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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.: R13-3330T
Plant ID No.: 021-00001
Applicant: Columbia Gas Transmission LLC (CGT)
Facility Name: Glenville Compressor Station
Location: Truebada, Gilmer County
SIC Code: 4922
NAICS Code: 486210
Application Type: Temporary
Received Date: July 7, 2016
Engineer Assigned: Jerry Williams, P.E.
Fee Amount: \$2,000
Date Fee Received: July 7, 2016
Complete Date: August 2, 2016
Due Date: September 16, 2016
Applicant Ad Date: July 7, 2016
Newspaper: *The Glenville Pathfinder*
UTM's: Easting: 519.750 km Northing: 4,308.770 km Zone: 17
Description: Temporary testing program on an existing turbine to install and test a new low load control algorithm. The Glenville Compressor Station is currently permitted under R13-3110 which was issued on November 6, 2013.

DESCRIPTION OF PROCESS

The following process description was provided by CGT in Permit Application R13-3330T:

The Glenville Station is proposing to conduct a project to field qualify the Taurus 60 engine model with a new low load control algorithm. CGT has agreed to host the field trial on one of their Unit #2, Taurus 60 7802S gas only compressor set package. The unit is permitted for 12 hours under low load conditions per year. Unit #2, (ESN2203T) was selected as the preferred test unit by Solar and CGT. The unit will be retrofitted with TPZ (Temperature Primary Zone) control logic, supplemental T2 (compressor discharge temperature) instrumentation probes and a Burner Acoustic Monitoring (BAM) 2.0 system.

The object of the testing is to reduce low load emissions of NO_x, CO, and VOCs. Since the permit allows 12 hours/year of low load operation this testing has identified the need for a temporary allowance of additional low load hours, which will push the annual total to 42 hours/yr. All other normal load (> 50%) will be covered by the existing permit limits.

Site visits by Solar engineering staff and the Pittsburgh District Office are being planned. The initial site visit (referred to as CGT Visit #1) will be completed to baseline the current control system and install the new Low Load Controls (LLC) algorithm on Unit #2. This new control schedule changes the engine controls to bleed at loads outside of below current SoLoNO_x mode operation to significantly reduce CO and UHC emissions. The BAM 2.0 system will be installed, which includes a new torch, to field qualify the new high temperature BAM dynamic pressure sensor along with an active control feature developed to quell high amplitude pressure oscillations by stepping up pilot fuel flow.

The data collection will be completed with; (1) Solar's Mobile Emissions Lab (MEL), (2) Remote Monitoring and Diagnostics (RM&D) for basic engine performance parameters, and (3) a (BAM) 2.0 module to monitor system acoustics simultaneously with the existing production BAM system. After system validation, the BAM 2.0 active control feature will be turned on. In the event of high BAM 2.0 readings, active control will step up pilot fuel flow to reduce amplitudes to safe levels and prevent damage. Active control will not trigger under normal circumstances. However, conditions such as fouled fuel injectors, loss of fuel skid edge pressure or extremely low ambient temperatures may drive higher combustor oscillations at which point active control would engage.

SITE INSPECTION

A site inspection was conducted by James Robertson of the DAQ Enforcement Section on June 3, 2015. The facility was operating in compliance.

Directions:

I-79 north to Burnsville exit. Turn left on State Route 5. Proceed approximately 12 miles to the station that is located on the left.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

CGT provided detailed calculations of the emission units in Attachment N of the permit application. This section will examine the emissions from the temporary testing of turbine T02.

Solar Taurus 60 Turbine (T02)

Potential emissions from the 7,943 hp (@ 32° F), 7,965 BTU/hr natural gas-fired Solar Taurus 60 combustion turbine are based on emission factors provided from the vendor, based on the emission factors provided for natural gas combustion as given in AP-42 Section 3.1. (AP-42 is a database of emission factors maintained by USEPA), material balance, and on emission

factors from 40 CFR 98, Subpart C. Emissions were based on the MDHI of the engine and annual emissions were based on the 42 hours of operation at low load conditions. The following table details the emission factor source and the PTE of turbine T02 used during low load operating conditions:

Pollutant	Emission Factor	Source	Hourly (lb/hr) ⁽¹⁾	Annual (ton/yr) ⁽²⁾
NO _x	0.00179 lb/hp-hr	Vendor Data	14.18	0.30
CO	0.124 lb/hp-hr	Vendor Data	986.45	20.72
PM _{2.5}	0.0066 lb/MMBTU HHV ⁽⁴⁾	AP-42 Table 3.1-2a (4/00)	0.42	0.01
PM ₁₀	0.0066 lb/MMBTU HHV ⁽⁴⁾	AP-42 Table 3.1-2a (4/00)	0.42	0.01
SO ₂	0.0571 lb/MMBTU HHV ⁽⁴⁾ (hourly) 0.000714 lb/MMBTU HHV ⁽⁴⁾ (annual)	20 grains S/100 scf (hourly) 0.25 grains S/100 scf (yearly)	3.54	<0.01
VOC	0.00177 lb/hp-hr	Vendor Data (25% of UHC) ⁽³⁾	14.09	0.30
Formaldehyde	0.00071 lb/MMBTU HHV ⁽⁴⁾	AP-42, Table 3.1-3 (4/00)	0.045	<0.01
Total HAPs	0.00103 lb/MMBTU HHV ⁽⁴⁾	AP-42, Table 3.1-3 (4/00)	0.065	<0.01
CO ₂ e	117.1 lb/MMBTU HHV ⁽⁴⁾	40CFR98 Subpart C	7,402.75	155.46

- (1) Maximum hourly emission rate based on low load conditions.
- (2) Annual emission rate based on 42 hours of operation at low load conditions.
- (3) VOC based on 25% of vendor data for unburned hydrocarbons (UHC).
- (4) HHV heat input based on HHV=1.1*LHV.

The total facility PTE for the Glenville Compressor Station is shown in the following table:

Pollutant	R13-3110 Turbine T02 PTE (tons/year)	R13-3330T Turbine T02 PTE (tons/year)	PTE Change (tons/year)
Nitrogen Oxides	18.13	18.23	0.10
Carbon Monoxide	37.10	46.95	9.85
Volatile Organic Compounds	2.77	2.91	0.14
Particulate Matter-10/2.5	1.77	1.83	0.06
Sulfur Dioxide	0.19	0.19	0
Formaldehyde	0.19	0.20	<0.01
Total HAPs	0.28	0.29	<0.01
Carbon Dioxide Equivalent	31,432	32,424	992

The increases listed above occur during the additional 30 hours of temporary testing during low load operating conditions.

REGULATORY APPLICABILITY

The following rules and regulations apply to this temporary permitting action:

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 engine testing and mapping event is in an effort to enhance the stability of the unit under low load conditions and will ultimately reduce emissions. However, due to these testing efforts the amount of time previously allotted for low load operation, 12hrs/yr, will need to be extended to temporarily increase emissions beyond what is currently reflected by R13-3110. Therefore this pilot project is considered a change in method of operations not currently reflected by the existing permit. A total of 30 additional operating hours under low load conditions is being requested via a temporary permit as defined by this minor source NSR Rule.

As required under §45-13-8.3 (“Notice Level A”), CGT placed a Class I legal advertisement in a “newspaper of general circulation in the area where the source is . . . located.” Additionally, CGT paid the appropriate application fee.

45CSR16 (Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60)

45CSR16 applies to this source by reference of 40CFR60 Subparts KKKK. These requirements are discussed under that rule below.

45CSR30 (Requirements for Operating Permits)

CGT is subject to 45CSR30. The Glenville Compressor Station has the potential to emit more than major regulatory threshold for NO_x and CO. Due to this facility's potential to emit over 100 tons per year of criteria pollutant, CGT is required to have an operating permit pursuant to Title V of the Federal Clean Air Act as amended and 45CSR30.

CGT is required to pay the appropriate annual fees and submit an annual Certified Emissions Statement.

40CFR60 Subpart KKKK (Standards of Performance for Stationary Combustion Turbines)

Per §60.4305, Subpart KKKK applies to combustion turbines with a peak heat input of 10 MMBTU/hr or greater. Since turbine T02 is greater than this, CGT will be subject to the rule. §60.4320 requires the turbines to meet the NO_x requirement in Table 1 of the rule. Since the turbine is new, natural gas fired turbines between 50 and 850 MMBTU/hr, Table 1 requires it to meet a NO_x limit of 25 ppm at 15% O₂ or 150 ng/J of useful output. To demonstrate compliance with the limit, §60.4400(a) requires both an initial (within 180 days of startup or 60 days of achieving full load operation) and annual (not to exceed 14 months from previous test) performance test. However, §60.4340 allows the

permittee to be exempted from the annual testing if continuous emission monitors or continuous parameter monitoring systems are installed that meet the requirements of the section. Additionally, if the NO_x testing results show emissions less than 75% of the limit, testing frequency can be reduced to once every 2 years (with no more than 26 months after the previous test.) One of the objectives of this temporary testing is to assure the turbine continues to meet the requirements of this standard under low load conditions.

40CFR60 Subpart OOOOa (Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution for which Construction, Modification or Reconstruction Commenced after September 18, 2015)

EPA published its New Source Performance Standards (NSPS) and air toxics rules for the oil and gas sector on August 16, 2012. EPA published amendments to the Subpart on September 23, 2013 and June 3, 2016. 40CFR60 Subpart OOOOa establishes emission standards and compliance schedules for the control of the pollutant greenhouse gases (GHG). The greenhouse gas standard in this subpart is in the form of a limitation on emissions of methane from affected facilities in the crude oil and natural gas source category that commence construction, modification or reconstruction after September 18, 2015. This subpart also establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO₂) emissions from affected facilities that commence construction, modification or reconstruction after September 18, 2015. The effective date of this rule is August 2, 2016.

