Florida Power
CORPORATION

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BUREAU OF AIR REGULATION

November 6, 2000

Mr. Hamilton S. Oven, P.E., Administrator
Siting Coordination Office
Florida Department of Environmental Protection
2600 Blair Stone Road (M.S. 48)
Tallahassee, Florida 32399-2400

RE: Florida Power Corporation
Hines Energy Complex
Power Block 2
Power Plant Siting Supplemental Application No. PA-92-33SA
DOAH Case No. 00-3125EPP; OGC Case No. 00-01490

Dear Mr. Oven:

Florida Power Corporation (FPC) is pleased to submit to the Florida Department of Environmental Protection (FDEP), and all parties to the above-referenced certification proceeding, responses to the agency comments in the FDEP's Notice of Insufficiency. Consistent with the provisions of the Florida Electrical Power Plant Siting Act, FPC is submitting this information within 40 days of the filing of FDEP's Notice of Insufficiency.

In the spirit of cooperation, responses are being provided by FPC to all agency comments contained in FDEP's Notice of Insufficiency. However, FPC considers the following agency comments to be beyond the scope of sufficiency pursuant to Section 403.5067 Florida Statutes, since they raise issues unrelated to the proposed Power Block 2 project:

Agency	Comment
FDEP Industrial Wastewater	1
	2 (except as to volume of brine)
	3
	4
	5
	6
FDEP Groundwater	1
Southwest Florida Water Management District (SWFWMD)	2 (except as to request for flow diagram depicting proposed post-reclamation drainage enhancement for Camp Branch)
	4
	5

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P.O. Box 14042 • St. Petersburg, FL 33733-4042 • (727) 820-5151
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In developing the enclosed responses, FPC has communicated with staff of FDEP and SWFWMD in an effort to ensure the responses address the matters of concern or ambiguity in an appropriate manner. Consequently, we trust that our responses will be determined to be sufficient. In accordance with the agreed-upon schedule, the FDEP's determination as to the sufficiency of these responses is due by November 28, 2000.

As always, FPC looks forward to continuing to work with you and the agency staff participating in the certification process. Should you, your staff, or any agency representatives have any questions concerning the information provided, please do not hesitate to contact me at 727-826-4121.

Sincerely,

Patricia Q. West

Patricia Q. West
Manager, Environmental Programs

Enclosure

cc: See attached list of recipients

Florida Power Corporation
Hines Energy Complex Power Block 2
Supplemental Site Certification Application
Responses to Sufficiency Requests

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Florida Power Corporation

Supplemental Site Certification Application:

Responses to Sufficiency Requests

Hines Energy Complex

POWER BLOCK 2

November 2000

Florida Power CORPORATION

Volume 3

STATE OF FLORIDA
DIVISION OF ADMINISTRATIVE HEARINGS

IN RE: FLORIDA POWER CORPORATION	)	
HINES ENERGY COMPLEX	)	OGC CASE NO. 00-1490
(POWER BLOCK 2)	)	DOAH CASE NO. 00-3125EPP
POWER PLANT SITING SUPPLEMENTAL	)	
APPLICATION PA92-33SA	)	
	)	

FLORIDA POWER CORPORATION'S NOTICE OF FILING RESPONSES TO NOTICE OF INSUFFICIENCY OF THE DEPARTMENT OF ENVIRONMENTAL PROTECTION

Applicant, Florida Power Corporation (FPC), by and through its undersigned counsel, hereby serves notice that it has submitted its responses to all of the comments and questions of the Department of Environmental Protection (DEP) regarding the insufficiency of the Supplemental Site Certification Application for FPC's Hines Unit 2 Project. FPC's responses to the DEP's Notice of Insufficiency, issued September 26, 2000, are contained in a one-volume document entitled "Florida Power Corp. Supplemental Site Certification Application Responses to Sufficiency Requests," dated November 6, 2000. This document has been submitted directly to the DEP and copies distributed to the recipients of the Supplemental Site Certification Application. A copy of FPC's transmittal letter to DEP for these Responses is included in the Response.

These Responses have been submitted in accordance with Section 403.5067(1)(a), Florida Statutes, and Rule 62-17.081, Florida Administrative Code (F.A.C.).

Respectfully submitted this 6th day of November, 2000.

HOPPING GREEN SAMS & SMITH, P.A.

By: [signature]

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Counsel for
FLORIDA POWER CORPORATION

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that copies of the foregoing have been furnished to the following by hand delivery or overnight delivery on this 6th day of November, 2000:

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Attorney

HINES ENERGY COMPLEX: POWER BLOCK 2 RESPONSES TO AGENCY SUFFICIENCY COMMENTS AND QUESTIONS

Florida Department of Environmental Protection

I	Air	FDEP-1 – FDEP-69
II	Water	
	A. Industrial Wastewater	FDEP-70 – FDEP-76
	B. Groundwater	FDEP-77

Southwest Florida Water Management District

I	Water Use and Reclamation	SWFWMD-1 – SWFWMD-8

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

I: AIR

See the following October 30, 2000 letter from Mr. Ken Kosky, P.E. of Golder Associates to Mr. Joe Kahn, P.E. of the Florida Department of Environmental Protection.

Golder Associates Inc.
6241 NW 23rd Street, Suite 500
Gainesville, FL 32653-1500
Telephone (352) 336-5600
Fax (352) 336-6603

Golder Associates

October 30, 2000 9837576

New Source Review Section, Bureau of Air Regulation
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Attention: Mr. Joseph Kahn, P.E.

RE: Request for Additional Information
DEP File No. 1050234-004-AC (PSD-FL-296)
Hines Energy Complex, Power Block 2

Dear Joe:

This correspondence and attachments provide information requested by the Florida Department of Environmental Protection (DEP) in the letter dated August 23, 2000 regarding the air construction permit application.

Comment 1
Please provide the air quality impact modeling data files for Department review. The Department may have additional questions related to air quality modeling after review of this information.

Response: This information was provided to FDEP on August 24, 2000.

Comment 2
Please provide the CO concentrations for natural gas firing and fuel oil firing at the outlet of the turbine/inlet of the HRSG, for conditions of 50% and 60% of full load, or provide curves that cover these operating conditions. Also provide mass emission estimates for these loads.

Response: The operating conditions requested in the application for Power Block 2 were for the load ranges from 60 to 100 percent load for gas-firing and 65 to 100 percent load for oil-firing. The performance for 60 percent load for gas firing was inadvertently omitted from the emissions tables in Appendix A of the Air Construction Permit/PSD Application. The data supplied in Appendix A, which has been updated to include 60 percent load for gas firing and emissions of HAPs, cover the operating characteristics for these conditions. This information is submitted with this letter as Attachment 1. Operating under conditions of 50 percent (gas and oil) and 60 percent (oil only) load would only occur during periods of startup, shutdown, fuel switching and malfunction. Siemens Westinghouse has provided expected performance for loads of 50 and 60 percent.

