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ENGINEERING EVALUATION/FACT SHEET

B ACKGROUND INFORMATION

Application No.:	R13-3249A
Plant ID No.:	103-00006
Applicant:	Dominion Transmission, Inc. (DTI)
Facility Name:	Hastings Compressor Station
Location:	Pine Gove
NAICS Code:	486210
Application Type:	Modification
Received Date:	November 11, 2015
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	$2,000.00
Fee Deposit Date:	November 13, 2015
Complete Date:	March 9, 2017
Due Date:	June 9, 2017
Applicant Ad Date:	December 2, 2015
Newspaper:	*Wetzel Chronicle*
UTM's:	Easting: 542.78 km Northing: 4,377.20 km Zone: 17
Description:	The application is for the replacement of the two existing reciprocating engines at the Hastings Compressor Station, which is part of the Mockingbird Hill Expansion Project.

PROJECT DESRIPTION

The Hasting Compressor Station currently operates in Wetzel County, West Virginia to provide compression to support the transport of natural gas through interstate pipelines.

The Hasting Compressor Station operates under Title V operating permit number R30-10300006-2011. The operating permit covers emission sources at the Mockingbird Hill Compressor Station, Lewis Wetzel Compressor Station, and Hastings Compressor Station.

Dominion Transmission Inc. (DTI) is currently authorized to operate the following:

Hastings Compressor Station

- Two (2) Cooper GMXE-6 Reciprocating Engines (001-01, 001-02), each rated at 500 bhp;
- One (1) Generac Model QT080 Auxiliary Generator (002-06) rated at 128 bhp;
- One (1) Dehydration Unit Still (004-02) rated at 7.5 MMscf/day;
- One (1) Reboiler (005-06) rated at 0.55 MMBtu/hr;
- One (1) Enclosed Combustion Device (DEHY1) rated at 32.8 Mscf/day;
- One (1) Heater (005-01) rated at 10.0 MMBtu/hr;
- Seven (7) aboveground storage tanks (TK1 – TK7) of various sizes for the storage of fluids; and
- Various fugitive components related to the operation of the equipment proposed at Hastings Compressor Station.

Lewis Wetzel Compressor Station

- One (1) Caterpillar Model 3612 Compressor Engine (001-03) rated at 3,550 bhp and equipped with a Catalytic Converter (CC1);
- One (1) Cummings Model KTA19G Auxiliary Generator (002-05) rated at 530 hp; and
- One (1) Bryan Model RV 450W-FDG Boiler (005-05) rated at 4.5 MMBtu/hr;

Mockingbird Hill Compressor Station

- Three (3) Capstone Microturbines Auxiliary Generators (002-02, 002-03, 002-04), each rated at 80 bhp;
- One (1) Cleaver Brook MTF 700-1250-60 Boiler (005-04) rated at 1.25 MMBtu/hr);
- One (1) Solar Taurus 60 Combustion Turbine (006-02) rated at 8,175 bhp; and
- Three (3) storage tanks of various sizes for the storage of fluids.

DTI seeks the authorization to make the following changes at the Hastings Compressor Station:

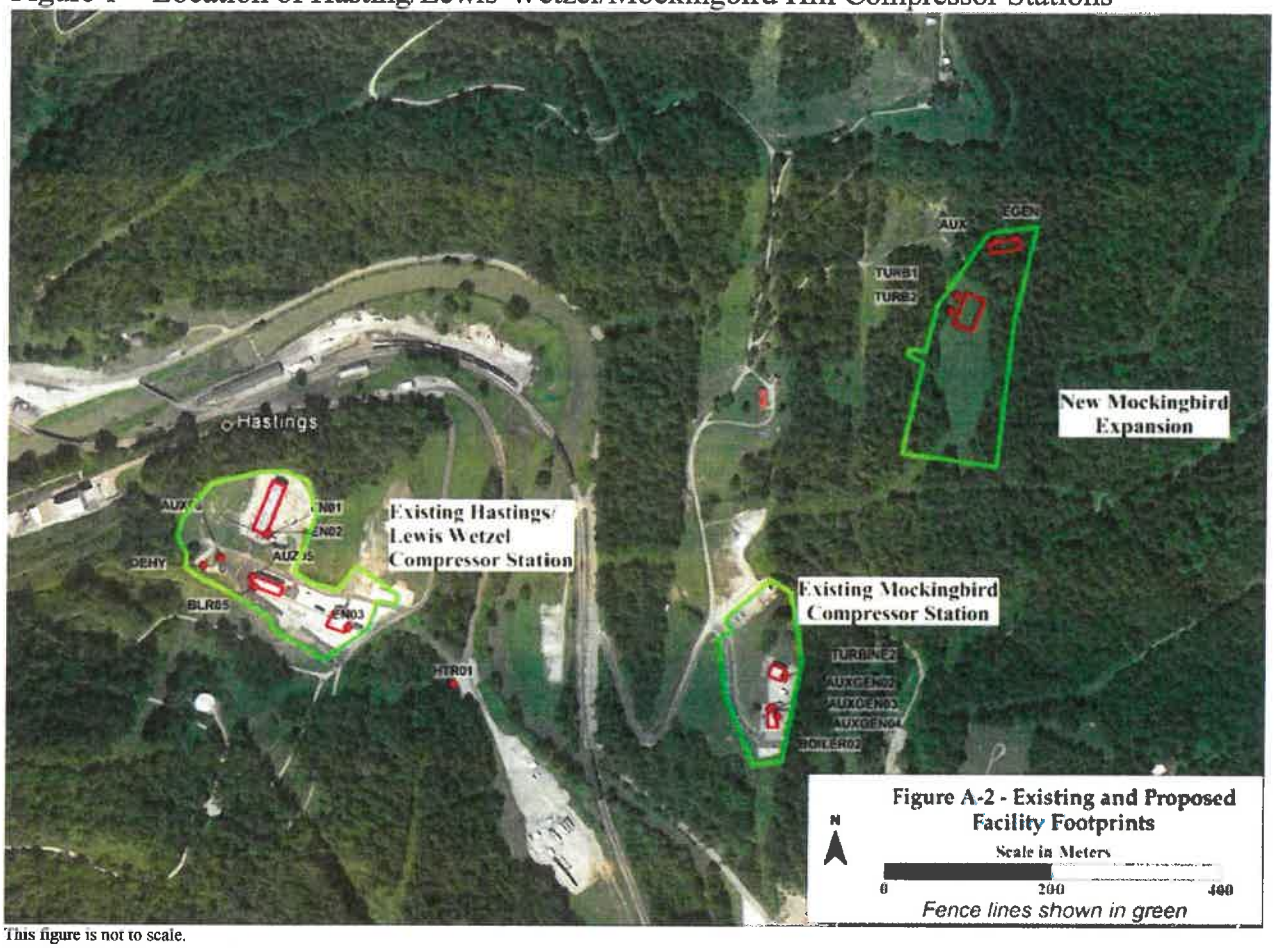
- Removal of the two (2) Cooper GMXE-6 Reciprocating Engines (001-01, 001-02), each rated at 500 bhp;
- Replacement of the above engines by the installation of one (1) Ajax DPC-2803LE Reciprocating Engine (RICE-1) rated at 600 bhp; and one (1) Ajax DPC-2802LE Reciprocating Engine (RICE-2) rated at 384 bhp.

As part of this project, DTI seeks authorization for the construction and operation of the following emission units at the Mockingbird Hill Compressor Station:

- Two (2) Solar Titan 130 Combustion Turbines (CT-1, CT-2) each rated at 20,500 hp (ISO);
- One (1) Caterpillar Auxiliary Generator (EG-1) rated at 1,416 hp;
- One (1) Boiler (WH-1) rated at 7.20 MMBtu/hr;
- One (1) Accumulator Tank (TK-1) with a capacity of 2,500 gallons;
- One (1) Hydrocarbon Waste Tank (TK-2) with a capacity of 1,000 gallons; and

- Various operational natural gas releases associated with station components (FUG-01) and piping fugitive emissions (FUG-02) related to equipment proposed at the Mockingbird Hill Compressor Station.

Figure 1 – Location of Hasting/Lewis-Wetzel/Mockingbird Hill Compressor Stations



This figure is not to scale.

DTI had submitted the proposed changes to the Hasting Compressor Station as part of the Major Modification Permit Application for the Mockingbird Hill Station to comply with the prevention of significant deterioration (PSD) permitting requirements of the 45 CSR 14, which was filed on September 17, 2015. Upon request by the Division of Air Quality (DAQ), DTI filed this modification to incorporate the proposed changes under Permit Application R13-3249A. The Hasting Compressor Station and Mockingbird Hill Compressor Station to include the expansion project are unrelated in terms of operation and inter dependence on each other and in addition these facilities are located at different surface sites separated by a considerable distance of greater than a quarter of mile.

