Commonwealth of Pennsylvania
Department of Environmental Protection
May 15, 2007

Subject: Review of Application for Synthetic Minor Permit
Texas Eastern
Armagh Compressor Station
New Florence, PA
Indiana County

To: Air Quality Permit File: #32-00230

Thru: Barbara Hatch, P.E.
Title V Facilities Chief
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Background:

The Armagh Compressor Station was originally installed in 1963 to recompress and move natural gas through transmission pipelines. The owner - Texas Eastern Transmission, L.P. (Texas Eastern) transports natural gas via underground pipelines from the Gulf Coast region of the United States to the Northeast and Mid-Atlantic states. At several points along the pipeline, the gas must be recompressed to ensure that it continues to move along the pipeline and can be delivered to customers at serviceable pressures. A RACT Permit was issued for this facility in 1995. At the time the Dry Low NOx technology was developed by GE for only the larger "Frame 7" turbines. So at the time of the RACT review this technology was not considered. No control technology was deemed feasible for RACT. The Armagh Compressor Station, was permitted in the Bureau of Air Quality as a Title V Facility – TV-32-00230 was issued on June 27, 1997.

Texas Eastern proposed to expand gas transmission capacity at its Armagh Compressor Station in March of 2002. Texas Eastern submitted a plan approval for the Armagh Station. At the time, a General Electric (GE) Frame 5, Model MS5001A turbine that is rated at 13,400 horse power was operating at the gas compressor station. Texas Eastern upgraded the turbine to Model M5001R-NT turbine that is rated at approximately 22,000 horse –power at NEMA.

Texas Eastern on December 18, 2006 formally requested the replacement of the NOx and CO Continuous Emission Monitoring Systems (CEMS) requirement with an

alternate method of compliance monitoring (parametric). At the time of the Plan Approval submittal Texas Eastern proposed the CEM installation to provide a continuous demonstration of compliance with the respective emission limitations. The vendor could not guarantee the effectiveness of the control devices in respect to the emission limits so Texas Eastern installed the CEM's for NOx and CO. The turbine has since been in operation for five years and the CEM data has shown compliance with the emission limits for NOx and CO. Texas Eastern is proposing to take a restriction of 25 tons of NOx emissions during the ozone season as specified in 25 PA Code §145.4(b). Those requirements will be detailed in the Regulatory Review of this review.

Plan Approval Modification (March 2002): Equipment and Emissions:

Texas Eastern modified or uprated the old turbine through the same manufacturer GE. The simple cycle turbine is used to drive a compressor. The compressor is used to transmit natural gas. Emissions from the turbine are the product of natural gas combustion. The chart below describes the comparison of the two Turbine Models:

Comparison of Turbine Model Operating Data:

Model	Old MS5001A	New MS5001R-NT
Net Powder Output (hp)	13,400	22,000
Heat Input (MMBTU/hr)	158.80	257.43
Heat Rate (BTU/hp-hr.)	11,851	11,043

Data based on an ambient temperature of 80 degrees F.

The modified turbine utilizes a Dry Low NOx (DLN) combustion technology. This enabled the uprated turbine not to exceed NOx concentrations of 25 ppmvd at 15% oxygen. Prior to the uprate, the existing turbine operated at NOx concentrations of 75 ppmvd. It is anticipated during startup, NOx concentrations could reach 110 ppmvd at 15% oxygen. Texas Eastern was given an emission limit of 95 tons per 12 consecutive month basis for NOx emissions. Prior to the Plan Approval, Texas Eastern had a potential of 136 tons per year of NOx emissions in their TVOP. A cap on NOx emissions will enable the station to no longer be considered a major source (Title V Permit), but rather a synthetic minor. Texas Eastern, over the last 5 years, has shown through CEM data that the NOx emissions were below the limits specified in the Plan Approval.