With natural gas firing, the CO emission rate is 50 ppmvd corrected to 15 percent O_2 at 60 percent load and 200 ppmvd corrected to 15 percent O_2 at 50 percent load. This performance is expected over the range of ambient temperatures. The mass CO emissions at an ambient temperature of 59°F are 146 and 508 lb/hr for 60 and 50 percent load, respectively.

With distillate oil firing, the CO emission rate is 580 ppmvd corrected to 15 percent O_2 at 60 percent load and 1,000 ppmvd corrected to 15 percent O_2 at 50 percent load. This performance is expected over the range of ambient temperatures. The mass CO emissions at an ambient temperature of 59°F are 1,779 and 2,783 lb/hr for 60 and 50 percent load, respectively.

Comment 3

Please provide the vendor's quote used in the cost effectiveness analysis for selective catalytic reduction. This quote must be for this project and not a scaled estimate from another project, or from a turbine of different size or manufacturer.

Response: Attached (see Attachment 2) is a vendor quote for the installation of SCR on a Siemens Westinghouse 501F combustion turbine operating in combined cycle configuration that was used in the BACT analysis for Power Block 2. This budgetary estimate was developed specifically for this machine but not necessarily the project. The Hines Energy Complex, Power Block 2 will utilize the Siemens Westinghouse 501F combustion turbine. These turbines are based on a standard design with standard performance curves. As such, the quoted SCR system is not specific to a project but to a type of turbine and is based primarily on the mass flow through the machine and inlet emissions. Therefore, as a budgetary estimate for the project, the attached vendor quotation is valid for use in evaluating BACT. The actual SCR vendor will be determined during the procurement stage of the project and after final regulatory approvals (i.e., Air Construction Permit and PSD Approval, and Site Certification Conditions) are obtained and design engineering is performed. However, the basic conceptual design of the SCR system will remain the same.

Comment 4

Based on the hours of operation and load levels requested in the application, the Department is likely to require control of CO with an oxidation catalyst to an expected level of 6 ppmvd @ 15% O_2 or less. Please address, if you wish, any changes to your requested allowable operation given this possibility.

Response: The proposed BACT emission rate for CO when firing natural gas for loads of 65 to 100 percent is 10 ppmvd (corrected to 15 percent oxygen). This emission rate is within the range of CO emissions rate established by the Department as BACT on "F" Class turbines when firing natural gas. For oil firing, the proposed BACT emissions rate for CO for loads of 65 to 100 percent is 30 ppmvd corrected to 15 percent O_2. Again, this emission rate is within the range of CO emissions rate established as BACT on "F" Class turbines when firing distillate oil. In determining the potential emissions for CO and in the BACT evaluation, 3,000 hours of low load operation was included to accommodate cycling of the plant. This produced a conservative estimate of CO emissions that was based on 4,760 hours of gas-firing at 100 percent load, 1,000 hours of oil-firing at 100 percent load and 3,000 hours operation at 60 percent load when firing natural gas. It is requested that the Department consider establishing a 24-hour block average emission limit for CO when firing gas. A 24-hour block average was proposed by the Department for the Osprey Energy Center (PSD-FL-287) to accommodate low load operation. This project is also using the Siemens Westinghouse 501F combustion turbine. A concentration of 23 ppmvd corrected to 15 percent oxygen is calculated based on Siemens Westinghouse data for 8 hours of low-load operation when firing natural gas. This is calculated from 10 ppmvd corrected to 15 percent O_2 for 16 hours and 50 ppmvd corrected to 15 percent O_2 for 8 hours [(10 x 16 + 50 x 8)/24 = 23]. Given the Osprey Energy Center draft permit and FPC's experience with Hines Energy Complex Power Block 1, FPC proposes a 24-hour block average CO limit of 16 ppmvd corrected to 15 percent O_2.

Comment 5
Please provide the vendor's quote used in the cost effectiveness analysis for oxidation catalyst for CO control, and provide a cost effectiveness estimate using this quote. This quote must be for this project and not an estimate from another project, or from a turbine of different size or manufacturer.

Response: Attached (see Attachment 2) is a vendor quote for the installation of an oxidation catalyst on a Siemens Westinghouse 501F combustion turbine operating in combined cycle configuration. This vendor quote was used in the BACT analysis. Also, please refer to the response to Comment 3 regarding project specific vendor quotations.

Comment 6
The Department has advised other applicants that it considers SCONOx to be a commercially available technology. Please obtain a vendor quote from Alstom Power for SCONOx with commercial and performance guarantees similar to that of the SCR system with an oxidation catalyst, and provide a cost effectiveness estimate using this quote. This quote must be for this project and not an estimate from another project, or from a turbine of different size or manufacturer.

Response: Attached (see Attachment 3) is a vendor quote from ABB Alstrom Power for the installation of a SCONOx™ system on a Siemens Westinghouse 501F combustion turbine operating in combined cycle configuration. This vendor quote was used to evaluate the cost effectiveness of the SCONOx™ technology. Attachment 4 contains Tables 4-5a and 4-6a that show the capital and annualized cost, respectively, for SCR and SCONOx™. Table 4-8 presents a comparison of the environmental aspects of each technology. Also, please refer to the response to Comment 3 regarding project specific vendor quotations.

Although SCONOx™ is theoretically technically feasible, it has not been demonstrated on an "F" Class combustion turbine. Performance data on future applications on "F" Class turbines considering SCONOx™ will likely be available after 2002, well after the Hines Energy Complex, Power Block 2 is scheduled to start construction. The SCONOx™ system has only been operated on a 32 MW facility in California since 1996 and a 5 MW unit in Massachusetts since 1999. The scale up of this complicated technology should not be underestimated. The SCONOx™ technology installed on an "F" Class turbine would involve a dozen or more different catalyst chambers for absorption and regeneration. Every 15 to 30 minutes, dampers would be operated to isolate a particular catalyst chamber for regeneration. Each regeneration cycle must isolate the chamber so that oxygen is not introduced and regeneration gas (hydrogen) is introduced. There is concern that damper seal leaks would be significant as applied to the large volume flows associated with an "F" Class CT. While ammonia is not required for the SCONOx™ system, the turbine backpressure with SCONOx™ is approximately 60 percent greater than for SCR, and SCONOx™ requires natural gas and steam for regeneration of the catalyst beds. In contrast, SCR is a proven and demonstrated technology that can achieve the same NO_x reduction performance.