Process Description

The Hasting Compressor Station operates as a field gas production gathering facility. Field gas from the local gathering lines are routed through this compressor station on an as needed basis. The purpose of these compressors is to increase the pressure and send the field gas to the Hasting Extraction Plant for processing. The natural gas that is used to fuel the internal combustion engines EN01, and EN02 is residue gas (processed field gas) from Hastings Extraction Plant.

However, DTI has classified the Hastings Compressor Station in accordance with the Federal Energy Regulatory Communion (FERC) as a transmission facility. The pipeline that the Hastings Compressor Station is connected to and supports connects to a interstate pipeline system that is under common ownership which brings it under the jurisdiction of FERC.

The existing engines are two (2) Cooper GMXE-6 that are rated at 500 brake horsepower (bhp). DTI proposes to replace these engines with one (1) Ajax DPC-2803LE reciprocating engine rated at 542 bhp which is identified as EN04 and one (1) Ajax DPC-2802LE Reciprocating Engine rated at 347 bhp that is identified as EN05.

SITE INSPECTION

On July 13, 2016, the writer conducted a site visit of the proposed site for expansion of the Mockingbird Hill Compressor Station that has been proposed to the DAQ under Permit Application R14-0033, which included visiting the Hastings Compressor Station. Mr. Laurence Labrie and Mr. Joseph Stigall, which represented DTI, accompanied the writer during this visit.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Engines

As part of the Mockingbird Hill Expansion Project, the two existing reciprocating engines (EN01) and (EN02) will be replaced with two new reciprocating engines (EN04 and EN05). The applicant used emission data from GE, the engine manufacturer, for determining carbon monoxide (CO), formaldehyde (H2CO), oxides of nitrogen (NO_x), and volatile organic compounds (VOCs) emissions after the control device (three-way catalyst). The greenhouse gases, which includes carbon dioxide (CO_2), methane, and nitrous oxide (N_2O), were determined using procedures outlined in Subpart C of Part 98. Filterable and condensable particulate matter (PM), filterable PM less than 10 microns (PM_{10}), filterable PM less than 2.5 microns ($PM_{2.5}$), and sulfur dioxide (SO_2) were based on emission factors published in Chapter 3.2 of AP-42.

Presented in the following table are the hourly and annual potential emissions from the two replacement engines:

Table #1 – PTE for EN04 & EN05				
	EN04 – 542 bhp		EN05 – 347 bhp	
Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Hourly (lb/hr)	Annual Emissions (tpy)
PM	0.20	0.88	0.13	0.57
PM_{10}	0.20	0.88	0.13	0.57
$PM_{2.5}$	0.20	0.88	0.13	0.57
NO_x	1.19	5.23	0.77	3.53
CO	2.39	10.47	1.53	6.70
SO_2	0.003	0.01	0.002	0.01
VOCs	0.84	3.66	0.54	2.35
Total HAPs	0.20	0.87	0.13	0.56
H_2CO	0.096	0.42	0.06	0.30
CO_2e	502.03	2,199.98	323.81	1,418.97

Equipment Leaks

Dominion has estimated the potential to emit from equipment leaks for the existing Hastings Compressor Station using API's 2009 Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry. The volume of methane released through leaking components is estimated to be 2.19 million standard cubic feet (MMscf) per year, which makes the total volume of gas lost through leaks to be 2.70 MMscf/yr. The PTE of VOC emissions was estimated as a total for the Hastings Compressor Station to be 13.94 tpy. These fugitive leaks have the potential to release greenhouse gases, which are methane and carbon dioxide. The potential CO_2e from these leaks were estimated to be 1,159.79 tpy.

The fugitive potential from the leaks associated with the compressors is 0.83 tons of VOC per year with 0.03 tons bring classified as HAPs. GHG potential from equipment leaks due to the compressors was estimated to be 69.40 tons of CO_2e per year. The potential emissions from equipment leaks for the existing compressors and new compressor are the same.

