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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-3289
Plant ID No.:	051-00157
Applicant:	Williams Ohio Valley Midstream LLC
Facility Name:	Francis Compressor Station
Location:	Near Moundsville, Marshall County
SIC/NAICS Codes:	1389/213112
Application Type:	Construction
Received Date:	December 23, 2015
Engineer Assigned:	Joe Kessler
Fee Amount:	$2,000
Date Received:	December 23, 2015
Complete Date:	January 21, 2016
Due Date:	April 20, 2016
Applicant's Ad Date:	December 29, 2015
Newspaper:	*Moundsville Daily Echo*
UTM's:	526.243 km Easting • 4,413.806 km Northing • Zone 17
Latitude/Longitude:	39.87580/-80.69590
Description:	Construction of a natural gas compressor station at the existing Oak Grove Natural Gas Processing Facility. This facility is considered "one-source" with the Oak Grove Natural Gas Processing Facility (will have the same Facility ID Number 051-00157).

DESCRIPTION OF PROCESS

Williams Ohio Valley Midstream LLC (OVM) is proposing to construct a natural gas compressor station to be located at the inlet of the existing Oak Grove Natural Gas Processing Facility (currently operating under the active Permit Number R13-3070A) near Moundsville, Marshall County, WV. The proposed new compressor station will be considered "one-source" with the Oak Grove Natural Gas Processing Facility. The proposed Francis Compressor Station will consist of one (1) natural gas-fired Caterpillar G3616 4-Stroke Lean Burn (4SLB) 1,380 horsepower (hp) compressor engine and one (1) electric Leroi LRG-DP compressor to provide additional pressure to pull natural gas into the adjacent processing plant. At all times the engine is in operation, a Catalytic Combustion Corporation Model REM-2415F-D-32HB-HFX4 oxidation catalyst shall be used for emissions control (CO - 90%, VOCs - 70%, Formaldehyde - 70%).

SITE INSPECTION

Due to the nature of the source, the writer deemed a site inspection as not necessary. The Oak Grove Natural Gas Processing Facility was last "Part Of Site" inspected by DAQ Compliance/ Enforcement (C/E) Inspector Mr. James Jarrett on May 14, 2015. Based on that inspection, the facility was determined to be "Status 10 - Out of Compliance." It was during this inspection that it was discovered that OVM was combusting ethane at the flare outside the scope of Permit Number R13-3070.

AIR EMISSIONS AND CALCULATION METHODOLOGIES

OVM included in Attachment N of the permit application air emissions calculations for the equipment and processes at the Francis Compressor Station. The following will summarize the calculation methodologies used by OVM to calculate the potential-to-emit (PTE) of the proposed facility.

Compressor Engine

Potential emissions from the Caterpillar G3616 4SLB 1,380 hp compressor engine (22E) was based on post-control emission factors provided by the oxidation catalyst vendor, the engine vendor, and as given in AP-42, Section 3.2 (AP-42 is a database of emission factors maintained by USEPA). Hourly emissions were based on the (as calculated using a fuel heat rating of 8,182 Btu/hp-hr) maximum design heat input (MDHI) of the engines of 11.29 mmBtu/hr and the maximum hp rating. Annual emissions were based on 8,760 hours of operation per year. The following table details the PTE of the compressor engine:

Table 1: Compressor Engine PTE

Pollutant	Emission Factor	Source	Hourly (lb/hr)	Annual (ton/yr)
CO[(1)]	0.29 g/hp-hr (controlled)	Catalyst Vendor	0.89	3.89
NO_X	0.50 g/hp-hr	Engine Vendor	1.52	6.66
$PM_{2.5}/PM_{10}/PM$[(2)]	9.91×10^{-3} lb/mmBtu	AP-42, Table 3.2-2	0.11	0.49
SO_2	5.88×10^{-4} lb/mmBtu	AP-42, Table 3.2-2	0.01	0.03
VOCs[(1)]	0.42 g/hp-hr (controlled)	Catalyst Vendor	1.29	5.64
Total HAPs	Various	AP-42, Table 3.2-2	0.43	1.89
Formaldehyde[(1)]	0.12 g/hp-hr (controlled)	Catalyst Vendor	0.37	1.60

(1) Based on post-control emission factor provided by the oxidation catalyst vendor.
(2) Includes condensables.