While ammonia is not used or emitted from a SCONOx™ system, there are substantial natural gas and energy requirements for the system that would directly produce additional air pollutants. The natural gas required to produce the steam needed for SCONOx™ is equivalent to 27 mmBtu/hr or 235,200 mmBtu/year. The natural gas requirement needed for SCONOx™ is equivalent to 1.9 mmBtu/hr or 16,000 mmBtu/year. These energy requirements, combined with the turbine backpressure and electrical usage would increase emissions of carbon dioxide by about 23,800 ton/year. When all the energy requirements for SCONOx™ are considered, it is about 2.3 percent of the combustion turbine heat input. In contrast, SCR results in an additional 0.3 percent of the combustion turbine heat input.

Data suggest that a budgetary estimate of capital cost for SCONOx™ on one turbine/HRSG unit for the proposed Hines Energy Complex, Power Block 2 is $30 million. Information supplied by ABB Alstrom is attached and the procedures in the EPA Cost Control Manual were used to estimate total capital and annualized costs. In contrast, the capital cost for SCR is about $3.2 million, which is about one-tenth the cost of SCONOx™. The annualized cost of SCONOx™ is estimated at $6.3 million while the annualized cost for SCR is $1.7 million. These comparisons are shown in Tables B-3a and B-4a (see Attachment 4), which present the capital and annualized costs of SCR and SCONOx™. The cost effectiveness of SCONOx™ is $9,340 per ton of NO_x removed. In contrast, the cost effectiveness of SCR is $2,570 per ton of NO_x removed. The cost effectiveness of SCONOx™ is nearly 4 times higher than SCR with uncertainty in its demonstrated feasibility on "F" Class combustion turbine projects.

Comment 7

Please provide an updated estimate of HAP emissions for this project and include complete supporting information for any emission factors and assumptions used in the estimate. The application does not indicate whether this project is major for HAPs. Please address.

Response: Golder Associates has revised the emission factors for hazardous air pollutants (HAPs) to reflect the availability of additional data. The revised HAP emissions are based on emission factors from the April 2000 revision of EPA's AP-42 emission factor database. The HAPs are included as part of Tables A-26 and A-27 in Attachment 1.

An evaluation of the HAP emissions from the project indicates that emissions are less than 25 tons/year for all HAPs and less than 10 tons/year for any single HAP and therefore not a major source of HAPs. As shown in Table A-27, the maximum total emissions of HAPs are estimated to be 7.7 tons/year with maximum emissions of any single HAPs at 2.7 tons/year (i.e., for formaldehyde). Therefore, the requirements of 40 CFR 63.43 for a maximum achievable control technology are not applicable to the project.

Except for formaldehyde and toluene, the emission factors are those presented in Tables 3.1-4 and 3.1-5 of the revised AP-42 section for combustion turbines. For formaldehyde, a review of EPA's database was conducted and an emission factor was estimated based on comparisons of the turbines and emission characteristics from EPA's database to those proposed for this project. A discussion regarding this review and estimation of the formaldehyde emission factor is presented below.

The original emission factor for formaldehyde used in the application was from the Electric Power Research Institute (EPRI)- sponsored Electric Utility Trace Substances Synthesis Report. This report was submitted to EPA as part the requirements of the 1990 Clean Air Act Amendments to study potentially toxic air pollutants from utility sources. These data were the most technically accurate and complete data available on emission from utility sources. The emission factor used for the proposed CTs was 34 lb/10^{12} Btu. It should be recognized that there are still limited data on formaldehyde emissions from large (i.e., > 100 MW) gas turbines.

The recent EPA emission factor suggests formaldehyde emissions from gas turbines of 780 lb/10^{12} Btu when firing natural gas at loads greater than 80 percent. The EPA suggested emission factor for all loads is 3,100 lb/10^{12} Btu.

The AP-42 emission factors for formaldehyde when firing natural gas are not appropriate for the proposed Power Block 2 for several reasons. First, and most importantly, the data used to develop the AP-42 emission factors are not representative of the Siemens Westinghouse combustion turbine. Second, an evaluation of the data in the EPA Combustion Turbine Emissions Database clearly suggests a much lower emission factor for formaldehyde. Some of the important aspects of the EPA Gas Turbine Database related to formaldehyde emission are as follows.

- The formaldehyde emissions are from small (< 30 MW) gas turbines. The available data are from an average capacity of about 28 MW. More importantly, the median capacity, or the turbine size where an equal number of turbines are above and below that size, is about 15 MW. Data from only 8 large turbines (>30 MW) are included in the EPA database, with a maximum size of 88 MW.

- In contrast to the AP-42 emission factors for formaldehyde, which are based on an average value, the median value is substantially lower. For all loads, the median formaldehyde emission factor is about 320 lb/10^{12} Btu; for turbine loads greater than 50 percent, the median emission factor is about 110 lb/10^{12} Btu. Since the median emission factor is about 8 to ten times lower than the average factor, this clearly points to the wide range in formaldehyde emissions and how the individual turbine combustion characteristics can influence the results. The median is a measure of the middle of the distribution and in distributions where there is symmetry about the mean, the mean and median coincide. However, in highly skewed distributions, as that observed for formaldehyde emissions, the median is more representative of a "truer average" since the median is not influenced by extreme values.
- There is a strong relationship between formaldehyde and CO emissions, as noted by EPA in the support document and as observed in the data. Gas turbines with higher CO emissions had higher observed formaldehyde emissions. An evaluation of the coincident CO and formaldehyde data from the EPA database indicates that formaldehyde emissions were 150 lb/10^{12} Btu with CO emissions less than 0.1 lb/mmBtu under baseload conditions.

The CO emissions from the Siemens Westinghouse 501F turbine are less than 0.1 lb/mmBtu under base load conditions. Preliminary testing on a facility in California using a Siemens Westinghouse 501F combustion turbine indicates that formaldehyde emissions are about 150 lb/10^{12} Btu.

The California Air Resource Board sponsored a program to develop emission factors for toxic air pollutants. These factors, referred to as California Air Toxic Emission Factors (CATEF), included an emission factor for formaldehyde. The suggested emission factor for formaldehyde for firing natural gas in combined cycle facilities is 108 lb/10^{12} Btu.

Based on the available data, formaldehyde emissions would be in the range between 100 and 150 lb/10^{12} Btu. An emission factor of 150 lb/10^{12} Btu is considered appropriate for the Hines Energy Complex, Power Block 2 for formaldehyde emissions.

