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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.: G70-A124A
Plant ID No.: 103-00098
Applicant: American Energy-Marcellus, LLC (AEM)
Facility Name: WJ Criswell 405
Location: Wetzel County
NAICS Code: 211111
Application Type: Modification
Received Date: April 14, 2015
Engineer Assigned: David Keatley
Fee Amount: \$1,500
Date Fee Received: April 16, 2015 and May 5, 2015
Complete Date: June 6, 2015
Due Date: July 24, 2015
Applicant Ad Date: April 22, 2015
Newspaper: *Wetzel Chronicle*
UTM's: Easting: 532.769 km Northing: 4,384.25 km Zone: 17
Description: Installation and operation of: three (3) 1.5-mmBtu/hr line heaters, three (3) after-the-fact gas processing units (GPUs), one (1) 47-bhp generator engine, modification of emissions from the produced water tanks, and removal of three (3) 1.0 mmBtu/hr GPUs from the permit registration.

DESCRIPTION OF PROCESS

Raw natural gas (water, condensate, and natural gas) come from three (3) natural gas wells to three 1.5 mmBtu/hr GPUs (GPU-1 through GPU-3), 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 which will exit the facility via pipeline and condensed liquid stream. In the second stage of separation the condensed liquid stream is routed to three (3) 1.5-mmBtu/hr line heaters. The line heaters increase the temperature of the liquid to encourage separation of phases. The fluids from the line

heaters are sent to a 1.0 mmBtu/hr low-pressure flash separator. The flash from the low-pressure separator is captured with a flash gas compressor driven by a natural gas fired 118 bhp engine and exits the facility via sales gas pipeline. Produced water from the flash separator is sent to three (3) 400-bbl produced water tanks (PTK-1 through PTK-3). Condensate from the flash separator is sent to one (1) 0.75 mmBtu/hr condensate stabilizer (CS-1). The condensate stabilizer increases the temperature of the condensate and encourages hydrocarbons to vaporize. The vapors from the condensate stabilizer will be sent to the flash gas compressor. The liquid from the condensate stabilizer flows to three (3) 400-bbl condensate tanks (CTK-1 through CTK-3). The vapors from the condensate stabilizer are sent to a condenser. The liquids which are condensed go to a pressurized natural gas liquids (NGL) tanks. The liquids from the NGL tank will be trucked offsite. The vapors from the condenser are sent to the flash gas compressor.

Condensate and produced water (originally a pipeline was going to handle the produced water) will be loaded into trucks and transported offsite. During loading there will be vapor return to a 18.24 mmBtu/hr National Oilwell Varco MEVC200 enclosed combustor (18C) to reduce the emissions from the truck loading operation. Working, breathing, and flashing losses from the storage tanks will be routed to an enclosed combustor (18C). The facility will also have a HIPOWER generator to provide electrical power. The generator is powered by a 47-bhp PSI engine (ENG-2).

SITE INSPECTION

A site inspection of the facility was performed by Steven Pursley of DAQ's NSR Permitting section 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

The following will summarize the calculation methodologies used by AEM to estimate the potential-to-emit (PTE) of the proposed/modified equipment.

Line Heaters and GPUs:

HAP and criteria pollutant emissions from the natural gas-fired GPU burners (GPU-1 through GPU-3) and line heaters (HTR-1 through HTR-3) are estimated using AP-42 section 1.4

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 ENG-2 were estimated based on AP-42 Chapter 3.2 (for 4 stroke, rich burn engines). Emissions of VOCs, CO and NO_x were based on EPA certificate of conformity. Emissions of CO₂e were estimated using emission factors from 40 CFR 98 Subpart C.

Storage Tanks:

Uncontrolled working, breathing, and flashing vapors from the tanks are estimated with E&P Tanks for the condensate and produced water. A representative liquid sample from 404 was used in E&P Tanks. A control efficiency of 98% was then applied to account for the vapor combustor to arrive at the controlled working, breathing, and flashing emissions.

Truck Loading Emissions:

Loading emissions were estimated using E&P Tanks. The calculations were based on 1,073,100 gallons per year of condensate and 2,989,350 gallons per year of produced water.