Fugitives

Equipment Leaks

OVM based their uncontrolled fugitive process and piping components leak calculations (25E) 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 controlled emissions from various sources (valves and connectors) were based on Table 5-2 and the use of a Leak Detection and Repair (LDAR) protocol that meets the minimum requirement of a 10,000 ppm_v leak definition and monthly monitoring. VOC emissions were based on conservatively estimated light liquid (100% by weight) and gas (28.30% by weight) VOC contents (with a conservative safety factor). Hazardous Air Pollutants (HAPs) were also based on conservatively estimated constituent values. Component counts were based on design estimates.

Maintenance and Emergency Events

OVM also included in their fugitive emission estimate a certain number of scenarios where natural gas is released for emergency or maintenance purposes (24E). Those included were compressor blowdown/startup events (208 events/year) and engine cold starts (208 events/year). Gas released per each event were based on engineering estimates. VOC/HAP by-weight percentages (16,500 lb-VOC/mmscf) of the natural gas was based on actual gas analysis data with a conservative safety factor.

Other Equipment Leaks

OVM estimated new fugitive leaks of natural gas from other potential sources such as leaks from the both compressors' engine rod packing and crankcases (23E). VOC/HAP emissions were based upon emission factors taken from 40 CFR 98, Subpart W and manufacturer's data.

Emissions Summary

Based on the above estimation methodology as submitted in Attachment N of the permit application, the annual PTE of the Francis Compressor Station is given in the following table:

Table 2: Francis Compressor Station (ton/yr) PTE Summary.

Source	CO	NO_x	PM[(1)]	SO_2	VOCs	HAPs
Compressor Engine	3.89	6.66	0.49	0.03	5.64	1.89
Fugitive Emissions	0.00	0.00	0.00	0.00	24.55	0.59
Facility-Wide Totals →	**3.89**	**6.66**	**0.49**	**0.03**	**30.19**	**2.48**

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

The new post-modification facility-wide of the Oak Grove Natural Gas Processing Facility including the Francis Compressor Station is included as Attachment A.

REGULATORY APPLICABILITY

The proposed Francis Compressor Station is subject to the following substantive state and federal air quality rules and regulations: 45CSR13, 40 CFR 60 Subpart JJJJ, and 40 CFR 63, Subpart ZZZZ. Each applicable rule (and those that have questionable non-applicability) and OVM's compliance therewith will be discussed in detail below.

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 proposed construction of the Francis Compressor Station at the existing Oak Grove Natural Gas Processing Facility has a potential to increase emissions at the existing facility in excess of six (6) lbs/hour and ten (10) TPY of a regulated pollutant (see Attachment A) and, therefore, pursuant to §45-13-2.24, the changes are defined as a "modification" under 45CSR13. Pursuant to §45-13-5.1, "[n]o person shall cause, suffer, allow or permit the construction, modification, relocation and operation of any stationary source to be commenced without . . . obtaining a permit to construct." Therefore, OVM is required to obtain a permit under 45CSR13 for the modification of the facility.

As required under §45-13-8.3 ("Notice Level A"), OVM 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 29, 2015 in the *Moundsville Daily Echo* and the affidavit of publication for this legal advertisement was submitted on December 31, 2015.

45CSR14: Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration - (NON APPLICABILITY)

The Francis Compressor Station is being constructed (and will be considered one source with) the Oak Grove Natural Gas Processing Facility. This facility is located in Marshall County, WV. Marshall County is classified as "in attainment" with all National Ambient Air Quality Standards (NAAQS) except for, in certain tax districts, SO_2. The Clay Tax District, where the Moundsville facility is located, is classified as "non-attainment" for SO_2. Therefore, applicability to major New Source Review (NSR) for all pollutants except for SO_2 is determined under 45CSR14.