For toluene, an emission factor of 33 lb/10^{12} Btu was determined to be representative for the project based on an evaluation of EPA's Gas Turbine Database. This factor is based on the median value for loads greater than 80 percent. The recent EPA emission factor, which is based on data from much smaller turbines than those proposed for this project, suggests toluene emissions from gas turbines of 130 lb/10^{12} Btu when firing natural gas at loads greater than 80 percent. For all loads, the average and median EPA factors are 94 and 19 lb/10^{12} Btu, respectively. Since the median emission factor is about 4 to 5 times lower than the average factor, this clearly points to the large range in toluene emissions and how the individual turbine combustion characteristics can influence the results. The emission factor of 33 lb/10^{12} Btu is also about a factor of 4.5 times lower than that of formaldehyde, which is similar to the ratio of EPA's formaldehyde to toluene emission factors.

EPA developed the emission factors for many of the other HAPs in a manner similar to that for formaldehyde. For these HAPs, fewer data are available and are also considered not representative of state-of-the-art DLN combustion systems. The use of AP-42 emission factors for these HAPs is considered to provide conservative estimates of emissions.

Comment 8

Provide an estimate of the duration and quantity of emissions under expected startup and shutdown scenarios. How many (and what duration) of startup and shutdown cycles are anticipated per day, month, and year for each combustion turbine? The Department plans to address excess emissions from startup and shutdown in its BACT determination.

Response: To determine the amount of startup and shut down cycles for the purposes of this response, a production simulation model was run for the initial years of operation (2004 and 2005). The model incorporates historical data representative of load and simulates how the Power Block 2 would operate given its specific power generating parameters (e.g., heat rate, capacity, fuel cost, etc.). While such modeling has limitations, it provides a general estimate of projected operations.

The results indicate that in 2005 when the units are fully operational, there would be an average of about 32 startup and shutdown cycles per unit per year. The startup and shutdown cycles are highly dependent on the season. For the winter months of December, January and February, 18 startup and shutdown cycles per unit are predicted. During the Spring months (March, April and May), 10 startup and shutdown cycles per unit are predicted. For the summer months of June, July and August, about one startup and shutdown cycle per unit is predicted. In the fall, (September, October and November), three startup and shutdown cycles per unit are predicted. The months of June, July and October were predicted to have no startup and shutdown cycles, while the months of December, January and March are predicted to have 7 to 8 startup and shutdown cycles.

Estimating excess emissions from the startup and shutdown cycles is confounded by many factors, making an accurate estimate difficult. This includes the availability of turbine performance for very low loads and the specific conditions during which the startup and shutdown occur. For the latter, the time for startup can vary. A warm start can be accomplished within two hours, while a cold start requires up to four hours. Conservative "ballpark" estimates of excess emissions have been developed based on the annual number of startup and shutdown cycle per unit. Startup was assumed to require an average of three hours while shut down was assumed to require one hour. Natural gas was assumed as the fuel since it is the primary fuel proposed for Power Block 2. An average load of 50 percent was assumed during these periods since data are available from the manufacturer for this condition. The emissions during the startup and shutdown cycles used in the estimate were 196 lb/hr, 508 lb/hr and 29.8 lb/hr for NOx (without SCR), CO and VOC, respectively. The mass emissions of PM and SO_2 are not higher at 50 percent load relative to other loads. The amount of estimated excess emissions for NOx, CO and VOC, respectively, are 25.1 tons/year, 65.0 tons/year and 3.8 tons/year. (Example calculation: 32 startup/shutdown cycles per unit x 4 hours x 196 lb/hr x ton/2,000 lb x 2 units = 25.1 tons/year.)

It should be recognized that the number of predicted startup and shutdown cycles is likely to be conservative, given the experience with Power Block 1, which has experienced very few startup and shutdown cycles over the last one and a half years.

FPC proposes that during operation, excess emissions will be minimized according to the Department's Rules at 62-210.700. For example, the proposed control system for NOx would be operated when the temperature within the catalyst bed reaches the proper reaction temperature for the system to operate (650 °F +/- 20 °F).

Comment 9

The maximum heat input rate at 59°F of 1830 mmBtu/hr, firing gas, and 1932 mmBtu/hr, firing oil, (HHV) is less than the newly increased allowable maximum heat input rate of 1915 mmBtu/hr, firing gas, and 2020 mmBtu/hr, firing oil, (HHV) for the turbines for Power Block 1. Please address and revise the estimated potential mass emissions if the requested maximum heat input rate is revised in this application.

Response: The performance, including heat rate, and emissions contained in the application were provided to FPC by Siemens Westinghouse for Power Block 2. The increased performance of Power Block 1 cited by the Department represents about a 5 percent increase in heat input. Heat input is proportionally related to mass flow and emissions at the same heat rate. If acceptable to the Department, FPC proposes a 5 percent increase in heat input and mass flow to envelop the likelihood of increased performance. These changes are reflected in the revised data sheets provided with this response that reflect a 5 percent increase in heat input and mass flow. (see Attachment 5). These have been identified separately from those using the Siemens Westinghouse-provided information.

Comment 10

What are the actual CO and NO_x concentrations at the outlet of the turbines of Power Block 1 over the range of the operating conditions requested for Power Block 2?

Response: There is no NO_x CEM located prior to the SCR catalyst in Power Block 1. In addition, no SCR inlet testing has been recently performed at Power Block 1 with its current design. Therefore, there are no valid test results available to accurately estimate NO_x emissions over the range of operating conditions from the combustion turbines installed in Power Block 1. For CO, the compliance tests conducted in 1999 while only at full-load were 0.66 ppmvd (2.11 lb/hr) for Unit 1A and 1.14 ppmvd (3.78 lb/hr) for Unit 1B. The compliance tests conducted at full-load in 2000 for CO, were 0.36 ppmvd (1.12 lb/hr) for Unit 1A and 0.15 ppmvd (0.43 lb/hr) for Unit 1B. These results were previously submitted to the Department to demonstrate compliance with the CO emission limits.

Comment 11

Are there any other proposed emissions units related to this project such as fuel heaters, cooling towers, fuel storage tanks? Will emissions increase at any existing emissions units as a result of this project?

Response: The project does not include fuel heaters, cooling towers or storage tanks. Fuel heaters are not required for Power Block 2 since any fuel heating can be accommodated through the use of steam from the HRSG. The condenser cooling for the steam cycle is accomplished using cooling water from an existing cooling pond. The existing 3.7 million-gallon storage tank constructed for Power Block 1 is sufficient for Power Block 2 and no new storage tanks are required. When in operation, there will be insignificant amounts of fugitive VOC emissions from operation and maintenance. This includes lube oil vents, relief valves, painting, etc. Such insignificant activities were identified in the Title V application for Power Block 1 and will be included in the Title V application for Power Block 2. The operation of Power Block 2 will not increase emissions from existing sources currently at the Hines Energy Complex site.