The design of the modified (uprated) turbine incorporates an axial compressor discharge air extraction system that is expected to keep CO concentrations at or below 28 ppmvd at 15% oxygen over the normal operating range of the turbine. Despite expectations, GE was not willing to guarantee the performance of the axial compressor discharge air extraction system. As such, installation of an oxidation catalyst was utilized to ensure that CO concentrations in the turbine's exhaust never exceed 28 ppmvd at 15%

oxygen during normal operation. It is anticipated that, during startup, transient CO concentrations could reach 100 ppmvd at 15% oxygen. The combination of the CO control that is inherent in the design of the turbine and the add-on CO control provide Texas Eastern with sufficient confidence to propose an annual CO limit based on an annual average CO concentration of 10 ppmvd at 15% oxygen. Texas Eastern took a limitation of 30.0 tons of CO emissions. A CEMS unit was installed and it showed that while the turbine was operating it was well below those limits.

Pollutant	Scenario	Emission Limit	Basis
NOx	Normal Operations	25 ppmvd at 15% oxygen	15-minute rolling avg.
		28.2 lbs/hr	60-minute rolling sum
	Transient Periods*	110 ppmvd at 15% oxygen	15-minute rolling avg.
	All	95.00 tpy	12-month rolling sum
CO	Normal Operations	28 ppmvd at 15% oxygen	15-minute rolling avg.
		18.6 lbs/hr	60-minute rolling avg.
	Transient Periods*	100 ppmvd at 15% oxygen	15-minute rolling avg.
	All	30.0 tpy	12-month rolling sum

The duration of the exceedance of emission limits established for normal operations shall not exceed 30 minutes during startup/shutdown. Startup/Shutdown emissions and emissions during a failure of the emission controls must be included in determination of compliance with annual emission limits.

Projected Emissions:

Pollutant	Post-Uprate		Change	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
NOx	28.19	95.00	-2.86	- 41.00
CO	18.54	30.06	-5.98	- 77.33
SO2	1.06	4.64	0.52	2.79
PM/PM10	2.06	9.02	1.01	4.42
VOC	.40	1.09	-0.28	-1.90
Formaldehyde	.22	1.0	-0.01	-0.04

VOC, SO2, PM10, and Formaldehyde emissions were determined using AP-42 emission factors and the company is proposing to report emissions of these pollutants in the future

based on AP-42 emissions. Additional emissions will also be emitted from the Emergency Generator (445 HP) & Gas Heater (<1 MMBTU/HR).

Regulatory Analysis:

Texas Eastern took a limitation at the time of the plan approval in 2002 to avoid being considered a major facility. At the time of the issuance of the Plan Approval 32-00230A, allowable emission limitations were determined per PA Code Title 25 & 127.1: "new sources shall control the emission of air pollutants to the maximum extent, consistent with best available technology (BAT) as determined by the Department as of the date of issuance of the plan approval for the new source."

This turbine is subject to the applicable requirements of 40 CFR 60, Subpart GG, Standards of Performance for Stationary Gas Turbines. Subpart GG establishes NOx and SO2 emission limitations, monitoring, testing, recordkeeping and reporting requirements. However, since the standards were established in 1982, technological advances in turbine design have resulted in lower emission rates than those allowed by Subpart GG. The more stringent NOx and SO2 emission limitations imposed by the BAT determinations will apply. The DLN technology will be able to operate at 25 ppm NOx at the proposed range of operability.

The applicant is requesting relief from NOx CEM requirements using the provision of 40 CFR 60.334(c). Plan Approval 32-00230A required (perhaps erroneously) that the uprated turbine comply with the requirements of the Nox Budget Rule found at PA Code Chapter 145. The preamble to Chapter 145 clearly states that "The regulations establish a program to limit the emission of nitrogen oxides (NOx) from the fossil-fired combustion units with rated heat input capacity of greater than 250 MMBtu/hr per hour and electric generating facilities of greater than 25 megawatts." The uprated turbine does not meet either the definition of a combustion unit (found at Title 25 PA Code § 121.1) or an electric generating unit. Nevertheless, the company has complied with the NOx Budget rule in the past. At this time, the company wishes to be exempted from the NOx Budget Rule using the exemption provisions of Title 25 Code § 145.4(b) by limiting their Nox emissions during the control period to less than 25 tons per year.