Table 1: Estimated Maximum Controlled New/Modified Air Emissions

Emission Point ID	Emission Unit ID	Emission Source	Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (tpy)
1E through 6E	GPU-1 through GPU-3 HTR-1 through HTR-3	Line Heater and Gas Production Unit (Air Emissions from Each)	Nitrogen Oxides	0.12	0.51
			Carbon Monoxide	0.10	0.43
			Volatile Organic Compounds	0.01	0.03
			PM	0.01	0.04
			PM ₁₀	0.01	0.04
			n-Hexane	<0.01	0.01
			CO _{2e}	176	770
10E	PTK-1 through PTK-3 CTK-1 through CTK-3 TRL-1 TRL-2 and CTRL-1	National Oilwell Varco MEVC200 Combustor (Produced Water Tanks, Condensate Tanks, Truck Loading, and Combustion Emissions)	Nitrogen Oxides	1.43	6.28
			Carbon Monoxide	1.21	5.28
			Volatile Organic Compounds	0.68	2.96
			Total Particulate Matter	0.11	0.48
			PM ₁₀	0.11	0.48
			CO _{2e}	2,073	9,082
			9E	ENG-2	HIPOWER Generator Engine 47 bhp
Carbon Monoxide	0.61	2.68			
Volatile Organic Compounds	0.37	1.63			
PM	0.01	0.02			
PM ₁₀	0.01	0.02			
Formaldehyde	0.03	0.12			
CO _{2e}	58	254			

Table 2: Summarized Estimated Maximum Controlled Regulated Facility Wide PTE

Pollutant	Maximum Annual Facility Wide Emissions (tons/year)
Nitrogen Oxides	10.99
Carbon Monoxide	10.53
Volatile Organic Compounds	6.38
Total Particulate Matter	4.19
PM ₁₀	4.19
Sulfur Dioxide	0.06
Total HAP Emissions	0.41
CO _e	13,986

REGULATORY APPLICABILITY

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

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

The GPUs and Line heaters (GPU-1 through GPU-3 and HTR-1 through HTR-3) 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.

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

AEM has proposed an enclosed combustor for controlling the working, breathing, and flashing emissions produced from the condensate tanks, produced water tanks, and truck loading. 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.

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.

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

Since these changes include a substantive requirement (Rule 6) this application will be a Modification.

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45CSR22 Air Quality Management Fee Program

This facility is not subject to 45CSR30. This facility does not exceed 45CSR30 emission thresholds as can be seen in Table 2. 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. This facility has a maximum horsepower capacity less than 1,000 hp and is a 9M and is required to pay a \$200 annual fee. AEM is required to keep their Certificate to Operated current.

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

40CFR60 Subpart JJJJ sets forth emission limits, fuel requirements, installation requirements, and monitoring requirements based on the date of construction, date of manufacture, and horsepower (hp) of the spark ignition internal combustion engine. All proposed engines will commence construction after June 12, 2006.

Engine ENG-2 are subject to this subpart. ENG-2 is a certified engine and the Certificate on Conformity will be available in the file. To keep the designation of certified this engine must be operated and maintained to the manufacturer's emission-related written instructions and must keep records of conducted maintenance to demonstrate compliance.

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 began 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 this regulation. 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.

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. This facility is subject to the area source requirements for non-emergency spark ignition engines.

Engine ENG-2 is a "New Stationary RICE" sources at an area source of HAPs and is an affected source because construction commenced after June 12, 2006 [63.6590(a)(2)(iii)] due to the installation dates of the engines being after June 12, 2006. Engine ENG-2 must meet the requirements of 40CFR60 subpart JJJJ and has no additional requirements due to this regulation.

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

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

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 AEM 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.

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.

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 combustor that AEM has proposed is not used to comply with one of these regulations. The purpose of the combustor is to control emissions from the tanks that are routed to it and truck loading. In addition 40CFR60.18 refers to flares but makes no mention of enclosed combustion devices. Therefore combustor CTRL-1 is not subject to this regulation.

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: 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)):

Table 3: HAP Considerations

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

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.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates compliance with all state and federal air quality requirements will be satisfied and this facility is expected to meet the requirements of General Permit G70-A. Therefore AEM's request to modify and operate it natural gas production facility WJ Criswell 405 under permit registration G70-A124A is recommended to the Director of Air Quality.



David Keatley
Permit Writer - NSR Permitting

June 30, 2015

Date

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