Comment 12

Please provide supporting information for the SAM emissions factor.

Response: The emission factor for sulfuric acid mist (SAM) was based on 10 percent conversion of the sulfur in fuel to SAM. This factor was assumed to account for the conversions of sulfur or SO_2 in the combustion turbine, SCR catalyst and the HRSG to sulfur trioxide (SO_3) emissions and then SAM. The combustion process was assumed to account for 5 percent of the conversion of sulfur to SAM. The SCR catalyst and HRSG was assumed to account for another 5 percent of the conversion of sulfur to SAM. These assumptions are consistent with emission estimates provided to Golder Associates on the emissions of SO_3 for "F" Class turbines on other projects, AP-42 emission factors for distillate oil firing in steam generators (i.e., Table 1.3-1 in AP-42) and information on SCR systems.

Comment 13

What are cases A, B, C and D in Table A-25?

Response: The cases listed in Table A-25 with columns identified as A, B, C and D were based on different operating scenarios based on hours of natural gas and distillate oil firing, as well as low-load operation. This table has been updated and included in the revised Appendix A to the Air Construction Permit/PSD Application (see Attachment 1).

Comment 14

Please provide more information to support the estimate of costs of instrumentation considered in the cost estimate for CO catalyst. Also, provide more detail regarding the estimate for heat rate penalty in your analysis.

Response: The instrumentation cost was based on the standard factor in the EPA OAQPS Cost Control Manual of 10% of the vendor-supplied equipment. If an oxidation catalyst were installed a CO CEM is anticipated with appropriate instrumentation. (e.g., continuous CO monitor, calibration equipment, calibration gases, etc.).

The heat rate penalty results from the pressure drop caused by the oxidation catalyst. This causes a reduction in the amount of power that can be generated by the combustion turbine and an increase in the amount of fuel required for each MW generated (i.e., heat rate as in mmBtu/kW-hour). These are each distinct and separate costs since the former results in revenue that would otherwise be obtained while the combustion turbine was operating, while the latter is an increase in cost of generation as a result of requiring more fuel input for each MW generated. The concept of performance loss is presented in EPA's Alternative Control Techniques Document—NO_x Emissions from Stationary Gas Turbines, Table 6-8 (January 1993; EPA-453/R-93-007). The performance loss of the oxidation catalyst was estimated at 0.2 percent. The cost estimate was based on a baseload generating capacity of the turbine of 180 MW at a heat input of 1,837 mmBtu/hr. The generation lost was calculated as follows: 0.002 x 180 MW x $0.04/ kW-hr x 1,000 kW/MW x 8,760 hr/yr = $126,144. The heat rate increase was calculated as follows: 0.002 x 1,837 mmBtu/hr x $3/mmBtu x 8,760 hr/year = $96,553. The total is $222,697 as listed in the annualized cost table.

We appreciate your timely review of these responses. Please call if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

Kennard F. Kosky, P.E.
Principle
Professional Engineer Registration No. 14996

SEAL

KFK/jfg

cc: J. Michael Kennedy, FPC

R.C.McCann, Golder
Greg Worley, EPA Region IV

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ATTACHMENT 1

Tables A- 9 through –12 (60 percent load for natural gas firing)
Table –25
Tables 26 and 27 for HAPs

Table A-9. Design Information and Stack Parameters for the FPC Hines-2 Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 60% Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Combustion Turbine Performance			
Evaporative cooler status/ efficiency (%)	Off	Off	Off
Ambient Relative Humidity (%)	80	60	55
Gross power output (MW)	120.13	108.54	93.99
Gross heat rate (Btu/kWh, LHV)	10,125	10,610	11,075
(Btu/kWh, HHV)	11,230	11,775	12,295
Heat Input (MMBtu/hr, LHV)- calculated	1,216	1,152	1,041
- provided	1,214	1,154	1,061
(MMBtu/hr, HHV) - estimated	1,347	1,280	1,178
(HHV/LHV)	1.110	1.110	1.110
Fuel heating value (Btu/lb, LHV)	21,038	21,038	21,038
(Btu/lb, HHV)	23,345	23,345	23,345
(HHV/LHV)	1.110	1.110	1.110
CT Exhaust Flow			
Mass Flow (lb/hr)	2,321,309	2,687,524	2,572,306
Temperature (°F)	1,088	1,112	1,083
Moisture (% Vol.)	7.18	7.89	9.17
Oxygen (% Vol.)	13.18	13.08	13.08
Molecular Weight - calculated	28.50	28.42	28.26
- provided	28.50	28.42	28.27
Volume Flow (acfm)= [(Mass Flow (lb/hr) x 1,545 x (Temp. (°F)+ 460°F)] / [Molecular weight x 2116.8] / 60 min/hr			
Mass flow (lb/hr)	2,321,309	2,687,524	2,572,306
Temperature (°F)	1,088	1,112	1,083
Molecular weight	28.50	28.42	28.26
Volume flow (acfm)- calculated	1,364,103	1,308,271	1,708,519
- provided			
Fuel Usage			
Fuel usage (lb/hr)= Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu (Fuel Heat Content, Btu/lb (LHV))			
Heat input (MMBtu/hr, LHV)	1,214	1,154	1,061
Heat content (Btu/lb, LHV)	21,038	21,038	21,038
Fuel usage (lb/hr)- calculated	57,690	54,830	50,440
- provided	57,690	54,830	50,440
Heat content (Btu/cf, LHV)	920	920	920
Fuel density (lb/ft³)	0.0437	0.0437	0.0437
Fuel usage (cf/hr)- calculated	1,319,220	1,253,819	1,153,431
Stack and Exit Gas Conditions- HRSG			
Stack height (ft)	125	125	125
Diameter (ft)	19.0	19.0	19.0
Temperature (°F)	190	190	190
HRSG- Volume flow (acfm)= CT Volume flow (acfm) x [(HRSG Temp. (°F) + 460 K) / (CT Temp. (°F) + 460)]			
CT Volume flow (acfm)	1,364,103	1,308,271	1,708,519
CT Temperature (°F)	1,088	1,112	1,083
HRSG Temperature (°F)	190	190	190
HRSG Volume flow (acfm)	782,731	747,695	719,726
Velocity (ft/sec)= Volume flow (acfm) / [((diameter)²/4) x 3.14159] / 60 sec/min			
Volume flow (acfm)	782,731	747,695	719,726
Diameter (ft)	19.0	19.0	19.0
Velocity (ft/sec)- calculated	46.0	44.0	42.3

Source: Siemens-Westinghouse, 2000.

