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west virginia department of environmental protection

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## ENGINEERING EVALUATION/FACT SHEET

### B BACKGROUND INFORMATION

Application No.:	R13-2834C
Plant ID No.:	051-00131
Applicant:	Dominion Transmission, Inc.
Facility Name:	Burch Ridge Compressor Station
Location:	Proctor
NAICS Code:	486210
Application Type:	Modification
Received Date:	June 2, 2014
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	\$2,000.00
Fee Deposit Date:	July 22, 2014
Complete Date:	September 30, 2014
Due Date:	December 29, 2014
Applicant Ad Date:	June 19, 2014
Newspaper:	<i>Moundsville Daily Echo</i>
UTM's:	Easting: 518.6 km      Northing: 4,399.9 km      Zone: 17
Description:	The application is for the installation of one new combustion turbine to compress natural gas from transmission.

### Process Description

The Burch Ridge Station is a transmission compressor station that services a natural gas pipeline system. The station receives natural gas via pipeline from an upstream compressor station, and compresses it using a combustion turbine. This project consists of adding one additional combustion turbine/compressor to increase the transmission capacity of this station. Currently the station operates one simple cycle, combustion turbine for compression. This existing turbine is a Solar Centaur 50 turbine which was installed in 2011. The station is only a transmission station with no other gas processing capabilities (i.e. dehydration unit). The pipeline that this particular station supports can be reserved thus transmitting the gas to a different end point in the pipeline system.

Auxiliary equipment at the station consists of a 530 bhp natural gas-fired emergency power generator (installed in 2011) and a 4.0 MMBtu/hr boiler.

Dominion Transmission proposes to increase the compression capacity of the station by installing one new centrifugal compressor that is driven by a combustion turbine. The proposed turbine is a Solar Centaur 50 with a heat input rating of 58 MMBtu/hr with a nominal power output 6,400 hp.

## SITE INSPECTION

A full on-site inspection was last performed by the WVDAQ on December 11, 2013. On that date the facility was found to be “in compliance” with all applicable rules and regulations, which includes Permit R13-2834. This action only proposes the installation of new turbine that is scheduled for 2015.

On October 7, 2014, the writer conducted a site inspection of the facility. Mr. Derek Hughes, Manager of Operations for Dominion, and Mr. Nicholas Chaplin, Supervisor of Gas Transmission Operations for Dominion, was present during this visit. The visit included a tour of the facility which pointed out the emission units covered by Permit R13-2834B. The facility was laid out as listed in the application. Mr. Hughes showed the writer how the operating hours for the turbine are recorded electronically, which include SoLoNO<sub>x</sub> mode and non-SoLoNO<sub>x</sub> modes. The writer verified the label on the engine for the generator set, which notes this particular engine has been certified to meet Part 60 Emission Standards. There were no signs of pre-construction activities for the additional turbine. The writer found the site to be in order and appropriate for this type of emission source.

## ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

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 turbine and existing one can vary significantly between these different operating modes. Solar refers to these modes as non-SoLoNO<sub>x</sub> modes except for normal operation, which is referred to as SoLoNO<sub>x</sub> Mode.

*Normal Operation:* At loads above 50% with ambient temperatures above zero degrees Fahrenheit. The Solar’s SoLoNO<sub>x</sub>, which is Solar’s gas turbine dry low NO<sub>x</sub> emission combustion system, combustion system works very well to minimize emissions generated from the combustion turbine. Typically, the system can maintain NO<sub>x</sub> 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%.

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*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, Dominion used 2 complete events per week to determine the annual potential to emit for the turbine.

*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 NO<sub>x</sub>, CO, and UHC emissions in PIL 167 Revision 4. For annual estimation purposes, Dominion used 12 hours per year.

*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 NO<sub>x</sub> CO and UHC emissions in PIL 167 Revision 4 for customers to estimate emissions during non-SoLoNO<sub>x</sub> modes, which includes conditions below zero. For annual estimation purposes, Dominion used 240 hours per year.

*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 NO<sub>x</sub>, CO, and UHC at these extreme conditions. For annual estimation purpose, Dominion used 16 hours per year.

