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ENGINEERING EVALUATION/FACT SHEET

B ACKGROUND INFORMATION

Application No.:	R13-3278
Plant ID No.:	103-00109
Applicant:	Mountain Valley Pipeline, LLC
Facility Name:	Bradshaw Station
Location:	Mannington, Wetzel County
NAICS Code:	486210
Application Type:	Construction
Received Date:	October 23, 2015
Engineer Assigned:	Roy F. Kees, P.E.
Fee Amount:	$2,000.00
Fee Deposit Date:	October 29, 2015
Complete Date:	December 23, 2015
Due Date:	March 23, 2016
Applicant Ad Date:	October 28, 2015
Newspaper:	*The Wetzel Chronicle*
UTM's:	Easting: 540.050 km Northing: 4,376.000 km Zone: 17
Description:	Construction of a new natural gas compressor station consisting of four (4) compressor turbines, fourteen (14) microturbines, two (2) fuel heaters, one (1) building heater and two (2) storage tanks.

Process Description

Natural gas enters the station via the transmission pipeline system and is compressed using one of the four (4) natural gas-fired turbines (each rated at 23,536 hp at site-specific conditions, and ISO rated at 20,500 hp each). The compressed natural gas flows into the pipeline to be transported further along the transmission system. The station is also equipped with two (2) fuel gas heaters, one (1) office building heater, one (1) produced fluids storage tank, one (1) used oil storage tank, and fourteen (14) natural gas-fired microturbine generators (each rated at 200 kW) providing electricity to the station. Once the tanks are filled, the contents are loaded onto trucks for transport.

For the Bradshaw Station, MVP is proposing to:

- Install four (4) new Solar Titan 130 turbines;
- Install fourteen (14) Capstone C200 Microturbine Genartors;
- Install two (2) 2.31-MMBtu/hr fuel gas heaters;
- Install one (1) 10,080 gallon Produced Fluids Tank;
- Install various small insignificant storage tanks (oil, etc.).

The power output from a natural gas-fired turbine is directly related to the fuel input rate and to the ratio of combustion air to fuel. As ambient temperatures decrease, a turbine's maximum power output will increase due to the increased density of inlet air. The Solar dry low NO_x (DLN) combustion system (known as SoloNO_x) limits formation of NO_x, CO, and VOC by pre-mixing air and fuel prior to combustion. When operating a Solar Titan 130 turbine at ambient temperatures~ 0^0 F and at loads ~ 50%, this DLN system is able to limit the exhaust gas concentration of these pollutants (corrected to 15% 0_2) to 15 ppm NO_x, 25 ppm CO, and 25 ppm unburned hydrocarbons (UHC, containing at least 80% non-VOC methane and ethane; therefore, 5 ppm VOC). At ambient temperatures of 0 to -20^0 F, additional pilot fuel is required by the turbine to maintain flame stability, which increases estimated emission concentrations to 42 ppm NO_x, 100 ppm CO, and 50 ppm UHC (10 ppm VOC). At turbine loads <50%, additional pilot fuel and air flow are required to maintain flame stability and turbine responsiveness. These changes increase estimated emission concentrations to 66 ppm NO_x, 4,400 ppm CO, and 440 ppm UHC (88 ppm VOC). Should loads drop below 50%, MVP will make every effort to either bring the load back above 50% or shut a turbine down (e.g., shut down another turbine and move that volume to the turbine, or shift the turbine volume to another turbine and shut down the turbine).

SITE INSPECTION

A site inspection was performed on December 2, 2015 by James Robertson of the enforcement section. "I was not able to get to the exact site, but I did drive the length of Fallen Timber Run Road and Bear Run Road. The station will be located on top of the mountain overlooking Fallen Timber and appears to be well away from houses and any other structure.

In my opinion this site is suitable for a Rule 13 Permit."

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Solar Combustion Turbines

The applicant classified the operation of the turbine into five operating modes, which are normal operation, startup/shutdown, low-load, below zero, and extreme below zero. The emissions from the proposed turbines can vary significantly between these different operating modes. Solar refers to these modes as non-SoLoNO$_x$ modes except for normal operation, which is referred to as SoLoNO$_x$ Mode.