25 PA Code § 145.4 Applicability:

(b) Twenty-five ton exemption

(1) Notwithstanding subsection (a), a unit under subsection (a)(1) or (2) that has a Federally enforceable permit that includes a NOx emission limitation restricting NOx emissions during a control period to 25 tons or less and that includes the special provisions in subsection (b)(4) shall be exempt from the requirements of the NOx Budget Trading Program.

Texas Eastern will be required to do the following:

1. Have a federally-enforceable permit restricting control period operating hours or heat input to a level that ensures that when multiplied by a default emissions rate set by the regulation, results in NOx emissions equal to or less than 25 tons of NOx per ozone season.

2. Keep records to demonstrate compliance with the permit (including restrictions on operating time or heat input). All records must be maintained for at least five (5) years.

3. Report hours of operation or heat input (as applicable) during the ozone season to the permitting authority by November 1 following each ozone season.

4. Establish a NOx Authorized Account Representative (AAR) and a general account from which the NOx Budget Administrator will deduct any allocated allowances in an amount equal to the permit limit on the unit's NOx emissions.

5. Ensure that any allowance allocations issued for the ozone season for which you are exempt are sufficient to cover the amount that will be deducted from the general account by EPA to reflect the unit's NOx emission limitations (in tons of NOx). If the facility sells or otherwise transfers allowances from the general account for an exempt unit, the facility must ensure that the unit's general account ultimately holds sufficient allowances to account for the deduction that will be made by EPA to reflect the exemption.

As part of the request for exemption from the NOx Budget Program and the associated NOx CEMS requirements, Texas Eastern proposes a limit on the allowable seasonal operating hours based on the following calculation:

1. The highest applicable default NOx rate (lb/mmBtu) form 40 CFR § 75.19 Table 2 for a gas-fired turbine = 0.7 lb/mmBtu.

2. The default NOx rate is used to determine the maximum potential hourly NOx mass emission (lb/hr) as follows:

   Maximum potential hourly NOx mass emission (lb/hr) =
   [Unit's max. rated heat input (mmBtu/hour)] x [Highest default NOx rate (lbs/mmBtu)]
   = [252.74 mmBtu/hr] x [0.7 lb/mmBtu]

   The maximum potential hourly NOx mass emissions is used to determine the unit's allowable operating hours:

Allowable seasonal operating hours = 50,000 lbs NOx (or less if applicable)/Maximum potential hourly NOx mass emissions.

= 50,000 lbs NOx per ozone season / 176.92 lbs/hr
= 282.62 hours per seson (May 1 through September 30)

In lieu of the existing NOx and CO CEMS requirement, Texas Eastern is proposing that compliance be demonstrated through a stack test during the term of the permit, portable analyzer test for (NOx and CO) if the unit operates greater than 750 hours per calendar year, hourly fuel flow rate, turbine speed, compressor discharge pressure, exhaust temperature, and ambient temperature.

Station-Wide Potential Combustion Emissions:

Pollutant:	Emissions (tpy)
NOx	98.00
CO	35.00
SO2	4.70
PM/PM10	9.04
VOC	1.10
Formaldehyde	1.00

The facility will be limited to less than 98 tons of NOx per 12 consecutive month period and 35 tons of CO per 12 consecutive month period.

Conclusions and Recommendations:

The application shows that the site meets the applicable requirements of 25 PA Code, Chapter 127 and 40 CFR Part 60, Subpart GG (related to standards of performance for turbines). I recommend that a Synthetic Minor Operating Permit be issued, subject to the attached special conditions.