

State of Florida  
DEPARTMENT OF ENVIRONMENTAL REGULATION  
INTEROFFICE MEMORANDUM

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ST. JOHNS RIVER

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BUREAU OF  
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SUB DISTRICT - JAX

TO : Joseph W. Landers, Jr.

FROM: J. P. Subramani *J. P. Subramani*

DATE: August 11, 1978

SUBJ: BACT Application for Four Florida Power Corporation  
Gas Turbines, Suwannee River Plant Site,  
Suwannee County

Facility: Four 63,000 KW gas turbine electric generating units to be located at Florida Power Corporation's Suwannee River Plant. The units, scheduled for commercial operation in October 1980, will be known as Suwannee River Peaking Units 1 through 4.

At a peak power level of 63,000 KW, each unit will burn approximately 37,910 pounds of distillate fuel per minute which constitutes a heat input rate of 739 million BTU/hr.

BACT Determination Requested by the Applicant

Nitrogen Dioxide:	75 ppm by volume
Sulfur Dioxide:	95 ppm by volume
Opacity:	Less than 20%

Date Receipt of a Complete BACT Application:

May 12, 1978

Date of Publication in the Florida Administrative Weekly:

June 23, 1978

Date of Publication in a Newspaper of General Circulation:

June 30, 1978 - Florida Times Union

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Study Group Members:

Steve Smallwood, Bureau of Air Quality Management, DER  
 Albert Townsend, South Florida District, DER  
 Robert Kapplemann, City of Jacksonville,  
 Department of Health  
 Frank Darabi, St. John River Subdistrict, DER.  
 Victoria Martinez, BACT Coordinator, DER

Study Group Recommendations:

	*Albert Townsend	Robert Kapplemann	Steve Smallwood	Frank Darabi
Ash Content of Fuel		.01%		Low
Particulates				.08 lb/ETU
NO <sub>2</sub>	Wet Method	50 ppmv-water or steam to fuel ratio of about 1.4	±75 ppmv with EPA's upward corrections for efficiency and fuel bound nitrogen	75 ppmv
SO <sub>2</sub>	Low Sulfur Oil	±.3% S Oil	±100 ppmv	.3% S Fuel
Opacity		10% except for start-up	±20%	20%
HC				
CO				
Noise				Minimized at property line.

\*Albert Townsend felt the data provided by the applicant was insufficient to establish specific emission limits.

\*\*Steve Smallwood considered 60 ppmv NO<sub>2</sub> 80 ppm SO<sub>2</sub> and 10% opacity to be a reasonable alternative. However, he felt sufficient information was not provided by the applicant to analyze the economic impact of this alternative.

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Other State and Local Emission Standard Applicable to Gas Turbines\*:

<u>Pollutant</u>	<u>Fuel</u>	<u>Typical</u>	<u>Most Stringent</u>
NO <sub>x</sub>	Gas	(75 ppm @ 15% O <sub>2</sub> ) 0.3 lb NO <sub>x</sub> /MMBTU	(42 ppm @ 15% O <sub>2</sub> ) 125 ppm @ 3% O <sub>2</sub> )
	Oil	(75 ppm @ 15% O <sub>2</sub> ) 0.3 lb NO <sub>x</sub> /MMBTU	(75 ppm @ 15% O <sub>2</sub> ) 0.3 lb NO <sub>x</sub> /MMBTU
SO <sub>2</sub>	Oil	187 ppm 1% Sulfur by Weight (1 lb SO <sub>2</sub> /MMBTU)	56 ppm 0.3% Sulfur by Weight (0.3 lb SO <sub>2</sub> /MMBTU)
CO	All	None	None
Visible Emissions	All	20%	0%

\*From the EPA's SSEIS document, EPA/450/2-77-017a

EPA's Proposed New Source Performance Standards for Gas Turbines:

The proposed standards were published in the Federal Register October 3, 1977 and are expected to be promulgated January, 1979, as follows:

Nitrogen Dioxide: 75 ppm by volume at 15 percent oxygen on a dry basis.

The standard would include an adjustment factor (see attachment) for gas turbine with thermal efficiencies greater than 25 percent, and also an adjustment factor (see attachment) for turbines burning fuels with fuel bound nitrogen content greater than 0.15 percent by weight. Each factor would result in a larger number. Measured NO<sub>x</sub> levels would be adjusted to the International Standards Organization (ISO) reference conditions of 15°C and 60% R.H., 101.3 kilopascals pressure.