Normal Operation: Normal operation is classified as loads above 50% of peak power output with ambient temperatures above zero degrees Fahrenheit. The Solar's SoLoNO$_x$, which is Solar's gas turbine dry low NO$_x$ emission combustion system, works very well to minimize emissions generated from the combustion turbine. Typically, the system can maintain NO$_x$ emissions at 15 ppm with the oxygen corrected to 15% in this mode. Carbon Dioxide (CO) and unburnt hydrocarbons (UHC) are maintained at 25 ppm with the oxygen level corrected to 15%. Pipeline quality natural gas has less than 10% of VOC; typically the VOC content is less than 1%. MVP assumed that the unburnt hydrocarbons would only be 20%, which is a reasonable assumption. The VOC emission concentration is 5 ppmvd at 15% oxygen.

Startup/Shut Down: Startup and Shutdown events should take approximately 10 minutes per event (10 min. startup & 10 min. shutdown) or 20 minutes for a complete startup/shut down cycle. Solar has published Product Information Letter (PIL) 170 Revision 5 for customers to estimate emissions during startup/shut down events of their turbines. To determine the annual potential emissions, MVP used 12 complete events per year to determine the annual potential to emit per each turbine. CO emissions are 384.5 pounds per complete cycle with NO$_x$ being only 4.30 pounds per cycle. VOC emissions are predicted to be 4.40 pounds per cycle.

Low-Load Operations: Low-load operation would be considered to be non-startup/shutdown modes with the turbine operating below 50% load (as determined by ambient temperatures). Solar provided an estimate of NOx, CO, and UHC emissions in PIL 167 Revision 4. Due to limited duration operation at this condition, MVP did not include emissions for annual estimates.

Below Zero Operations: Cold weather operations would be considered to be when the turbine is operating at loads above 50% when ambient conditions are below zero degrees Fahrenheit. Solar provided an estimate of NOx CO and UHC emissions in PIL 167 Revision 4 for customers to estimate emissions during non-SoLoNO$_x$ modes, which includes conditions below zero Due to limited duration operation at this condition, MVP did not include emissions for annual estimates.

Extreme Below Zero Operations: In addition to regular below zero operations, although very limited, there are times when the ambient temperatures fall below negative twenty degrees Fahrenheit. In PIL 167 Revision 4, Solar has additional guidelines for determining emissions of NOx, CO, and UHC at these extreme conditions. Due to limited duration operation at this condition, MVP did not include emissions for annual estimates.

Microturbine Generators

The facility will utilize fourteen (14) Capstone C200 Microturbine Generators. Potential emissions of NOx, CO, VOC, methane and CO2 are calculated using manufacturer's emission data. Emissions of all other criteria pollutants and HAPs are calculated using AP-42 factors for natural gas internal combustion engines. Although one unit will provide backup power, potential emissions of all units are calculated assuming continuous operation.

Fuel Gas Heaters

The fuel gas heaters are 2.31 MMBtu/hr natural gas fired heaters. MVP used emission factors from Tables 1.4.1-1 and 1.4.1-3 of AP-42 and Subpart C of Part 98 to estimate emissions from these heaters.

Storage Tanks

Working, breathing and flash loss emissions of VOC and HAPs from the produced fluids storage tank were calculated using E&P Tanks v2.0. Liquid loading emissions were calculated using AP-42 emissions factors.

Equipment Leaks

MVP has measured leaks throughout their pipeline systems and developed emission factors based on component leaks per compressor by type of component. The VOC emissions were estimated as a total for the compressors and other components to be 3.52 tpy. These fugitive leaks have the potential to release greenhouse gases, which are methane and carbon dioxide. The potential CO_2e from these leaks was estimated to be 2,207 tpy.

Emissions from the proposed new sources are indicated in the following table.