As the facility is not a "listed source" under §45-14-2.43, the individual major source applicability threshold for all criteria pollutants (with the exception of SO_2) is 250 TPY. As given above in Attachment A, the facility-wide post-modification PTE of the Oak Grove Natural Gas Processing Facility (including the Francis Compressor Station) is less than 250 TPY for all criteria pollutants. Therefore, the facility is not defined as a "major stationary source" under 45CSR14.

It is also important to note that the facility does not contain a "nested" major stationary source - in this case a secondary listed source: "Fossil Fuel Boilers (or combinations thereof) Totaling More than 250 Million Btu/hour Heat Input." All the natural-gas fired heaters would contribute to this 250 mmBtu/hr threshold. However, the aggregate MDHI of all the heaters is 223.36 mmBtu/hr. Therefore, no "nested" source is located at the Oak Grove Natural Gas Processing Facility.

45CSR19: Requirements for Pre-Construction Review, Determination of Emission Offsets for Proposed New or Modified Stationary Sources of Air Pollutants and Emission Trading for Intrasource Pollutants - (NON APPLICABILITY)

The Francis Compressor Station is being constructed (and will be considered one source with) the Oak Grove Natural Gas Processing Facility. Pursuant to §45-19-3.1, 45CSR19 "applies to all major stationary sources and major modifications to major stationary sources proposing to construct anywhere in an area which is designated non-attainment." As noted above, the Oak Grove Natural Gas Processing Facility (including the Francis Compressor Station) is located in Marshall County, WV which is classified as in attainment with all NAAQS; with the exception for SO_2 in the areas defined as the Clay (where the source is located), Washington, and Franklin Tax Districts. Pursuant to §45-14-2.35, the individual major source applicability threshold for all non-attainment pollutants is 100 TPY. As given in Attachment A, the facility-wide post-modification SO_2 PTE of the Oak Grove Natural Gas Processing Facility (including the Francis Compressor Station) is less than 100 TPY. Therefore, the facility is not defined as a "major stationary source" under 45CSR19 and the changes evaluated herein will not trigger the requirements of 45CSR19.

45CSR27: To Prevent and Control the Emissions of Toxic Air Pollutants - (NON APPLICABILITY)

Pursuant to §45-27-3.1, the "owner or operator of a plant that discharges or may discharge a toxic air pollutant into the open air in excess of the amount shown in the Table A [of 45CSR27] shall employ [Best Available Technology] at all chemical processing units emitting the toxic air pollutant." As calculated from Table 1 above, the PTE of formaldehyde generated by the compressor engine is greater than 0.5 TPY - greater than the 1,000 pound per year threshold given in Table A of 45CSR27. However, internal combustion engines do no meet the definition of "chemical processing units" under §45-27-2.4 and, therefore, the proposed engine is not subject to BAT under 45CSR27.

45CSR30: Requirements for Operating Permits

45CSR30 provides for the establishment of a comprehensive air quality permitting system consistent with the requirements of Title V of the Clean Air Act. Oak Grove Natural Gas Processing Facility (including the Francis Compressor Station) meets 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 Oak Grove Natural Gas Processing Facility (including the Francis Compressor Station) is subject to 45CSR30. Changes authorized by the draft permit must also be incorporated into the facility's Title V permit application or operating permit. Commencement date of any operation authorized by this permit shall be determined by the appropriate timing limitations associated with Title V permit revisions per 45CSR30.

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

OVM's proposed Caterpillar G3616 4SLB 1,380 hp compressor engine is defined under 40 CFR 60, Subpart JJJJ as stationary spark-ignition internal combustion engines (SI ICE) and is, pursuant to §60.4230(a)(4)(i), subject to the applicable provisions of the rule. Pursuant to

§60.4233(e): "Owners and operators of stationary SI ICE with a maximum engine power greater than or equal to 75 KW (100 HP) (except gasoline and rich burn engines that use LPG) must comply with the emission standards in Table 1 to this subpart for their stationary SI ICE." Therefore, as the proposed OVM's compressor engine is greater than 100 hp, it must comply with the emission standards under Table 1 for "Non-Emergency SI ICE ≥ 500 hp manufactured after July 1, 2010:" NO_x - 1.0 g/HP-hr, CO - 2.0 g/HP-hr, and VOC - 0.7 g/HP-hr. The emission standards and the proposed compliance therewith of the engines are given in the following table:

Table 3: Caterpillar G3616 Subpart JJJJ Compliance

Pollutant	Standard (g/HP-hr)	Uncontrolled Emissions (g/bhp)(1)	Control Percentage	Controlled Emissions (g/bhp)(1)	JJJJ Compliant?
NO_x	1.0	0.50	0.00%	0.50	Yes
CO	2.0	2.92	90.00%	0.29	Yes
VOC	0.7	1.41	70.21%	0.42	Yes

(1) Based on the Catalytic Combustion Corporation Model REM-2415F-D-32HB-HFX4 oxidation catalyst specification sheet included in the permit application. VOC emissions based on NMNEHC + CH_2O emission factors.

The Caterpillar G3616 is not a "certified" engine under Subpart JJJJ so OVM will have to show compliance with the emission standards pursuant to §60.4243(b)(2)(ii): conducting an initial performance test and thereafter conducting subsequent performance testing every 8,760 hours or 3 years, whichever comes first, to demonstrate compliance. Performance testing requirements are given under §60.4244 of Subpart JJJJ. OVM will additionally have to meet all applicable monitoring, recording, and record-keeping requirements under Subpart JJJJ.

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 (with amendments finalized 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 currently are not regulated at the federal level. Each potentially applicable section of Subpart OOOO is discussed below.

Compressor Engines

Pursuant to §60.5365(c), "[e]ach reciprocating compressor affected facility, which is a single reciprocating compressor located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment" that is constructed after August 23, 2011 is subject to the applicable provisions of Subpart OOOO. As the Francis Compressor Station is located before the point of custody transfer, the compressor engines are applicable to Subpart OOOO. The substantive requirements for the engines are given under §60.5385(a): the engines' "rod packing" must replaced according to the given schedule and the engine must meet applicable MRR given under §60.5410(c), §60.5415(c), and §60.5420(b)(1).

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. As the Francis Compressor Station is located before the point of custody transfer, any pneumatic controllers that meet the above definition will be required to meet the substantive requirement for pneumatic controllers as given under §60.5390.

Leak Detection and Repair Requirements (LDAR)

The substantive requirement for affected facilities at a natural gas processing plant is to meet the applicable LDAR conditions under Subpart VVa. The Oak Grove Natural Gas Processing Facility (which includes the Francis Compressor Station evaluated herein) is a natural gas processing plant that was modified after August 23, 2011. Therefore, LDAR requirements for onshore natural gas processing plants will apply to any applicable equipment at the Francis Compressor Station.

40 CFR 63 Subpart ZZZZ: Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

On June 1, 2013 the DAQ took delegation of the area source provisions of 40 CFR 63, Subpart ZZZZ. As the Francis Compressor Station is defined as an area source of HAPs (see Attachment A), the facility is subject to applicable requirements of Subpart ZZZZ. Pursuant to §63.6590(c):

> An affected source that meets any of the criteria in paragraphs (c)(1) through (7) of this section must meet the requirements of this part by meeting the requirements of 40 CFR part 60 subpart IIII, for compression ignition engines or 40 CFR part 60 subpart JJJJ, for spark ignition engines. No further requirements apply for such engines under this part.

§63.6590(c)(1) specifies that "[a] new or reconstructed stationary RICE located at an area source" is defined as a RICE that shows compliance with the requirements of Subpart ZZZZ by "meeting the requirements of . . . 40 CFR part 60 subpart JJJJ, for spark ignition engines." Pursuant to §63.6590(a)(2)(iii), a "stationary RICE located at an area source of HAP emissions is new if [the applicant] commenced construction of the stationary RICE on or after June 12, 2006." The engine proposed for the Francis Compressor Station is defined as a new stationary RICE (application states manufacture date of engines is after June 12, 2006) and, therefore, will show compliance with Subpart ZZZZ by meeting the requirements of 40 CFR 60, Subpart JJJJ. Compliance with Subpart JJJJ is discussed above.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

