



Board of Directors

Frank Bevc, *Chairman*
Siemens Westinghouse Power

Kathryn Rominger, *Vice Chair*
GE Power Systems

Robert Mack, *Treasurer*
IR Energy Systems

Richard Tuthill, *Secretary*
United Technologies Corporation

Mark Self
ALSTOM Power Inc

Kevin Dugan
Capstone Turbine

John March
Rolls-Royce

September 3, 2003

Mr. Yogesh Doshi
Bureau of Preconstruction Permits
New Jersey Department of Environmental Protection
P.O. Box 027
401 East State Street, Floor 2
Trenton, New Jersey 08625-0027

RE: Draft State of the Art Manual for Stationary Gas Turbines (2003 Revision).

Dear Mr. Doshi

The Gas Turbine Association has reviewed the State of New Jersey Department of Environmental Protection (NJDEP) draft document entitled "State of the Art (SOTA) Manual for Stationary Gas Turbines", 2003 revision (2003 GT SOTA Manual). We appreciate the opportunity to comment. This letter summarizes our comments regarding the 2003 GT SOTA Manual.

Executive Summary

GTA believes that, with the exception of the NO_x emissions during oil operation, many of the emissions described in the 2003 GT SOTA Manual are achievable using a combination of combustion design and post emission controls, but only at a single operating condition: ISO base load. At reduced load conditions, it may not be possible to achieve the emission levels proposed in the document. The lowest NO_x levels proposed for simple cycle gas turbines are not achievable by all gas turbines, and the largest industrial turbines cannot use an SCR for additional NO_x control.

GTA is particularly concerned about the ultra low NO_x levels noted for oil fuel operation. A 2.5 ppm NO_x emission level on fuel oil will be extremely difficult to achieve with fuel oil, and establishing such a low level is not state of the art.

Also, the document references the use of higher heating value in the heat addition rate to the gas turbine. Normal industry practice is to reference the lower heating value.

Member Companies

ALSTOM Power Inc.

Capstone Turbine Corporation

Elliott Energy Systems

GE Power Systems

IR Energy Systems

Rolls-Royce

Siemens Westinghouse
Power Corporation

South Carolina Institute for
Energy Studies

United Technologies Corporation

NO_x Emissions from Simple Cycle Gas Turbines

For gas turbines with greater than 500 MMBtu/hr fuel consumption, the 2003 GT SOTA Manual Performance Levels and Control Technology suggests a NO_x limit of 9 ppmvd @ 15% O₂. Few gas turbines can achieve 9 ppmvd NO_x emission levels. The text of the manual also is confusing, in that it references 500-1000 MMBtu/hr fuel consumption as the size range for gas turbines that can achieve 9 ppm NO_x. The table and the text require additional clarification.

GTA cautions against imposing a single performance level and suggest that the state consider how such a characterization may be viewed and used by other regulatory entities or third parties in other contexts. Moreover, GTA does not believe that the data presented by the NJDEP in its Fact Sheet supports such a limit.

GTA proposes the NO_x performance level for simple cycle gas turbines on natural gas be established as 9-45 ppmvd @ 15% O₂, a level that is compatible with DLN and control technologies such as water or steam injection, and 30-60 ppmvd @ 15% O₂ for gas turbines operating on fuel oil. This would be applicable to all gas turbin sizes. Also, these are the emissions achieved at the base load operating condition

Furthermore, if simple cycle gas turbines operating greater than 10% of the time are not addressed by the 2003 GT SOTA Manual, GTA recommends that this be clearly stated in the Table - 1.

Additional SCR Considerations

There is significant difficulty and cost related to SCR operation on a simple cycle gas turbine. Large frame gas turbines are not compatible with the current SCR catalyst technology, although SCR's have been used on smaller aeroderivative gas turbines that have cooler exhaust temperatures. In addition, SCR's may not be economical with small cogeneration facilities. Therefore, a broader range of NO_x emission requirements is recommended.

On the smallest gas turbine sizes, the use of an SCR, on either a simple or combined cycle, may not be economical.

Combined Cycle Gas Turbine Emissions

Fuel Oil NO_x

GTA does not believe that 2.5 ppmvd NO_x @ 15% O₂ emissions on fuel oil is achievable, either in combined cycle operation or in simple cycle operation. GTA proposes the NO_x performance level for combined cycle gas turbines on fuel oil gas be established as 12-60 ppmvd @ 15% O₂ when fuel oil used. Both the fuel composition and the technology choice (e.g. SCR) will affect the final NO_x produced. Also, smaller gas turbines, such as those that operate in Combined Heat and Power (CHP) cannot economically incorporate an SCR as part of emission control to meet the proposed levels. Table-1 should reference that the applicable size range for cogeneration applications should be greater than 150 MMBtu/hr. For gas turbines smaller than this, the appropriate reference should be the simple cycle range of emissions discussed previously.

Fuel oil is often only used as a backup fuel in the case of interruption of natural gas supply. GTA suggests that rather than focus on regulation of the emission concentration of NO_x on oil, it may be more beneficial to consider the total tons/year impact due to oil operation.