Potential Emissions from the Proposed New Emissions Units											
Source	Operating Mode	Cycles	Hr/Yr	NO_x (tpy)	CO (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	VOC (tpy)	SO_2 (tpy)	Total HAPs (tpy)	CO_2e (tpy)
S001 Solar Titan 130 CT #1	Full Load @ 0^0 F		8,756	42.95	45.64	11.57	11.57	5.02	2.62	2.47	91,630
	Startup/Shutdown	12	4	--	0.03	--	--	--	--	--	--
	Total		8,760	42.95	45.67	11.57	11.57	5.02	2.62	2.47	91,630
S002 Solar Titan 130 CT #2	Full Load @ 0^0 F		8,756	42.95	45.64	11.57	11.57	5.02	2.62	2.47	91,630
	Startup/Shutdown	12	4	--	0.03	--	--	--	--	--	--
	Total		8,760	42.95	45.67	11.57	11.57	5.02	2.62	2.47	91,630
S003 Solar Titan 130 CT #3	Full Load @ 0^0 F		8,756	42.95	45.64	11.57	11.57	5.02	2.62	2.47	91,630
	Startup/Shutdown	12	4	--	0.03	--	--	--	--	--	--
	Total		8,760	42.95	45.67	11.57	11.57	5.02	2.62	2.47	91,630
S004 Solar Titan 130 CT #4	Full Load @ 0^0 F		8,756	42.95	45.64	11.57	11.57	5.02	2.62	2.47	91,630
	Startup/Shutdown	12	4	--	0.03	--	--	--	--	--	--
	Total		8,760	42.95	45.67	11.57	11.57	5.02	2.62	2.47	91,630
S005-S018 (14) Capstone C200 Microturbines			8,760	4.90	13.44	0.98	0.98	1.26	0.42	0.14	16,324
S019-S020 (2) Fuel Gas Heaters			8,760	1.86	1.56	0.14	0.14	0.10	0.02	0.02	2,368
S021 Produced Water Tank				--	--	--	--	0.21	--	<0.01	2.10
S023 Office Building Heater			8,760	0.05	0.04	--	--	--	--	<0.01	0.62
S025 Liquids Loading				--	--	--	--	0.05	--	--	--
Equip. Leaks	Fugitive								3.52	0.26	6,516
Total				178.62	197.78	47.47	47.47	31.94	10.98	10.79	391,794
PSD major Source Threshold Values (45 CSR 14)				250	250	250	250	250	250		N/A
Major Source Title V (45 CSR 30)				100	100	100	100	100	100		N/A

REGULATORY APPLICABLILITY

MVP's proposed Bradshaw Compressor Station does not meet the definition of a Major Source under Prevention of Significant Deterioration (PSD), which is State Rule 45 CSR 14, and is classified as an area source for Hazardous Air Pollutants for applicability purposes under 40 CFR 63. The application as filed requires a construction permit issued under 45 CSR 13 (West Virginia's minor source permitting program).

Rule 2 (45 CSR 2)

The fuel gas heaters are only subject to the opacity requirement of 45 CSR §2-3.1. according to 45 CSR §2-11.1. Natural gas units are exempt for the visible emission monitoring plan requirements of this rule due to the nature of burning pipeline quality natural gas.

Rule 13 (45 CSR 13)

The proposed construction of Bradshaw Compressor Station has a potential to emit in excess of six (6) lbs/hour and ten (10) TPY of a regulated pollutant and, therefore, is subject to 45CSR13.

As required under §45-13-8.3, Mountain Valley Pipeline 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 28, 2015 in *The Wetzel Chronicle* and the affidavit of publication for this legal advertisement was submitted on November 9, 2015.

Rule 30 (45 CSR 30)

Bradshaw Station is subject to 45CSR30. The facility meets the definition of a major source per §45-30-2.26. The Bradshaw Station exceeds 100 tons/year of a regulated pollutant (NOx & CO). The Title V (45CSR30) application will be due within twelve (12) months after the date of the commencement of the operation or activity (activities) authorized by this permit.

NSPS (40 CFR Part 60)

New Source Performance Standards (NSPS) apply to certain new, modified, or reconstructed sources meeting criteria established in 40 CFR 60.

The fuel gas heaters are rated for 2.31 MMBtu/hr. The definition of affected source in Subpart Dc (Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units) is units between 10 MMBtu/hr and up to 100 MMBtu/hr. Thus, the proposed process heater is not an affected source and is not subject to the standards under Subpart Dc.

Subpart KKKK

U.S. EPA has promulgated NSPS for stationary combustion turbines constructed, modified, or reconstructed after February 18, 2005, in Subpart KKKK. Subpart KKKK applies to combustion turbines with a peak heat input of 10 MMBtu/hr and greater. The proposed mictrotubines will have a peak heat input of 2.3 MMBtu/hr and therefore will not be subject. However, the proposed Solar Titan turbines are rated at 141.6 MMBtu/hr (at 0^0 F). Therefore, the purposed turbines are affected sources under this subpart.

Sources subject to Subpart KKKK are exempt from the requirements of Subpart GG (NSPS for combustion turbines constructed/modified/reconstructed after October 3, 1977).

This subpart establishes emissions standards for NO_x and SO_2. These turbines would be limited to 0.060lb of SO_2 per MMBtu/hr of heat input. These turbines will be burning pipeline quality natural gas with a maximum sulfur content of 20 grains per 100 standard cubic feet of gas. Under 40 CFR §60.4365, a source is exempt from monitoring fuel sulfur content if the source burns natural gas that is covered by an transportation agreement (Federal Energy Regulatory Commission tariff limit) with a maximum of 20 grains of sulfur per 100 standard cubic feet of gas (40 CFR §60.4365(a)).

