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ENGINEERING EVALUATION/FACT SHEET

B BACKGROUND INFORMATION

Application No.:	R13-1077A
Plant ID No.:	017-00003
Applicant:	Dominion Transmission, Inc. (DTI)
Facility Name:	L.L. Tonkin Compressor Station
Location:	Proctor
NAICS Code:	486210
Application Type:	Modification
Received Date:	October 22, 2014
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	\$4,500.00
Fee Deposit Date:	October 24, 2014
Complete Date:	November 6, 2014
Due Date:	February 4, 2015
Applicant Ad Date:	October 28, 2014
Newspaper:	<i>The Herald Record</i>
UTM's:	Easting: 518.6 km Northing: 4,351.2 km Zone: 17
Description:	The application is for the installation of two new combustion turbines to compress natural gas for transmission and upgrade the combustion controller on the existing turbine to expand the transmission capacity of the compressor station.

Process Description

The L.L. Tonkin Compressor Station is located off Route 18 in Doddridge County, WV. The station will be upgraded to increase the natural gas throughput of the existing downstream mainline by boosting the pressure of the natural gas up to the current maximum allowable operating pressure (MAOP) of 1,200 pounds per square inch gauge (psig) to move gas south to Cornwell Station. DTI is proposing to upgrade the L.L. Tonkin Compressor Station with the addition of two new combustion turbines and upgrade to the existing station for bidirectional flow on the 33.55 acre parcel site that is owned by DTI. Associated equipment includes an addition to the compressor building, a new office building, coolers, and station piping.

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This project consists of adding two additional combustion turbine/compressors to increase the transmission capacity of this station and upgrading the existing turbine with SoLoNO_x combustion controller, adding a new boiler and emergency generator. Currently the station operates one simple cycle, combustion turbine for gas compression. This existing turbine is a Solar T-4500 turbine which was installed in 1989 and covered under Permit R13-1077. The station is only a transmission station with no other gas processing capabilities (i.e. dehydration unit).

Auxiliary equipment at the station consists of a 169 hp natural gas-fired emergency power generator (installed in 1989), three small aboveground storage vessels (at or less than 3,000 gallons each) and a 0.52 MMBtu/hr boiler. The application notes there are no changes planned for this existing source as part of this expansion project.

Dominion Transmission proposes to increase the compression capacity of the station by installing two new centrifugal compressors that are driven by combustion turbines. The proposed turbine is a Solar Centaur 50 with a heat input rating of 58 MMBtu/hr with a nominal power output of 6,000 hp.

As part of this expansion project, Dominion proposed to add another emergency generator and boiler to the station. The generator set will include a 600 bhp spark-ignition engine that is manufactured by Caterpillar. Dominion plans on operating this generator set only in the loss of electric service from local utility operator.

SITE INSPECTION

A full on-site inspection was last performed by the WVDAQ on January 30, 2013 by Mr. Douglass Hammell, Compliance and Enforcement Inspector. On that date the facility was found to be “in compliance” with all applicable rules and regulations, which includes Permit R13-1077. This action proposes the installation of new turbines, upgrading the existing turbine with SoLoNO_x and auxiliary equipment in for 2016.

On December 17, 2014, the writer while accompanied by Mr. Gene Coccari of the Small Business Assistance Group conducted a site inspection of the station. Mr. William Morrison, Dominion’s Environmental Compliance Coordinator, and the operational personnel assigned to the station were present during the visit. Only the emission units as noted in the facility’s Title V Operation Permit were at the station. There were no signs that commencement of construction has already taken place other than the actual pipeline segment has been changed, which is outside of the facility (downstream of the fire gates for the station). There were no issues about the facility noted during the visit.

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ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

The applicant classified the operation of the turbines 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_x modes except for normal operation, which is referred to as SoLoNO_x Mode.

Normal Operation: At loads above 50% 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, 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%.

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 100 complete events per year 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_x, CO, and UHC emissions in PIL 167 Revision 4. For annual estimation purposes, Dominion used 50 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_x CO and UHC emissions in PIL 167 Revision 4 for customers to estimate emissions during non-SoLoNO_x modes, which includes conditions below zero. For annual estimation purposes, Dominion used 20 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_x, CO, and UHC at these extreme conditions. For annual estimation purpose, DTI did not include an hours of operation during this condition.