Proposed 0.10 lb/MW-hr NO_x emission Level

The output based emission requirement may be an efficient regulatory method for gas turbines, instead of an absolute concentration requirement such as the 2.5 ppmvd NO_x emission level identified earlier in Table - 1. However, we note that the efficiency level has a threshold value of 54%, the limit should be as low as 40%. Also, the output based standard for fuel oil cannot be the same as that for natural gas. The GTA will be willing to work with the NJDEP to identify an appropriate standard for the special case of fuel oil operation. GTA would be willing to work with the department to develop an appropriate standard.

CO Emissions (combined and simple cycle, no oxidation catalyst)

GTA does not support the very low CO emissions performance levels proposed. These are 3 ppmvd CO @ 15% O₂ for (combined cycle fuel oil or natural gas), and 15 ppm (simple cycle)

GTA proposes the CO performance level for combined cycle gas turbines be preferably set at a range of 10-20 ppmvd @ 15% O₂ for natural gas operation and 20-30 ppmvd @ 15% O₂ for fuel oil operation or, at the very least, remain unchanged in the current SOTA Manual. The recommended emissions are engine only, without the use of post-combustion controls (i.e., an oxidation catalyst) considered.

In addition, the requirements detailed per footnote “b” to Table - 1 for maintaining CO emissions less than 250 ppmvd @ 15% O₂ during low load (<30%) operations may be problematic for gas turbines which have been optimized to reduce NO_x emissions at base load. GTA recommends other methods of limiting CO during startups and shutdowns (e.g. establish a reasonable time limit for startups and shutdowns or incorporate a tons per year limit on the gas turbine or gas turbine facility) should be considered.

Ambient temperature conditions influence the CO emissions from DLN gas turbines. Leaving the current CO level unchanged will allow greater flexibility in gas turbine operation at different ambient conditions.

VOC Emissions (combined cycle)

GTA does not support the very low VOC emissions performance level proposed in the 2003 GT SOTA Manual of:

- 4 ppmvd VOC @ 15% O₂ for Combined Cycle on Natural Gas and Fuel Oil

The proposed VOC emission rate of 4 ppmvd @ 15% O₂ represents a 60% reduction from the current rate limit of 10 ppmvd, which does not appear to be justified in either the Fact Sheet or the 2003 GT SOTA Manual. As with the ambient CO issues previously discussed, ambient VOC concentrations may easily reach 2 to 3 ppm. GTA recommends that there be no change from the current limit of 10 ppmvd. This recommended performance level is engine-based with NO post-combustion controls (i.e., an oxidation catalyst) considered.

In addition, with respect to the requirement specified per footnote “d” to Table-1, which requires maintaining VOC emissions less than 50 ppmvd @ 15% O₂ during low load (<30%) operations, may be a technical challenge for any gas turbine design. GTA recommends other methods of limiting VOC during startups and shutdowns (e.g. establish a reasonable time limit for startups and shutdowns or incorporate a tons per year limit on the gas turbine or gas turbine facility) should be considered.

Finally, the VOC's are not defined. VOC's should be defined as hydrocarbons that exclude both ethane and methane.

Ammonia Emissions (SCR Catalyst)

GTA does not support the reduction (by 50% from the current SOTA Manual) of ammonia slip (NH_3) emissions performance levels to:

- 5 ppmvd NH_3 @ 15% O_2 for Combined Cycle on Natural Gas and Fuel Oil

This emissions rate does not appear to be justified in either the Fact Sheet or the 2003 GT SOTA Manual. While this NH_3 emission level has been observed on natural gas (at least early in catalyst life), during fuel oil operation, it has been proven to be quite problematic. Oftentimes NH_3 injection rates are higher during fuel oil operation, due to the higher levels of NO_x coming out of the engine. This in turn leads to higher levels of NH_3 emissions at the stack.

GTA believes that the data presented does not support a change from the current exhaust standard for NH_3 of 10 ppmvd for both natural gas and fuel oil operation. Further, there have been significant problems with accurate measurements of ammonia in the exhaust flue gas. The technical challenges will make it very difficult to assure compliance at the low concentrations proposed.

Opacity

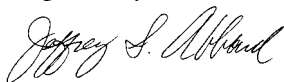
For oil-fired units with heat inputs less than 150 MMBtu/hr, the opacity limit during the start cycle should be no limit. Gas turbines in this size range can be started in less than 10-15 minutes resulting in minimal environmental impact.

Heat Capacity Input

The recommended threshold for consideration for heat input should be 150 MMBtu/hr, instead of 100 MMBtu. And this should be determined on a Lower Heating Value (LHV) basis, which is standard for the industry.

Thank you for giving GTA the opportunity to comment on the 2003 GT SOTA Manual. GTA would appreciate the opportunity to discuss these issues in person with the NJDEP at your convenience. Please feel free to contact me at (202) 669-7575 should you have any questions and/or comments regarding this submission.

Respectfully,



Jeff Abboud
Executive Director