40 CFR §60.4325 establishes NO_x standards for affected units as specified in Table 1 of Subpart KKKK. The proposed units are new turbines firing natural gas with a heat input of greater than 50 MMBtu/hr and less than 850 MMBtu/hr. In this subcategory, these turbines are limited to a NO_x standard of 25 ppm at 15 percent oxygen (O_2) content or 150 nanagram /Joule of useful output. The selected turbines are equipped with a dry low NO_x emission combustion system, known as SoLoNO_x™, which has been developed to provide the lowest emissions possible during normal operating conditions. Solar Taurus (manufacturer) predicts that the NO_x emissions with the SoLoNO_x™ combustion controls from the turbine to be 15 ppm when the ambient temperatures are at or above 0^0 F.

There are alternative standards for units operating at less than 75 percent of peak load or when operating temperatures are less than 0^0 F. The alternative limit is 150 ppm at 15% O_2 is listed in Table 1 to Subpart KKKK. The manufacturer predicts that the NO_x rate for the proposed turbines would increase up to 120 ppm for subzero operations. For low load operations, the manufacturer predicts the NO_x concentrations to increase slightly to 70 ppm for loads at or less than 50% of peak output and 50 ppm at idle conditions. The proposed turbines are capable of meeting the NO_x limitations under this subpart at normal and other than normal conditions.

This subpart requires sources to use one of two options in monitoring compliance with the standard, which are testing or a continuous emission monitoring system. Sources can conduct testing every year and reduce the subsequent testing to every two years if the NO_x results are at or less than 75% of the standard, which equates to 15 ppm for these two turbines. The applicant has elected to use the testing option at this time. The permit will be structured on the 15 ppm as the short term limit, which is 75% of the applicable limit, for the short term limit

with initial testing and subsequent testing every two years. Under the subpart, sources electing to conduct testing are only required to submit test reports of the results in lieu of submitting excess emissions and monitor downtime in accordance with 40 CFR §60.7(c).

Subpart OOOO

Turbines are driving compressors at a transmission station for a natural gas pipeline system. Subpart OOOO (Standards of Performance for Crude Oil and Natural Gas Production) establishes standards for certain process equipment at oil and natural gas production sites. This regulation defines sites from the wellhead and the point of custody transfer to the natural gas transmission and storage segment. The Bradshaw station is downstream of the custody transfer point of MVP's transmission system. Therefore, the proposed compressors are not affected sources and not subject to the performance standards of Subpart OOOO.

However, this subpart does include storage tanks that have a VOC potential of 6 tpy or greater that are located at natural gas transmission segments. 40 CFR §60.5365(e) is clear that the potential must be calculated using a generally accepted model or calculation methodology, based on the maximum average daily throughput determined for a 30-day period of production prior to the applicable emission determination deadline. The proposed produced water tank will not have VOC emissions greater than 6 TPY, therefore the tank will not be subject.

NESHAP (40 CFR Part 63)

With a potential to emit of 4.53 tpy of total HAPs, the station is classified as an area source of HAPs. Subpart YYYY, which is for combustion turbines, and Subpart DDDDD, which is for boilers and process heaters, are only applicable to affected units of the subparts operating at a major source of HAP. Thus, these regulations are not applicable to the station. The following will discuss the key applicable parts of each affected source with its corresponding subpart.

Subpart JJJJJJ

This subpart covers boilers located at an area source of HAPs. The proposed heater is natural gas fired, which is not listed as a subcategory in 40 CFR §63.11200. Thus, this regulation is not applicable to the process heater.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The Bradshaw Station will only have the potential to emit of 10.79 tons per year of HAPs. Therefore, no information about the toxicity of these HAPs is presented in this evaluation.

AIR QUALITY IMPACT ANALYSIS

The proposed construction is not classified as a major source as defined by 45CSR14, so air quality modeling was not required.

MONITORING OF OPERATIONS

MVP proposed to monitor the different operating modes (i.e. normal, low load, low temperature, etc.) in terms of hours per month. This monitoring will be used to determine actual emissions to show compliance with the annual limits. The turbines and are required to conduct annual compliance testing by regulation. No further monitoring is warranted for this particular facility.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that the Bradshaw Station should meet all applicable requirements of state rules and federal regulations. It is recommended that Mountain Valley Pipeline, LLC be granted a 45CSR13 construction permit for the Bradshaw Compressor Station.

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

3/14/16
Date