The applicant deducted these non-SoLoNO_x hours from the maximum possible of 8,760 hours per year, which turns out to be 299.2 non-SoLoNO_x hours and 8,460.8 hours of SoLoNO_x hours. Dominion used a NO_x and CO outlet concentration of 25 ppm for these two pollutants for

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SoLoNO_x. 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 that 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_x 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.

Pollutant/Sources	One Centaur 50 Turbine in SoLoNO _x Mode ⁵		One Centaur 50 Turbine Worst Case Non-SoLoNO _x Mode	Annual Emission ¹ for One Centaur 50 Turbine	Annual Emission ¹ for Two Centaur Turbines
	lb/hr	tpy	lb/hr	tpy	tpy
Oxides of Nitrogen (NO _x)	3.21	14.04	26.34 ³	14.43	29.16
Carbon Monoxide (CO)	3.25	14.25	680.00 ³	36.50	73.00
Volatile Organic Compounds (VOCs)	0.37	1.60	7.80 ³	6.12 ²	12.24
Particulate Matter (PM)/ PM less than 10 microns (PM ₁₀)/ PM less than 2.5 microns (PM _{2.5})	0.89	3.76	N/A	3.76	7.52
Sulfur Dioxide (SO ₂)	0.06	0.26	N/A	0.26	0.52
Carbon Dioxide Equivalence (CO ₂ e)	6,931.03	30,357.91	N/A	35,978.91 ²	71,957.82 ²
Formaldehyde (CH ₂ O or HCHO)	0.07	0.30	0.16	0.48 ²	0.96 ²
Total Hazardous Air Pollutants (HAPs)	0.08	0.35	0.17	0.53 ²	1.06

* 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_x modes and SoLoNO_x mode.

2- Includes fugitives from the new compressor VOCs – 4.25 tpy, CO₂e – 5,621 tpy, HAPs – 0.17 tpy.

3 – The worst case mode is Low Load Operations.

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Dominion adjusted the annual potential emissions of NO_x, CO, and VOCs for the existing Centaur 50 turbine at the facility operating in the non-SoLoNO_x modes. The adjustments in these pollutants are illustrated in the following table.

Pollutant\Sources	Limits in Permit R13-1077		SoLoNO _x Mode	Worst Case Non-SoLoNO _x Mode	Annual Emission ¹	Net Change in Permitted Emissions
	lb/hr	tpy	lb/hr	lb/hr	tpy	tpy
NO _x	22.6	99.0	6.52*	20.84	28.63	-70.37
CO	3.8	16.6	5.22*	667.00	44.16	27.56
VOCs	1.4	6.1	0.30	7.62	5.80	-0.30
PM/ PM ₁₀ / PM _{2.5}	--	--	0.70	N/A	3.03	N/A
SO ₂ \	0.04	0.18	0.04	N/A	0.18	0.00
CO _{2e}	--	--	5,466.13	N/A	29,562.65 ²	N/A
Formaldehyde	--	--	0.03	N/A	0.30 ²	N/A
Total HAPs	--	--	0.05	N/A	0.39	N/A

* Based on Maximum heat input using Higher Heating Value of the fuel.
 1 – Annual Emission includes the emissions from the non-SoLoNO_x modes and SoLoNO_x mode.
 2- Includes fugitives from the dry seals of the compressor.

The applicant used pollutant specific emission factors from the manufacturer and Chapter 1.4 of AP-42 data to estimate emissions from this new boiler. The writer reproduced the estimated emissions from the boiler, which are presented in the following table:

Pollutant	Emission Factor	Hourly Rate (lb/hr)	Annual Rate (TPY)
PM/PM ₁₀ /PM _{2.5}	0.0048 lb/MMBtu	0.01	0.04
Sulfur Dioxide (SO ₂)	0.00093 lb/MMBtu	0.002	0.009
Oxides of Nitrogen (NO _x)	0.088 lb/MMBtu	0.15	0.66
Carbon Monoxide (CO)	0.037 lb/MMBtu	0.06	0.26
Volatile Organic Compounds (VOCs)	0.005 lb/MMBtu	0.01	0.04
Total Hazardous Air Pollutants (HAPs)	0.00185 lb/MMBtu	0.003	0.013
Carbon Dioxide Equivalent* (CO _{2e})	117.1 lb/MMBtu	204.93	897.59

* Based on factors and global warming potentials from Tables A-1, C-1, and C-2 of Part 98 published on Federal Register on November 29, 2013.