Note: Universal gas constant= 1,545 ft-lb(force)/°R; atmospheric pressure= 2,116.8 lb(force)/ft²

Table A-10. Maximum Emissions for Criteria and Other Regulated Pollutants for the FPC Hines-2 Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 60% Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Hours of Operation	3,000	3,000	3,000
Particulate from CT and SCR			
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer (front- and back-half)			
Basis, lb/hr (a)	5.3	5.1	4.8
Particulate from SCR = Sulfur trioxide (formed from conversion of SO_2) converts to ammonium sulfate (= PM10)			
Particulate from conversion of SO_2 = SO_2 emissions (lb/hr) x Conversion SO_2 to SO_3 x lb SO_3/lb SO_2 x Conversion of SO_3 x lb SO_3 to $(NH_4)_2SO_4$ x $(NH_4)_2SO_4$/ lb SO_3			
SO_2 emission rate (lb/hr)- calculated	3.8	3.6	3.3
Conversion (%) from SO_2 to SO_3	10	10	10
MW SO_3/ SO_2 (80/64)	1.3	1.3	1.3
	100	100	100
MW $(NH_4)_2SO_4$/ SO_3 (132/80)	1.7	1.7	1.7
Particulate (lb/hr)- calculated	0.78	0.74	0.68
Particulate (lb/hr) from CT + SCR	6.1	5.8	5.5
(TPY)	9.1	8.8	8.2
Sulfur Dioxide (lb/hr) = Natural gas (cf/hr) x sulfur content(gr/100 cf) x 1 lb/7000 gr x (lb SO_2/lb S) /100			
Fuel use (cf/hr)	1,319,220	1,253,819	1,153,431
Sulfur content (grains/ 100 cf) - assumed (b)	1	1	1
lb SO_2/lb S (64/32)	2	2	2
Emission rate (lb/hr)- calculated	3.8	3.6	3.3
(lb/hr)- provided (1 gr/100 cf)	3.75	3.56	3.27
(TPY)	5.7	5.4	4.9
Nitrogen Oxides (lb/hr) = NOx(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 x Volume flow (acfm) x 46 (mole. wgt NOx) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 5.9 x 1,000,000 (adj. for ppm)]			
Basis, ppmvd @15% O_2 (a) (d)	3.5	3.5	3.5
Moisture (%)	7.18	7.59	9.17
Oxygen (%)	13.18	13.08	13.08
Volume Flow (acfm)	1,864,103	1,808,271	1,708,519
Temperature (°F)	1,088	1,112	1,083
Emission rate (lb/hr)- calculated	16.8	15.9	14.7
(lb/hr)- provided	16.8	15.9	14.6
(TPY)	25.2	23.9	21.9
[Ratio lb/hr provided/calculated]	1.000	0.999	0.996
Carbon Monoxide (lb/hr) = CO(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 lb/ft2 x Volume flow (acfm) x 28 (mole. wgt CO) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]			
Basis, ppmvd- calculated	56.8	56.8	55.1
Basis, ppmvd @ 15% O2- calculated	50	50	50
- provided (a)	50	50	50
Moisture (%)	7.18	7.89	9.17
Oxygen (%)	13.18	13.08	13.08
Volume Flow (acfm)	1,864,103	1,808,271	1,708,519
Temperature (°F)	1,088	1,112	1,083
Emission rate (lb/hr)- calculated from given pp	146.1	138.5	127.5
(lb/hr)- provided	154.0	146.0	134.0
(TPY)	231.0	219.0	201.0
[Ratio lb/hr provided/calculated]	1.054	1.054	1.051
VOCs (lb/hr) = VOC(ppm) x [1 - Moisture(%)/ 100] x 2116.8 lb/ft2 x Volume flow (acfm) x 16 (mole. wgt as methane) x 60 min/hr / [1545 x (CT temp (°F) + 460°F) x 1,000,000 (adj. for ppm)]			
Basis, ppmvd (as CH_4)- calculated	3.4	3.4	3.3
Basis, ppmvd @ 15% O2- calculated	3.0	3.0	3.0
- provided (a) (e)	3.0	3.0	3.0
Moisture (%)	7.18	7.59	9.17
Oxygen (%)	13.18	13.08	13.08
Volume Flow (acfm)	1,864,103	1,808,271	1,708,519
Temperature (°F)	1,088	1,112	1,083
Emission rate (lb/hr)- calculated	5.0	4.7	4.4
(lb/hr)- provided	5.3	5.0	4.6
(TPY)	8.0	7.5	6.9
[Ratio lb/hr provided/calculated]	1.054	1.053	1.052
Lead (lb/hr) = NA			
Emission Rate Basis	NA	NA	NA
Emission rate (lb/hr)	NA	NA	NA
(TPY)	NA	NA	NA
Mercury (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu (c)	8.00E-04	8.00E-04	8.00E-04
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	1.08E-06	1.02E-06	9.42E-07
(TPY)	1.62E-06	1.54E-06	1.41E-06
Sulfuric Acid Mist = SO2 emission rate (lb/hr) x conversion rate of SO2 to H_2SO_4 (%) x MW H_2SO_4/MW SO_2 (98/64)			
SO2 emission rate (lb/hr)	3.8	3.6	3.3
lb H_2SO_4/lb SO_2 (98/64)	1.53	1.53	1.53
Conversion to H_2SO_4 (%) (b)	10	10	10
Emission Rate (lb/hr)	0.58	0.55	0.50
(TPY)	0.87	0.82	0.76

Source: (a) Siemens-Westinghouse, 2000.
(b) Golder Associates Inc., 2000.
(c) Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table E-12)
(d) For NOx emissions, data originally provided at 3.5 ppmvd at 15% oxygen.
(e) For VOC emissions, data originally provided at 2.8 ppmvd at 15% oxygen.

Table A-11. Maximum Emissions for Other Regulated PSD Pollutants for the FPC HInes-2 Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 60% Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Hours of Operation	3,000	3,000	3,000
2,3,7,8 TCDD Equivalents (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	1.20E-06	1.20E-06	1.20E-06
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	1.62E-09	1.54E-09	1.41E-09
(TPY)	2.42E-09	2.30E-09	2.12E-09
Beryllium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Fluoride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00

Source: Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12).
Emission factors for metals are questionable and not used .

Note: No emission factors for hydrogen chloride (HCl) from natural gas-firing.