Summary of Emission Changes due to the Project

Table #2 – Summary of the Emission Changes				
	PTE of Existing Engines	PTE of New Engines	Net Change	Facility PTE After Change
Pollutant	TPY	TPY	TPY	TPY
PM	1.74	1.49	-0.25	1.87
PM_{10}	1.74	1.49	-0.25	1.87
$PM_{2.5}$	1.74	1.49	-0.25	1.87
NO_x	215.06	8.58	-206.48	13.7
CO	28.03	17.17	-10.86	27.00
SO_2	0.02	0.02	0.00	0.05
VOCs	22.25	6.01	-16.24	27.50
Total HAPs	2.82	1.41	-1.41	2.54
H_2CO	1.98	0.69	-1.29	0.71
CO_2e	4205.69	3618.96	-586.73	10,224.19

REGULATORY APPLICABLILITY

The definition of a "facility" from 45 CSR 14 (State of West Virginia's Prevention of Significant Deterioration Rule) means all of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, are under common control. The property for the surface sites of the Hasting Compressor Station, Lewis-Wetzel Compressor Station, Mockingbird Hill Compressor Station, and Pipeline Heater HTR01 are contiguous and adjacent. These surface sites are all own and operated by Dominion and belong to the same Standard Industrial Classification of 4922.

It should be noted that Lewis-Wetzel and Mockingbird Hill Stations are supporting interstate natural gas pipelines (transmission pipeline), which is under the SIC 4922 - ELECTRIC, GAS AND SANITARY SERVICES, NATURAL GAS TRANSMISSION. Hastings Station is engaged in compressing field gas to be delivered to the Hastings Extraction Plant for processing

.

None of the pollutant-emitting activities at these facilities are stationary sources listed in 45 CSR §14-2.43.a.and 45 CSR 14-2.43.e. Therefore, the potential to emit of a regulated New Source Review pollutant from the collection of these facilities must be 250 tons per year or greater to be classified as a major source. Also, fugitive emissions shall not be included in this determination.

The following table is a summary of potential to emit from the collection of sources.

Table #3 – Summary of PTE from the Compressor Stations and Line Heater at Hastings

Pollutant	Hastings CS (tpy)	Lewis-Wetzel CS (tpy)	Mockingbird Hill CS (tpy)	Line Heater HTR01 (tpy)	Totals PTE of the surface sites (tpy)
PM_{10}	1.78	1.34	12.00	0.33	15.45
$PM_{2.5}$	1.78	1.34	12.00	0.33	15.45
PM	1.78	1.34	12.00	0.33	15.45
SO_2	0.02	0.08	0.99	0.03	1.12
CO	34.15	68.09	28.84	3.68	134.76
NO_x	215.77	19.60	24.71	4.38	264.46
VOC	29.53	13.18	8.23	0.24	51.18

NOx and VOC are precursors to ozone.

Based on the summary of PTE of the collection of sources, this collection of sources is major source under 45 CSR 14 because the collection of sources has a potential to emit NOx emissions of 250 tpy or greater.

The project or proposed change in this application must next pose a significant increase of an NSR pollutant to determine if a major modification of a major source permit is required.

The PTE of the two new engines are compared to the significance threshold values outlined in 45 CSR 14-2.74.a. to determine if this engine replacement project is significant or not, which is outlined in the following table.

Table #4 – Summary of PTE for the Ajax Engines towards the PSD Significance Threshold					
Pollutant	**EN04 (tpy)**	**EN05 (tpy)**	**Total (tpy)**	**Significance Valve(tpy)**	**New Engines are significant**
PM_{10}	0.88	0.57	1.45	15	No
$PM_{2.5}$	0.88	0.57	1.45	10	No
PM	0.88	0.57	1.45	25	No
SO_2	0.01	0.01	0.02	40	No
CO	10.47	6.70	17.17	100	No
NO_x	5.23	3.53	8.76	40	No
VOC	3.66	2.35	6.01	40	No

The engine/compressor replacement project at the Hastings Compressor Station as proposed in the submittal classified as a modification under 45CSR13, and an Area Source for Hazardous Air Pollutants (HAPs). The applicant demonstrated that the proposed station does not have the potential to emit at or over 250 tpy of any criteria pollutants and less than 25 tpy of total HAPs with no single HAP being of more than 10 tpy.

NSPS

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

The new engines with associated compressors are new affected units under Subpart JJJJ (engines) and OOOOa for the compressors.