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Pollutant	Emission Factor	Hourly Rate (lb/hr)	Annual Rate (tpy)
PM/PM ₁₀ /PM _{2.5}	0.0048 lb/MMBtu	0.02	0.01
Sulfur Dioxide (SO ₂)	0.00093 lb/MMBtu	0.005	0.001
Oxides of Nitrogen (NO _x)	0.50 g/bhp-hr	0.66	0.17
Carbon Monoxide (CO)	2.0 g/bhp-hr	2.64	0.66
Volatile Organic Compounds (VOCs)	0.33 g/bhp-hr	0.44	0.11
Total Hazardous Air Pollutants (HAPs)	0.038 lb/MMBtu	0.19	0.01
Carbon Dioxide Equivalent* (CO _{2e})	117.1 lb/MMBtu	578.47	144.62

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

Pollutant	Project Emissions (tpy)	Facility New Potential (tpy)	Major Source Trigger Levels for Title V (tpy)	Major Source Trigger Levels for PSD (tpy)
Oxides of Nitrogen (NO _x)	58.62	60.32	100	250
Carbon Monoxide (CO)	118.08	122.07	100	250
Volatile Organic Compounds (VOCs)	18.33*	18.66	100	250
Particulate Matter (PM)/ PM less than 10 microns (PM ₁₀)/ PM less than 2.5 microns (PM _{2.5})	10.60	10.65	100	250
Sulfur Dioxide (SO ₂)	0.71	0.72	100	250
Carbon Dioxide Equivalence (CO _{2e})	102,561.68	103,677.98	N/A	N/A
Total Hazardous Air Pollutants (HAPs)	1.47	1.49	10 of any single HAP/25 Total HAPs	N/A

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

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REGULATORY APPLICABILITY

The L.L. Tonkin 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 118 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 under PSD. Therefore, 45 CSR 14 is not applicable for this facility as result of this project.

Since the potential of any of the criteria pollutants is over 100 tpy, then the facility remains as a major source and subject to the permitting requirements of Title V (45 CSR 30). The facility falls under the Title V program (45 CSR 30) as the station has a potential greater than 100 tpy of NO_x and hold a valid Title V Operating Permit. This means that the applicant is required to update their permit prior to start-up of the modified Turbine #1. As part of submitting this application, Dominion included a significant modification request to update the facility's operating permit.

The new boiler is only subject to State Rules 2 and 10. Since the boiler is less than 10 MMBtu per hour and will only burn natural gas, the boiler would only be subject to the visible emission standard of Rule 2, which is a 10 percent opacity limit. Boilers and process heaters that fire on natural gas usually exhibit no opacity. Therefore, this new boiler should be capable of meeting the standard without the use of any add-on control device.

There are no state rules that are applicable to the turbines and the engine for the generator 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.

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 L.L. Tonkin 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.

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Subpart GG

This subpart regulates oxides of nitrogen and sulfur dioxide from combustion turbines constructed, modified and reconstructed from October 3, 1977 to February 18, 2005. Turbine #1 is currently subject to the NO_x and SO₂ standard under Subpart GG. Under Part 60, the definition of “modification” is a change to an affected source that increases the emission of a pollutant that a subpart establishes an emission standard for the affected source.

Turbine #1 was tested on June 5, 1990 for NO_x which yielded an average of 17.7 pounds per hour. Adding the SoLoNO_x system to the turbine, NO_x potential from the turbine has been predicted to be 6.5 pounds per hour, which would be over a 10 pound per hour reduction in NO_x. The upgrade to this turbine should not increase the fuel required to produce the original power output rating of 4,417 hp. Therefore, SO₂ emissions are predicted to be unaffected due to this change. As result of the proposed upgrade to Turbine #1, this change does not constitute a modification of an affected source under Part 60.