Turbines are driving compressors at a transmission station for a natural gas pipeline system. Subpart OOOOa (Standards of Performance for Crude Oil and Natural Gas Production) establishes standards for certain process equipment. Each centrifugal compressor using wet seals is subject to this subpart. The compressor will use dry seals. Therefore, it is not an affected sources and not subject to the performance standards of Subpart OOOOa.

For the purposes of 60.5397a (LDAR), a “modification” to a compressor station occurs when one or more compressors is replaced by one or more compressors of greater total horsepower than the compressor(s) being replaced. No increase in horsepower is being realized, therefore, for the purposes of LDAR, a “modification” has not occurred.

45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants)

45CSR19 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contribute to Nonattainment)

The Glenville Compressor Station is located in Gilmer County which is an unclassified county for all criteria pollutants, therefore the facility is not applicable to 45CSR19. The emission increases associated with this temporary permitting action do not meet the

definition of a major modification under 45CSR14. Therefore, CGT is not subject to this rule.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

This section provides an analysis for those regulated pollutants that may be emitted from the temporary equipment and that are not classified as “criteria pollutants” or Greenhouse Gases. Criteria pollutants are defined as Carbon Monoxide (CO), Lead (Pb), Oxides of Nitrogen (NO_x), Ozone, Particulate Matter (PM), Particulate Matter less than 10 microns (PM₁₀), Particulate Matter less than 2.5 microns (PM_{2.5}), and Sulfur Dioxide (SO₂). Criteria 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.

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 methanol refer to the IRIS database located at www.epa.gov/iris.

The HAPs associated with this temporary testing are estimated to be 0.001 tons/year. Therefore, a detailed toxicological analysis was not performed.

AIR QUALITY IMPACT ANALYSIS

Modeling was not required of this source due to the fact that the facility is not subject to 45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants) or 45CSR19 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contribute to Nonattainment) as seen in the table listed in the Regulatory Discussion section under 45CSR14/45CSR19.

MONITORING OF OPERATIONS

CGT shall notify the Director in writing within 30 calendar days after the completion of the temporary testing on turbine T02. This testing is designed for evaluating control algorithms only. If CGT chooses to define new emission factors for low load conditions, they must do so under an approved test protocol utilizing appropriate EPA methods.

The following substantive monitoring, compliance demonstration, reporting and recording requirements (MRR) shall be required:

CGT will be required to maintain the following records for turbine T02

- Monthly operating hours
- Monthly operating hours at less than 50% load
- 617717817917101711171rs at 10 °F to -20 °F ambient temperature
- Monthly operating hours at less than -20 °F ambient temperature
- Monthly number of startup and shutdown cycles

These records will be used to calculate monthly emissions and 12-month rolling total.

Monthly emissions for each pollutant will be calculated using the following equation:

$$ME_{Px} = DLN_{Px} * DLN \text{ hrs} + LL_{Px} * LL \text{ hrs} + LT_{Px} * LT \text{ hrs} + SS_{Px} * SS \text{ cycles}$$

Where:

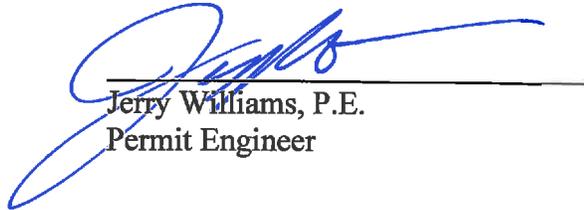
- ME_{Px} is the total unit emission rate (lb/hr) for pollutant X
- DLN_{Px} is the unit emission rates (lb/hr) for pollutant X during normal (DLN) operation
- LL_{Px} is the unit emission rates (lb/hr) for pollutant X during low-load (LL) operation
- LT_{Px} is the unit emission rates (lb/hr) for pollutant X during low-temperature (LT) operation
- SS_{Px} is the unit emission rates (lb/cycle) for pollutant X during startup/shutdown (SS) operation

At the end of each month, the monthly emissions will be summed for the preceding 12 months to determine compliance with the annual emissions limits.

CGT shall be required to meet all applicable Monitoring, Compliance Demonstration, Source-Specific Recording and Reporting Requirements as given under 40 CFR 60, Subparts JJJJ and KKKK.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates CGT's Glenville Compressor Station meets all the requirements of applicable regulations. Therefore, impact on the surrounding area should be minimized and it is recommended that the Gilmer County location should be granted a temporary permit under 45CSR13.



Jerry Williams, P.E.
Permit Engineer

8/10/2016

Date