Subpart JJJJ—Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

EN04 and EN05 will be engines manufactured after July 1, 2008. Both engines are spark ignition, 2-stoke lean burn, internal combustion engines. Thus, these two engines are affected sources under Subpart JJJJ. EN04 is rated for 542 bhp, which is greater than 500. EN05 is rated for 347 bhp, which is greater than 100 bhp and less than 500 bhp. Thus, both engines are subject to the emission standards through 40 CFR §4233(e), which refers to Table 1 to Subpart JJJJ.

The following table is a summary of the applicable emission standards for EN04 and EN05 from Table 1 to Subpart JJJJ.

Table 5 Summary of Emission Standards for Engine EN04 and EN05								
Engine No.	Engine Power Rating (bhp)	Engine Type	NOx	CO	VOC	NOx	CO	VOC
			g/hp-hr			ppmdv at 15% O2		
EN04	542	Non-EG, LB	1.0	2.0	0.7	82	270	60
EN05	347	Non-EG, LB	1.0	2.0	0.7	82	270	60

Dominion has proposed to install two non-certified engines. To meet the emission standards in the above table (table 1), these two, 2-stroke, lean burn engines will be using an oxidation catalyst to reduce CO and VOC emissions down to or below the emission standard. The engine manufacturer, (Ajax), believes that their 2-stroke, lean burn engine design will not require the use of any add-on control device to achieve the NOx standard from Subpart JJJJ.

Both engines will be required to undergo an initial performance test to demonstrate compliance to the standard within one hundred days after initial start-up. EN04 has a power output rating of greater than 500 bhp. Therefore, Subpart JJJJ requires non-certified engines with a power rating of 500 bhp or greater to undergo subsequent performance testing every 8,760 hours of operation or once every three years after the initial test, whichever is sooner.

The subpart requires the permittee to keep a maintenance plan for both engines to include associated control device(s).

Subpart OOOOa—Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced After September 18, 2015

The Ajax engines (EN04 & EN05) are used to drive reciprocating compressors at a station that is part of a field gas gathering system. Subpart OOOOa (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 Hastings Compressor Station is downstream from the well heads and upstream of a natural gas processing plant. Therefore, the proposed natural gas compressors are affected sources under Subpart OOOOa.

The project does not meet the criteria of an affect source as a "collection of fugitive components at a compressor station" as defined in 40 CFR §60.5365a(j)(1) or (2). The compressors for this project are replacing two compressors that are driven by two Copper GMCE-6 engines rated at 500 bhp each, which make the total power available for compression at

1,000 bhp. The Ajax DPC-2802 LE is rated at 347 bhp and the Ajax DPC-2803 LE is rated at 542 bhp. The combined total power available for compression is at 889 bhp. Thus, the net change in available power is a decrease (-) of 111 bhp. Therefore, the requirements of 40 CFR §60.5397a does not apply to the Hastings Compressor Station as a result of this project.

Since the compressors were manufactured after September 18, 2015, the new compressors are required to meet the Greenhouse Gas (GHG) and VOC emissions by replacing the rod packing in the reciprocating compressor every 26,000 hours of operation or once every 36 months. No other sections of this regulation are applicable to the proposed project.

Subpart ZZZZ—National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

This federal regulation has major source of HAP provisions and an area source of HAP provisions. Under the definition of *Major Source* in 40 CFR 63.6675, HAP emissions from any pipeline compressor station shall not be aggregated with emissions from similar units. For this determination, HAP emissions from Lewis-Wetzel and Mockingbird Hill shall not be aggregated with the Hastings Compressor Station sources for this major source of HAPs applicability determination. Also, HAP emissions from storage vessels that have the potential to release flash emissions from process fluids (produced water and/or natural gas condensate) shall be included.

TK07 at the Hastings Compressor Station is a 1,000 gallon above ground storage vessel that stores collected liquids from gas filters and separates within the facility. However, the amount of liquids collected/produced at the station is less than 500 gallons per year. DTI actual records of the amount of liquids off load from TK07 was 500 gallons, which was on May 6, 2014. Based on 40 CFR §63.6675, TK07 is not classified as a "storage vessel with the potential for flash emissions" because the throughput of liquids through TK07 is less than 79,500 liters per day (20,000 gallons per day). Thus, HAP emissions from TK07are not to be aggregated for major source applicability of the Hastings Compressor Station for Subpart ZZZZ.

Before the project, the Hastings Station is classified as an area source of HAPs with a potential of 3.4 tpy of total HAPs, which less is than 25 tpy of combined HAPs and no greater than 10 tons of a single HAP. After the engine/compressor replacement, the station will have a potential of 2.54 tpy of total HAPs.