Reconstruction under Part 60 is triggered if the cost of the capital improvements exceeds 50% of the cost of a new emission unit. Dominion believes the proposed upgrades to the turbine would not exceed over one million dollars and the cost of a new turbine would be about 4 million dollars, which is about 25% of a new turbine. Thus, the upgrade to Turbine #1 does not trigger reconstruction under Part 60 and the turbine remains subject to the same standards under Subpart GG.

Subpart JJJJ

Subpart JJJJ (Standard of Performance for Stationary Spark Ignition Internal Combust Engines) applies to stationary spark ignition engines manufactured after July 1, 2007. The new generator set will be equipped with a spark ignition engine manufactured after July 1, 2007. Thus, the engine would be subject to the standards of this subpart and subject to the emission limitations of Table 1 of Subpart JJJJ of Part 60, which include the following requirements for emergency engines greater than 130 bph.

- For NO_x, the limit is 2.0 grams per horsepower-hour (g/hp-hr) or 160 ppmvd at 15 % O₂.
- For CO, the limit is 4.0 g/hp-hr or 500 ppmvd at 15 % O₂.
- For VOC, the limit is 1.0 g/hp-hr or 86 ppmvd at 15 % O₂.

The proposed engine for the generator set is manufactured by Dresser Waukesha. The manufacturer claims that the NO_x rate is estimated at 0.5 g/hp-hr; CO is 2.0 g/hp-hr; and VOC (Non-Methane Hydrocarbon) is 0.22 g/hp-hr. According to the manufacturer’s data, this engine should be capable of meeting the emission standards of this subpart. However, the manufacturer did not certify the engine as specified under 40 CFR Part 90, 40 CFR Part 1048 or 40 CFR Part 1054. Therefore, the permit will require the applicant to conduct an initial performance test and

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either conduct subsequent performance testing every 8,760 hours of operation or once every 3 years, whichever is sooner.

Subpart KKKK

U.S. EPA has promulgated a 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 0⁰ F). Therefore, the proposed 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 SO₂. These turbines would be limited to 0.060lb of SO₂ 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 a 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 (O₂) content or 150 nana gram /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 0⁰ F.

There are alternative standards for units operating at less than 75 percent of peak load or when operating temperatures are less than 0⁰ F. The alternative limit of 150 ppm at 15% O₂ is listed in Table 1 to Subpart KKKK. The manufacturer estimates that the NO_x rate for the proposed turbines would increase up to 120 ppm for subzero operations. For low load operations, the manufacturer estimates 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 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 this turbine. The applicant has elected to

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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% O₂ then Dominion can test the turbines 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).

NESHAP

The station is classified as an area source of HAPs. The following paragraphs will discuss the key applicable provision that pertain to the affected source with its corresponding subpart.

Subpart ZZZZ

The internal combustion engine for the emergency generator set is classified as an affected source under the NESHAP for Stationary Reciprocating Internal Combustion Engines (Subpart ZZZZ). The proposed engine will have a power output rating of 600 bhp and be operated as a limited use engine that will comply with the requirements of Subpart JJJJ under Part 60. Therefore, no further requirements of Subpart ZZZZ applies to this engine according to 40 CFR §§63.6590(c) and (c)(1).

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The modified turbine and 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, 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 the 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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The proposed engine for the generator set is not certified and therefore Dominion will be required to conduct testing per the regulation. The proposed engine will be equipped with an integrated catalyst with air fuel ratio controller (AFR). Thus, Subpart JJJJ requires such non-certified engines be equipped with a non-resettable hour meter (40 CFR §60.4237) and the AFR be maintained and operated appropriately at all times when the engine is in operation (40 CFR §60.4243). No further monitoring of the engine is need given the regulation requires tracking of the hours of operation, maintenance performed, and performance testing every 3 years or 8,760 hours of operations, whichever occurs first.