The applicant deducted these non-SoLoNO<sub>x</sub> hours from the maximum possible of 8,760 hours per year, which turns out to be 299.2 non-SoLoNO<sub>x</sub> hours and 8,460.8 hours of SoLoNO<sub>x</sub> hours. Dominion used a NO<sub>x</sub> and CO outlet concentration of 25 ppm for these two pollutants for SoLoNO<sub>x</sub>. For VOCs, Dominion used Solar's data of 25 ppm and used the recommendations in PIL 168 that suggests only 20% of this concentration would be VOCs. This is a conservative estimate. The ratio of non-methane hydrocarbons to total hydrocarbons range from 10 to 20% in pipeline quality natural gas. Typically, pipeline quality natural gas consists of mainly methane (<70%), ethane, and carbon dioxide which are excluded as a VOC per 40 CFR §51.100. So, even the 10% ratio would be double of actual hydrocarbons in natural gas that are classified as VOCs per the Clean Air Act. The use of the 20% ratio of UHC to estimate VOC emissions from the turbine is appropriate.

The other pollutants such as sulfur dioxide, particulate matter and formaldehyde emitted from the turbine are not increased when operated in non-SoLoNO<sub>x</sub> mode. Thus, Dominion used Solar's PIL 168 and 171 to estimate these pollutants accordingly.

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

Table #1 Emissions from the Additional Turbine				
Pollutant\Sources	Turbine #2 SoLoNO <sub>x</sub> Mode		Turbine #2 Worst Case Non-SoLoNO <sub>x</sub> Mode	Annual Emission <sup>1</sup>
	lb/hr	tpy	lb/hr	tpy
Oxides of Nitrogen (NO <sub>x</sub> )	5.37	23.53	25.78 <sup>3</sup>	26.14
Carbon Monoxide (CO)	3.20	14.02	1,045.66 <sup>3</sup>	34.19
Volatile Organic Compounds (VOCs)	0.37	1.60	11.98 <sup>3</sup>	6.09 <sup>2</sup>
Particulate Matter (PM)/ PM less than 10 microns (PM <sub>10</sub> )/ PM less than 2.5 microns (PM <sub>2.5</sub> )	0.87	0.87	N/A	3.83
Sulfur Dioxide (SO <sub>2</sub> )	0.20	0.87	N/A	0.87
Carbon Dioxide Equivalence (CO <sub>2e</sub> )	6,829.2	29,911.7	N/A	35,679 <sup>2</sup>
Total Hazardous Air Pollutants (HAPs)	0.10	0.45	N/A	0.62 <sup>2</sup>

\* Hourly Emissions for the Turbines are based on normal operating conditions; Annual Emissions includes operations less than normal (i.e. low load, low temperature, startup/shutdown cycles, etc.)

1 – Annual Emission includes the emissions from the non-SoLoNO<sub>x</sub> modes and SoLoNO<sub>x</sub> mode.

2- Includes fugitives from the new compressor VOCs – 4.25 tpy, CO<sub>2e</sub> – 5,621 tpy, HAPs – 0.17 tpy.

3 – The worst case mode is Extreme Below Zero Operations.

Dominion adjusted the annual potential emissions of NO<sub>x</sub>, CO, and VOCs for the existing Centaur 50 turbine at the facility operating in the non-SoLoNO<sub>x</sub> modes. The adjustments in these pollutants are illustrated in the following table.

Table #2 Changes in Potential with the adjustments for Non-SoLoNO <sub>x</sub> Operations for Turbine #1				
Pollutant	Existing Potential (tpy)	Non-SoLoNO <sub>x</sub> Modes (tpy)	Adjust Potential (tpy)	Net Change
NO <sub>x</sub>	23.03	2.63	25.67	2.63
CO	28.04	19.69	47.72	19.69
VOCs	8.02*	0.25	1.85	- 6.17

\* - Original potential was based on the assumption 100% of UHC was VOCs.

The facility potential after the expansion project is illustrated in the following table.