40 CFR 63.6590(c) notes that engines subject to Subpart JJJJ to Part 60 that are located at an area source of HAPs that complies with the requirements of Subpart JJJJ have no further requirements of Subpart ZZZZ apply to such engines.

There are no other area-source subparts under Part 63 that are applicable to the replacement of the engines or compressors at this facility. Under 45 CSR 30, the station will remain classified as a major source subject to the permitting requirements of Title V of the Clean Air Act. This means that the facility must incorporate the proposed changes to the facility into their Title V Operating Permit.

The proposed modification has the potential to emit of 6 pounds per hour and 10 tons per year of a criteria pollutant (CO and VOCs) before an add-on control device. To make the oxidation catalysts practically enforceable, Dominion submitted a complete application, paid the required filing fees, and published a class I legal ad in the *Wetzel Chronicle* on December 2, 2015. Therefore, the facility is required to obtain a modification permit under 45 CSR 13.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

Many non-criteria regulated pollutants fall under the definition of HAPs which, with some revision since, were 187 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 HAPs are routinely emitted from combustion units: Benzene, Ethylbenzene, Formaldehyde, Toluene, and Xylene. The following table lists each HAP's carcinogenic risk (as based on analysis provided in the Integrated Risk Information System [IRIS]):

Table #6 - Classification of the HAPs

HAP	Type	Known/Suspected Carcinogen	Classification
Formaldehyde	VOC	Yes	Category B1 - Probable Human Carcinogen
Benzene	VOC	Yes	Category A - Known Human Carcinogen
Ethylene benzene	VOC	No	Inadequate Data
Toluene	VOC	No	Inadequate Data
Xylenes	VOC	No	Inadequate Data

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

The proposed modification is not classified as a major modification of major source as defined by 45CSR14, so air quality modeling was not required for this particular application. However, Dominion's proposed expansion of the Mockingbird Hill Compressor Station filed under Permit Application R14-0033 does trigger a major modification of major source permit.

MONITORING OF OPERATIONS

Monitoring of the proposed engines/compressors should be focused on hours of operation and maintaining the proposed oxidation catalysts. Tracking hours of operation through the hour-meter should be adequate for the engines/compressor. Subpart JJJJ requires engine EN04 be tested every 8,760 hours of operation or once every three years, whichever is sooner. As part of this testing, it is required to measure the inlet temperature at the inlet to the control device and the pressure drop across the element during the testing for establishing a baseline for these parameters that is linked to a compliance demonstration.

Subpart OOOOa requires the rod packing to be replaced in both compressors once every 26,000 hours of operation or every 36 months. Thus, the non-resettable hour meter on the engine can be used to track the operation of the compressor as well.

The key for the engines to maintain compliance with the permitted emissions limits is to properly maintain catalyst elements. The manufacturer, Ajax, recommended that the catalyst element not be inserted until the engine burn-in period has been completed to prevent engine oil from damaging the catalyst element, which is during the initial first 200 hours of operation of the engine. This writer recommends to allow the permittee to complete the engine burn-in period not to exceed the first 200 hours of engine operation without the catalyst element bring installed.

Ajax prescribed monitoring the exhaust temperature at the inlet of the catalyst to be between 450 and 900^{0}F to ensure activation of the catalytic reaction and pressure drop across the element not to exceed 2 inches of water column above the measured pressure drop of the catalyst at initial start-up with the engine operating at or near full load conditions to ensure the element is not plugged and needs cleaned or replaced. Ajax provides software to determine the engine loading from inputting engine operating conditions. These recommendations are outlined in Ajax' Technical Information Bulletin #061013 Dated May 2013.

CHANGES TO PERMIT R13-3249B

Other than incorporating the requirements for the new engines with associated compressors, the changes to Permit R13-3249B is limited to updating the general conditions and creating separate sections for certain emission units. The new engines with associated compressors were inserted into Section 5.0. The dehydration unit with enclosed combustion unit were left in Section 4.0. The specific conditions for the existing emergency generator were relocated into Section 6.0.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that the Hastings Compressor Station should meet applicable requirements of state rules and federal regulations. It is recommended that Dominion Transmission Inc. be granted a 45CSR13 modification permit for the proposed engine replacement project at the Hastings Compressor Station near Pine Grove, West Virginia.

Edward S. Andrews, P.E.
Engineer

May 1, 2017
Date