CHANGES TO PERMIT R13-1077

Permit R13-1077 established emission limits for Turbine #1 and required the use of the alternative fuel monitoring schedule to demonstrate compliance with Subpart GG of Part 60. The request for the alternative fuel monitoring schedule was approved by U.S. EPA Region III on April 14, 1989, for the L.L. Tonkin Station. Regardless of this approved alternative fuel monitoring schedule, sources that consume a gaseous fuel that meets the definition of “natural gas” in §60.331(u) may use a current and valid contact, tariff sheet, or transportation contract that specify the maximum sulfur content of the natural gas of 20 grains per 100 cubic feet of gas or less in lieu of conducting the fuel monitoring for sulfur as required in §60.334(h)(1).

The requirement of monitoring for nitrogen was waived in the memorandum on Authority for Approval of Custom Fuel Monitoring Schedules under NSPS Subpart, which the L.L. Tonkin Station was approved to use on April 14, 1989. This schedule reduces the fuel monitoring from daily to twice a month for six months and then twice annually if there are no changes in the fuel supplier. However, the subpart today clearly notes that stationary gas turbines shall monitor the nitrogen content of the fuel combusted in the turbine if the source claims an allowance for fuel bound nitrogen with regards to the NO_x emission standard of §60.332. The most recent change to Subpart GG occurred in the Federal Register on February 24, 2006. Condition 3.2.2. of the facility’s Title V permit notes no fuel-bound nitrogen monitoring is required per Permit R13-1077. The requirement in the Permit R13-1077 was correct until §60.332 was revised as it is stated today.

Permit R13-1077 determined that the NO_x allowable for Turbine #1 was 0.0165 % NO_x concentration. This allowable was determined with an fuel-bound nitrogen of 0.03 percent by weight in the natural gas which yields an F value of 0.0012 in accordance with §60.332(a)(4).

The writer recalculated the allowable NO_x emission concentration for the turbine in accordance with §60.332(a)(2) with a value for F set to zero which yielded an allowable of 0.0153 percent of NO_x by volume. This is the correct approach to use with no fuel-bound nitrogen monitoring requirement. This concentration converted into terms of parts per million by volume is 153 ppm. Even at this concentration, the turbine was below this allowable during the initial compliance demonstration, which was conducted on June 5, 1990. The highest NO_x concentration measured was 94.53 ppm_{dv} corrected to 15% oxygen.

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With the SoLoNO_x system, the manufacturer (Solar) anticipates the NO_x emission concentration of 38 ppmdv at and above 50% load with temperatures at or above 0^oF. For turbine operating at 40% load or low load conditions, Solar anticipates the NO_x emission concentration to be 54 ppmdv. The manufacturer's anticipated emissions rates were adjusted for the turbine to be operating at an elevation of 777 feet above sea level, which is the elevation that the station is located.

The SoLoNO_x system should ensure the NO_x emissions from the turbine from 100% to 40% load conditions to be just over 35% of the allowable standard under Subpart GG. Thus, compliance with the NO_x standard from Subpart GG should not be a problem with this turbine once the SoLoNO_x is installed on it. By adjusting the NO_x allowable to 0.0153 percent, which equates to 153 ppmvd and holding tariff sheet indicating the sulfur content is 20 grains or less per 100 cubic feet of gas, the station is not required to conduct any fuel monitoring per the subpart.

Under Subpart GG, turbines which use water or steam injection to control NO_x emissions are required to install continuous emission monitoring (CEM) systems or establish and monitor operating parameters. The existing turbine configuration and the SoLoNO_x add on system does not use water or steam. This SoLoNO_x utilizes lean-premixed combustion technology to prevent the formation of NO_x emissions. Only turbines constructed after July 8, 2004 that is a lean premix combustion turbine has to monitor the appropriate parameters to determine whether the unit is operating in low-NO_x mode under Subpart GG.

The writer proposes to require monitoring that the turbine is operating in SoLoNO_x mode and conducting initial compliance demonstration to show the turbine with the SoLoNO_x system can achieve a NO_x concentration of no greater than 38 ppm and CO concentration of no greater than 50 ppm.

The emission limits stated in Permit R13-1077 will be retained in the modified permit until the proposed upgrade of Turbine #1 has been complete and will be replaced with limits in line with expected emissions from of the SoLoNO_x system.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that the expansion project for the L.L. Tonkin Station should meet all 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 L.L. Tonkin Compressor Station.



Edward S. Andrews, P.E.

Engineer

January 2, 2015

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Date

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