Table A-12. Maximum Emissions for Hazardous Air Pollutants for the FPC Hines-2 Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 60% Load

Parameter	Ambient/Compressor Inlet Temperature		
	20 °F	59 °F	90 °F
Hours of Operation	3,000	3,000	3,000
Acetalhyde (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (b), lb/10^12 Btu	4.00E+01	4.00E-01	4.00E-01
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	5.39E-02	5.12E-02	4.71E-02
(TPY)	8.08E-02	7.68E-02	7.07E-02
Benzene (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (b), lb/10^12 Btu	1.20E+01	1.20E+01	1.20E-01
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	1.62E-02	1.54E-02	1.41E-02
(TPY)	2.42E-02	2.30E-02	2.12E-02
1,3 Butadiene (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (b), lb/10^12 Btu	4.30E-01	4.30E-01	4.30E-01
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	5.79E-04	5.50E-04	5.06E-04
(TPY)	8.69E-04	8.26E-04	7.60E-04
Acrolein (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (b), lb/10^12 Btu	6.40E+00	6.40E+00	6.40E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	8.62E-03	8.19E-03	7.54E-03
(TPY)	1.29E-02	1.23E-02	1.13E-02
Formaldehyde (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (a), lb/10^12 Btu	1.50E+02	1.50E+02	1.50E+02
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	5.30E-01	1.92E-01	1.77E-01
(TPY)	7.95E-01	2.88E-01	2.65E-01
Ethlybenzene (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (b), lb/10^12 Btu	3.20E+01	3.20E+01	3.20E+01
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	4.31E-02	4.10E-02	3.77E-02
(TPY)	6.46E-02	6.14E-02	5.65E-02
Napthalene (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (b), lb/10^12 Btu	1.30E+00	1.30E+00	1.30E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	1.75E-03	1.66E-03	1.53E-03
(TPY)	2.63E-03	2.50E-03	2.30E-03
Propylene Oxide (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (b), lb/10^12 Btu	2.90E+00	2.90E+00	2.90E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	3.91E-03	3.71E-03	3.41E-03
(TPY)	5.86E-03	5.57E-03	5.12E-03
Polycylic Aromatic Hydrocarbons (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (b), lb/10^12 Btu	2.20E+00	2.20E+00	2.20E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	2.96E-03	2.82E-03	2.59E-03
(TPY)	4.44E-03	4.22E-03	3.89E-03
Xylene (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis (b), lb/10^12 Btu	6.40E+01	6.40E+01	6.40E+01
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	8.62E-02	8.19E-02	7.54E-02
(TPY)	1.29E-01	1.23E-01	1.13E-01
Toluene (lb/hr) = Basis (lb/10^12 Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^12 Btu			
Basis, lb/10^12 Btu	3.30E+01	3.30E+01	3.30E+01
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	4.44E-02	4.22E-02	3.89E-02
(TPY)	6.67E-02	6.34E-02	5.83E-02

Sources: (a) Golder Associates, 2000; (b) EPA,2000
Emission factors for metals are questionable and not used.

Table A-25 Summary of Maximum Potential Annual Emissions for the CT/HRSG

Pollutant		Annual Emissions (tons/year)[a]			Maximum Emissions (tons/year)[b]				PSD
		Natural Gas	Natural Gas	Distillate Oil	Case A	Case B	Case C	Case D	Significant Emission Rates
	Load:	100%	60%	100%					
	Hours:	8,760	3,000	1,000					
One Combustion Turbine: Combined Cycle									
SO_2		22.4	5.4	48.6	22.4	20.1	68.4	66.1	40
PM/PM10		34.4	8.8	29.8	34.4	31.4	60.3	57.3	25/15
NO_x		101	24	55	101.2	90.4	144.3	133.5	40
CO		184	219	53	184.0	340.0	216.0	372.0	100
VOC (as methane)		19.1	7.5	10.5	19.1	20.0	27.4	28.4	40
Sulfuric Acid Mist		3.4	0.8	7.4	3.4	3.1	10.5	10.1	7
Lead		0	0.00E+00	1.04E-02	0.0E+00	0.0E+00	1.0E-02	1.0E-02	0.6
Mercury		6.41E-06	1.54E-06	6.05E-04	6.4E-06	5.8E-06	6.1E-04	6.1E-04	0.1
MWC Organics (as 2,3,7,8-TCDD)		9.62E-09	2.30E-09	3.67E-07	9.6E-09	8.6E-09	3.8E-07	3.7E-07	3.50E-06
MWC Metals (Be & Cd)		0.0	0.0	3.4E-03	0.0E+00	0.0E+00	3.4E-03	3.4E-03	15
MWC Acid Gases (HCL)		0.0	0.0	0.2	0.0	0.0	0.2	0.2	40.0
Total HAPs		1.93	0.77	1.80	1.9	2.0	3.5	3.6	25
Two Combustion Turbines: Combined Cycle									
SO_2		44.9	10.7	97.1	44.9	40.2	136.9	132.3	40
PM/PM10		69	18	60	69	63	121	115	25/15
NO_x		202	48	109	202	181	289	267	40
CO		368	438	106	368	680	432	744	100
VOC (as methane)		38.1	15.0	21.0	38.1	40.1	54.8	56.7	40
Sulfuric Acid Mist		6.9	1.65	14.87	6.87	6.16	20.96	20.25	7
Lead		0.00E+00	0.00E+00	2.09E-02	0.00E+00	0.00E+00	2.09E-02	2.09E-02	0.6
Mercury		1.28E-05	3.07E-06	1.21E-03	1.28E-05	1.15E-05	1.22E-03	1.22E-03	0.1
MWC Organics (as 2,3,7,8-TCDD)		1.92E-08	4.61E-09	7.34E-07	1.92E-08	1.73E-08	7.51E-07	7.49E-07	3.50E-06
MWC Metals (Be & Cd)		0.00E+00	0.00E+00	6.90E-03	0.00E+00	0.00E+00	6.90E-03	6.90E-03	15
MWC Acid Gases (HCL)		0.0	0.00	0.40	0.00	0.00	0.40	0.40	40.0
Total HAPs		3.9	1.55	3.60	3.87	4.09	7.02	7.25	25

[a] Based on 59 °F compressor inlet air temperature

[b] Maximum emission cases:

Operation	Number of Hours for Operation: Case A	Case B	Case C	Case D
100 % Load	8,760	5,760	7,760	4,760
100 % Load-Oil	0	0	1,000	1,000
60% Load-Gas	0	3000	0	3,000
Total hours	8,760	8,760	8,760	8,760

Table A-26. Toxic Air Pollutant Emission Factors and Emissions for Combustion Turbine when Firing Natural Gas
FPC Hines Energy Complex - Power Block 2 (Siemens Westinghouse 501 F)