This section provides an analysis for those regulated pollutants that may be emitted from the proposed Francis Compressor Station 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_{10} and $PM_{2.5}$), and Sulfur Dioxide (SO_2). 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. The following table lists each HAP with a PTE contribution from the Francis Compressor Station above 0.05 TPY (100 lbs/yr) and the associated 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
Acetaldehyde	VOC	Yes	B2 - Probable Human Carcinogen
Acrolein	VOC	No	Inadequate Data
Formaldehyde	VOC	Yes	B1 - Probable Human Carcinogen
n-Hexane	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 estimated maximum emissions of the modification are less than applicability thresholds that would define the proposed modification as "major" under 45CSR14 and, therefore, no air quality impacts modeling analysis was required. Additionally, based on the nature and location of the proposed source, an air quality impacts modeling analysis was not required under §45-13-7.

MONITORING, COMPLIANCE DEMONSTRATIONS, REPORTING, AND RECORDING OF OPERATIONS

The draft permit contains the following substantive monitoring, compliance demonstration, reporting, and record-keeping requirements (MRR):

- OVM shall be required to meet the following Monitoring, Compliance Demonstration, Recording and Reporting Requirements for the oxidation catalysts:

  a. OVM shall be required to regularly inspect, properly maintain and/or replace catalytic reduction devices and auxiliary air pollution control devices to ensure functional and effective operation of each compressor engine's physical and operational design. OVM shall be required to ensure proper operation, maintenance and performance of catalytic reduction devices and auxiliary air pollution control devices by:

     (1) Maintaining proper operation of the automatic air/fuel ratio controller or automatic feedback controller.

     (2) Following the catalyst manufacturer emissions related operating and maintenance recommendations, or develop, implement, or follow a site-specific maintenance plan.

  b. To demonstrate compliance with section 4.1.3. of the draft permit, OVM shall be required to maintain records of the maintenance performed on each RICE and/or generator; and

  c. To demonstrate compliance with section 4.1.3(c) of the draft permit, OVM shall be required to maintain a copy of the site specific maintenance plan or manufacturer maintenance plan.

- OVM shall be required to meet the following Monitoring, Compliance Demonstration, Recording and Reporting Requirements for the fugitive emissions:

  a. For the purposes of determining compliance with 4.1.4(c) of the draft permit, OVM shall be required to monitor and record the monthly and rolling twelve month records of the number of compressor blowdowns, station shutdown vents, filter maintenance releases, and pigging events at the facility. The information will further include the duration, estimated volume of gas vented, and reason for event;

  b. OVM shall be required to monitor and record other events (not listed under 4.1.4(c) of the draft permit) where a substantive amount of gas is released (i.e., pressure relief trips). The information will further include the duration, estimated volume of gas vented, reason for event, and corrective actions taken; and

  c. OVM shall be required to report all events recorded under 4.2.3(b) of the draft permit to the DAQ in writing as soon as practicable but no later than fifteen (15) days after the event.

PERFORMANCE TESTING OF OPERATIONS

The draft permit contains the following substantive performance testing requirements:

- At such reasonable time(s) as the Secretary may designate, in accordance with the provisions of 3.3 of the draft permit, OVM 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.

- OVM shall be required to, pursuant to the timing and other requirements of 40 CFR 60, Subpart JJJJ, conduct, or have conducted, performance testing on the compressor engines to determine the emission rates of CO, NOx, and VOCs. The testing shall, in addition to meeting all applicable requirements under 40 CFR 60, Subpart JJJJ, be in accordance with 3.3.1. of the draft permit. Results of the this performance testing shall, unless granted in writing a waiver by the Director, be used to determine compliance with the CO, NOx, and VOC emission limits given under 4.1.2(c) of the draft permit.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that compliance with all applicable state and federal air quality regulations will be achieved. Therefore, I recommend to the Director the issuance of a Permit Number R13-3289 to Williams Ohio Valley Midstream LLC for the proposed construction and operation of the Francis Compressor Station located at the existing Oak Grove Natural Gas Processing Facility near Moundsville, Marshall County, WV.

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Joe Kessler, PE
Engineer

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Date