclosed vapor combustor in order to ensure emissions from the tanks remain below 6 tons per year. 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 with a bleed rate equal to or less than 6 scfd, therefore the controllers will not be subject to the applicable provisions of Subpart OOOO. The gas wells at the WJ Criswell-405 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 Gas Production Units (1S, 2S & 3S) 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 for the Prevention of Significant Deterioration of Air Quality

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The facility-wide potential-to-emit of the WJ Criswell - 405 natural gas production facility (see table 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.

Potential Source Aggregation

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).

Most of the AEM facilities in the area share the same SIC code as WJ Criswell 405. Additionally, although AEM has stated that "common control may not be established between any two distinct wells", it is the writers belief that several wells in the general area meet the common sense notion of "common control". Therefore, the potential classification of the WJ Criswell - 405 facility as one stationary source with any other AEM 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 WJ Criswell - 405 natural gas production facility is not located contiguous with, or *directly* adjacent to any other EQT facility. In fact, AEM states that there is no other AEM facility within 1 mile of the WJ Criswell - 405 facility. Facilities separated by this distance do not meet the common sense notion of a single plant. Therefore, the WJ Criswell - 405 facility is not considered to be on contiguous or adjacent property with any other AEM facility.

45CSR30: Requirements for Operating Permits

The facility is not subject to 45CSR30. The WJ Criswell - 405 Pad is subject to 40CFR60 Subparts JJJJ and 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.

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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 (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 WJ Criswell - 405 facility are each 16,800 gallons, or 63.5 m³. 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 WJ Criswell 405 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 (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 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. American Energy included the following HAPs as emitted in substantive amounts in their emissions estimate: Benzene, n-Hexane, and Formaldehyde. The following table lists each HAP’s carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)):

HAPs	Type	Known/Suspected Carcinogen	Classification
n-Hexane	VOC	No	Inadequate Data
Benzene	VOC	Yes	Category A - Known Human Carcinogen
Formaldehyde	VOC	Yes	Category B1 - Probable Human Carcinogen

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

Since this application addresses the construction of a minor stationary source, as defined in 45CSR14, no modeling was performed.

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, AEM 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, AEM shall be required to:
 - (1) Conduct an initial Method 22 visual emission observation on the GPUs and Flash Separator Heaters to determine the compliance with the visible emission provisions. American Energy shall be required to take a minimum of two (2) hours of visual emissions observations on the GPU and Flash Separator Heaters.
 - (2) Conduct monthly Method 22 visible emission observations of the GPU and Flash Separator Heater 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, American Energy shall be required to take immediate corrective action.

- American Energy 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.
- American Energy 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.
- AEM shall be required to maintain records of the amount of natural gas burned in all engines, heaters or other fuel burning units.

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-A124 for the construction of a natural gas production facility near Wileyville, Wetzel County, be granted to American Energy - Marcellus, LLC



Steven R. Pursley, PE
Engineering



February 9, 2015

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