Table #3 Burch Ridge New Potential after the Expansion		
Pollutant	Annual Emissions (tpy)	Major Source Trigger Levels for Title V (tpy)
Oxides of Nitrogen (NO <sub>x</sub> )	53.89	100
Carbon Monoxide (CO)	83.74	100
Volatile Organic Compounds (VOCs)	13.56*	100
Particulate Matter (PM)/ PM less than 10 microns (PM <sub>10</sub> )/ PM less than 2.5 microns (PM <sub>2.5</sub> )	7.80	100
Sulfur Dioxide (SO <sub>2</sub> )	1.75	100
Carbon Dioxide Equivalence (CO <sub>2</sub> e)	76,249.43	100,000
Total Hazardous Air Pollutants (HAPs)	1.72	10 of any single HAP/25 Total HAPs

\* VOC potential for the facility includes fugitives for compressors and other piping components

### REGULATORY APPLICABILITY

The Burch Ridge Station as configured at the time of submittal of this application is classified as a non-major source (minor source) under Prevention of Significant Deterioration (PSD) and as an Area Source for Hazardous Air Pollutants. For this particular facility (natural gas compressor station), the PSD major source threshold is having the potential to emit 250 tons per year or greater of any criteria pollutant. As a result of this proposed change, the facility will only have the potential to emit 84 tons per year of CO, which is the most of any of the criteria pollutants emitted by the facility. Thus, the proposed turbine expansion project does not make the facility a major source.

Since the potential of any of the criteria pollutants is less than 100 tpy and is less than 100,000 tpy of CO<sub>2</sub>e, this project does not affect the facility's status as a non-major source subject to Title V as a deferred source. The facility falls under the Title V program (45 CSR 30) since the existing turbine is an affected source that is subject to a subpart under Part 60 (Deferred Title V Source). This means that the station is not required at this time to obtain an operating permit but has to submit annual certified emissions statements with corresponding fees.

There are no state rules that are applicable to the new turbine other than to obtain a permit under 45 CSR 13, of which Dominion has satisfied the applicable requirements under 45 CSR13. The remainder of the discussion in this section will focus on applicable federal regulations.

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## NSPS

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

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 Burch Ridge Compressor is downstream of the custody transfer point of Dominion's transmission system. Therefore, the proposed compressor is not an affected source and not subject to the performance standards of Subpart OOOO.

### *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 Solar Centaur 50 turbine is rated at 52.5 MMBtu/hr (at 0<sup>0</sup> F). Therefore, the proposed turbine is affected source 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<sub>x</sub> and SO<sub>2</sub>. These turbines would be limited to 0.060lb of SO<sub>2</sub> 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<sub>x</sub> 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<sub>x</sub> standard of 25 ppm at 15 percent oxygen (O<sub>2</sub>) content or 150 nana gram /Joule of useful output. The selected turbines are equipped with a dry low NO<sub>x</sub> emission combustion system, known as SoLoNO<sub>x</sub><sup>™</sup>, which has been developed to provide the lowest emissions possible during normal operating conditions. Solar Taurus (manufacturer) predicts that the NO<sub>x</sub> emissions with the SoLoNO<sub>x</sub><sup>™</sup> combustion controls from the turbine to be 15 ppm when the ambient temperatures are at or above 0<sup>0</sup> F.

Dominion currently operates an identical model Centaur 50 turbine at the station from which the NO<sub>x</sub> emissions have been measured at 13.8 ppm corrected to 15% O<sub>2</sub> on October 10, 2012 and 14.9 ppm corrected to 15% O<sub>2</sub> on September 24, 2014.

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There are alternative standards for units operating at less than 75 percent of peak load or when operating temperatures are less than 0° F. The alternative limit of 150 ppm at 15% O<sub>2</sub> is listed Table 1 to Subpart KKKK. The manufacturer predicts that the NO<sub>x</sub> rate for the proposed turbines would increase up to 120 ppm for subzero operations. For low load operations, the manufacturer predicts that the NO<sub>x</sub> concentrations to increase slightly to 70 ppm for loads at or less than 50% of peak output and 50 ppm at idle conditions. The propose turbines are capable of meeting the NO<sub>x</sub> 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 monitoring system. Sources can conduct testing every year and reduce the subsequent testing to every two years if the NO<sub>x</sub> results are at or less than 75% of the standard, which equates to 15 ppm for this turbine. The applicant has elected to use the testing option at this time. The permit will be structured on the 25 ppm for the short term limit with initial testing and annual testing unless the results are less than 18.75 ppm corrected to 15% O<sub>2</sub> then Dominion can test the turbine once 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 reports in accordance with 40 CFR §60.7(c).

#### TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The new emission units will not emit any pollutants that are not already being emitted by another emission source at the facility. As a result of this expansion project, the potential to emit of total hazardous air pollutants is less than 2 tons per year. Therefore, no information about the toxicity of the HAPs is presented in this evaluation.

#### AIR QUALITY IMPACT ANALYSIS

Based on the annual emission rates, the proposed modification is not classified as a major source as defined by 45CSR14, so air quality modeling was not required.

#### MONITORING OF OPERATIONS

Dominion proposed to monitor the different operating modes (i.e. normal, low load, below zero, extreme below zero, startup/shut downs) in terms of hours or cycles per month for the turbine. This monitoring will be used to determine actual emissions to show compliance with the annual limits. This approach will be used for both turbines. The applicable rules and regulations require tracking hours of operation for the engine for the generator set through the hour-meter. The boiler will be restricted to fuel type and heat input which will correspond through fuel monitoring.

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## CHANGES TO PERMIT R13-2834B

Permit R13-2834B established three separate sections one for each of the emission units (turbine, boiler, and emergency generator). The proposed draft consolidates the sections into 3 specific conditions with one for each type of emission source. Only truly applicable requirements of the monitoring, testing, recordkeeping, and reporting for each of the type of emission sources are carried over in the draft. The current permit has numerous requirements that are duplications or the requirement is not truly applicable due to the type of fuel used by the emission source or size of the emission source.

The current permit did not address any non-SoLoNO<sub>x</sub> operation. The current permit focus on mass rate short term limits and fuel usage. Turbine emissions are dependent on the actual operating mode than the actual fuel usage. Thus, the writer recommends setting a short concentration limit for NO<sub>x</sub> based on the NSPS standard and setting annual limits for NO<sub>x</sub>, CO, and VOC. Compliance with the short term concentration is to be conducted using stack testing in accordance with the NSPS Subpart KKKK procedures with the annual compliance which would be conducted monthly by calculating the emissions based on length of time per operating mode using the best available data.

The current permit included both types of Subpart KKKK limits, which are concentration for NO<sub>x</sub> and heat input for SO<sub>2</sub> based, which is appropriate for this type of turbine, and gross output based in terms of megawatts of electricity for NO<sub>x</sub> and SO<sub>2</sub>, which would be ideal for turbine/generator configurations. The proposed draft omitted the output based limits because the terms of these limits are not appropriate for this type of turbine configuration (turbine /compressor). For the SO<sub>2</sub> standard for the Subpart KKKK, the draft permit specifically requires the tariff limit on sulfur content of 20 grains per 100 cubic feet of natural gas, which the facility currently uses as a means of complying with the SO<sub>2</sub> standard. Under Subpart KKKK, sources having a tariff limit less than 20 grains of sulfur per 100 cubic of natural gas are excluded from the sulfur monitoring in 40 CFR §60.4370. Thus, making the source maintain a tariff or other legal means (transportation contract) allow the agency the ability to omit the monitoring requirement from the permit.

The existing engine for the generator set has been certified by the engine manufacturer to meet the emission standards of Subpart JJJJ to Part 60. Under Subpart JJJJ, one of the compliance options for sources is to purchase a certified engine. The existing permit included all of the applicable requirements regardless of selected compliance operation. The proposed draft streamlines these requirements to focus on sources purchasing a certified engine and operating the engine in accordance with the manufacturer's written emission related instructions as intended in the subpart. This streamlining included omitting testing language that is applicable to non-certified emergency engine. This proposed monitoring for the engine is to focus on the hours operated and the purpose of that operation (i.e. emergency situation, non-emergency situation).

The conditions for the existing boiler were streamlined with the fuel restriction by type and monitoring fuel usage. This particular boiler burns only natural gas, which has been noted to

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generate little to no visible emissions. Given the design heat input size and fuel type, the boiler is not subject to Sections 4, 5, 6, 8, and 9 of 45 CSR 2 according to 45 CSR §2-11.1 and 45 CSR §§2A-3.1. excludes the unit from PM testing and visible emission monitoring plan requirements. Thus, the draft permit will use the fuel restriction on the boiler as a means for complying with the visible emission standard and therefore the visible emission monitoring requirements of the existing permit are omitted.

#### RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that the expansion project for the Burch Ridge 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 modification to Burch Ridge Compressor Station.

Edward S. Andrews, P.E.  
Engineer

October 31, 2014  
Date

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