Sulfur Dioxide: 150 ppm by volume corrected to 15 percent oxygen, or  
 0.8% Sulfur by weight in fuel.

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BACT Determination by Florida Department of Environmental Regulation:

Nitrogen Dioxide: 75 ppm by volume at 15 percent oxygen on a dry basis, adjusted to ISO.

The proposed standard would be EPA's proposed New Source Performance Standard. NO<sub>x</sub> emissions from gas turbines, therefore, would be limited according to the following equation:

$$STD = (.0075 E) + F$$

Where:

STD = allowable NO<sub>x</sub> emission (percent by volume at 15 percent oxygen)

E = efficiency adjustment factor:  $\frac{14.4 \text{ kilojoules/watt}\cdot\text{hr}}{\text{Actual ISO heat rate}}$

F = fuel-bound nitrogen allowance:

<u>Fuel-Bound Nitrogen</u> percent by weight (N)	<u>F</u> (NO <sub>x</sub> - percent by volume)
(N) less than 0.015 percent	0
(N) between 0.015 and 0.1 percent	0.04 (N)
(N) between 0.1 and 0.25 percent	0.004 + 0.0067 (N-0.1)
(N) greater than 0.25 percent	0.005

During performance tests to determine compliance with the proposed standard, measured NO<sub>x</sub> emission at 15 percent oxygen would be adjusted to ISO ambient atmospheric conditions by the following correction factor:

$$NO_x = (NO_{x_{obs}}) \left( \frac{P_{ref}}{P_{obs}} \right)^{0.5} e^{19 (H_{obs} - 0.00633)}$$

Where:

NO<sub>x</sub> = Emissions of NO<sub>x</sub> at 15 percent oxygen and ISO standard ambient conditions.

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$NO_{x_{obs}}$  = Measured  $NO_x$  emission at 15 percent oxygen, ppmv.  
 $P_{ref}$  = Reference combustor inlet absolute pressure at 101.3 kilopascals (1 atmosphere) ambient pressure.  
 $P_{obs}$  = Measured combustor inlet absolute pressure.  
 $H_{obs}$  = Specific humidity of ambient air.  
 $e$  = Transcendental constant (2.718)

Sulfur Dioxide: 95 ppm by volume corrected to 15 percent oxygen in a dry basis, or 0.5% Sulfur by weight in fuel

Hydrocarbons: None

Carbon Monoxide: None

Particulates: None

Opacity: Less than 20%

Justification of DER Determination:

Nitrogen Dioxide:

The proposed standard was selected after carefully examining the recommendations of the study group and the SSIES document for EPA's proposed standard. The SSIES document showed test data on 8 simple cycle peaking gas turbines. Of these, only 6 were fired with distillate fuel. Tests for controlled emissions were available for 4 of these 6 turbines. Test results showed a range in emission of 55 to 80 ppmv (after EPA's proposed upward correction for turbine efficiencies above 25%). Although three of these four turbines had emissions below or at the 60 ppmv level, the EPA's 75 ppmv standard was preferred because it allowed for the uncertain validity of the limited test data available.

SO<sub>2</sub>

The only available and economically feasible technique for sulfur dioxide emission control is low sulfur oil. Other techniques for tail gas cleanup cost two to three times as much as the turbine itself.

In selecting the 0.5% S fuel by weight as the standard, the availability of this fuel and the relative economic advantage of its use were considered.

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The lower 0.3% S by weight proposed by two members of the study group would result in an increase in fuel cost of 1.8% or about \$53,500/unit per year - a conservative estimate. Increases in ambient air concentrations expected to result from the operation of the turbines do not justify the need for the more stringent standard and increased cost of production.

HC, CO, Particulates:

The SSEIS document shows insignificant impact on ambient air from the limited gas turbines emissions of these pollutants.

Opacity:

The proposed standard is consistent with the SSEIS document and agrees with the recommendation of two of the three members of the group proposing an opacity standard.

Details of Analysis May be Obtained by Contacting:

Victoria Martinez  
Bureau of Air Quality Management  
Department of Environmental Regulation  
2600 Blair Stone Road  
Twin Towers Office Building  
Tallahassee, Florida 32301

Recommendation from: Bureau of Air Quality Management

by: J. P. Subramani  
J. P. Subramani

DATE: AUGUST 11, 1978

Approved by:

Victoria Landers, Jr.  
J. W. Landers, Jr.  
Secretary

DATE:

August 16, 1978