Parameter		Emission Rate (lb/hr) firing Natural Gas for Operating Conditions of									Natural Gas Maximum Annual Emissions (TPY) (2)	
		100 % Load			80 % Load			60 % Load				
Ambient Temperature (°F)		20 °F	59 °F	90 °F	20 °F	59 °F	90 °F	20 °F	59 °F	90 °F		
HIR (MMBtu/hr)		2,012	1,830	1,705	1,652	1,534	1,419	1,347	1,230	1,178	1 CT	2 CTs
HAPs (Section 112(b) of Clean Air Act)												
1,3-Butadiene		0.00087	0.00079	0.00073	0.00071	0.00066	0.00061	0.00058	0.00055	0.00051	0.0034	0.0069
Acetaldehyde		0.080	0.073	0.068	0.066	0.061	0.057	0.054	0.051	0.047	0.32	0.64
Acrolein		0.0129	0.0117	0.0109	0.0106	0.0098	0.0091	0.0086	0.0082	0.0075	0.051	0.103
Benzene		0.0241	0.0220	0.0205	0.0198	0.0184	0.0170	0.0162	0.0154	0.0141	0.096	0.19
Ethylbenzene		0.0644	0.0586	0.0546	0.0529	0.0491	0.0454	0.0431	0.0410	0.0377	0.256	0.51
Formadehyde		0.302	0.275	0.256	0.248	0.230	0.213	0.202	0.192	0.177	1.20	2.4
Naphthalene		0.00262	0.00238	0.00222	0.00215	0.00199	0.00184	0.00175	0.00166	0.00153	0.0104	0.021
Polycyclic Aromatic Hydrocarbons (PAH)	(3)	0.00443	0.00403	0.00375	0.00363	0.00337	0.00312	0.00296	0.00282	0.00259	0.0176	0.035
Propylene Oxide		0.0563	0.0531	0.0494	0.0479	0.0445	0.0412	0.0391	0.0371	0.0342	0.232	0.46
Toluene		0.066	0.060	0.056	0.055	0.051	0.047	0.044	0.042	0.039	0.265	0.53
Xylene		0.129	0.117	0.109	0.106	0.098	0.091	0.086	0.082	0.075	0.51	1.03
Antimony		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HAPs (Total)											2.97	5.9

(1) Emissions based on the following emission factors and conversion factors for firing natural gas:

Emission Factors		Value	Reference
1,3-Butadiene	(a)	0.43	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000
Acetaldehyde		40	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000
Acrolein		6.4	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000
Benzene		12	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000
Ethylbenzene		32	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000
Formadehyde		150	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000, Database
Naphthalene		1.3	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000
Polycyclic Aromatic Hydrocarbons (PAH)		2.2	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000
Propylene Oxide	(a)	29	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000
Toluene		33	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000, Database
Xylene		64	$lb/10^{12}$ Btu; AP-42, Table 3.1-3, EPA 2000
Antimony		0.0	
Arsenic		0.0	
Beryllium		0.0	
Cadmium		0.0	
Chromium		0.0	
Lead		0.0	
Manganese		0.0	
Mercury		0.0	
Nickel		0.0	
Selenium		0.0	

(a) Based on 1/2 the detection limit; expected emissions are lower.

(2) Annual emissions based on ambient temperature of 59 °F firing natural gas for 8760 hours at 100 percent load
(3) Assumed to be representative of Polycyclic Organic Matter (POM) emissions, a regulated HAP.

Table A-27. Toxic Air Pollutant Emission Factors and Emissions for Combustion Turbine when Firing Natural Gas and Fuel Oil
FPC Hines Energy Complex - Power Block 2 (Siemens Westinghouse 501 F)

Parameter	Emission Rate (lb/hr) during Distillate Fuel Oil for Operating Conditions of: 100 % Load			80 % Load			65 % Load			Maximum Annual Emissions (TPY): Distillate Fuel Oil (2)		Natural Gas (4)		Natural Gas and Fuel Oil (2)	
Ambient Temperature (°F)	20 °F	59 °F	105 °F	20 °F	59 °F	105 °F	20 °F	59 °F	105 °F						
HIR (MMBtu/hr)	2,100	1,932	1,707	1,644	1,524	1,364	1,385	1,296	1,182	1 CT	2 CTs	1 CT	2 CTs	1 CT	2 CTs
HAPs (Section 112(b) of Clean Air Act)															
1,3-Butadiene	0.0336	0.0309	0.0273	0.0263	0.0244	0.0218	0.0222	0.0207	0.019	0.015	0.031	0.0034	0.0069	0.019	0.037
Acetaldehyde	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.32	0.64	0.294	0.57
Acrolein	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.051	0.103	0.045	0.091
Benzene	0.116	0.106	0.094	0.090	0.084	0.075	0.076	0.071	0.063	0.053	0.11	0.096	0.19	0.138	0.28
Ethylbenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.256	0.51	0.227	0.45
Formaldehyde	0.588	0.541	0.478	0.460	0.427	0.382	0.388	0.363	0.331	0.27	0.5	1.20	2.4	1.34	2.7
Naphthalene	0.0735	0.0676	0.0597	0.0575	0.0533	0.0477	0.0485	0.0454	0.0414	0.034	0.07	0.0104	0.021	0.043	0.086
Polycyclic Aromatic Hydrocarbons (PAH) (3)	0.084	0.077	0.0683	0.0658	0.0610	0.0546	0.0554	0.0518	0.0473	0.039	0.08	0.0176	0.035	0.054	0.11
Propylene Oxide	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.232	0.46	0.206	0.41
Toluene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.265	0.53	0.234	0.47
Xylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.51	1.03	0.45	0.91
Antimony	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic	0.0231	0.0213	0.0188	0.0181	0.0168	0.0150	0.0152	0.0143	0.0130	0.011	0.021	0.0	0.0	0.0106	0.022
Beryllium	0.000651	0.000599	0.000529	0.000510	0.000472	0.000423	0.000429	0.000402	0.000366	0.00030	0.0006	0.0	0.0	0.00030	0.00060
Cadmium	0.01008	0.00927	0.00819	0.00789	0.00732	0.00655	0.00665	0.00622	0.00567	0.0044	0.009	0.0	0.0	0.0046	0.009
Chromium	0.0231	0.0213	0.0188	0.0181	0.0168	0.0150	0.0152	0.0143	0.0130	0.011	0.021	0.0	0.0	0.0106	0.021
Lead	0.0294	0.0270	0.0239	0.0230	0.0213	0.0191	0.0194	0.0181	0.0165	0.014	0.027	0.0	0.0	0.014	0.027
Manganese	1.66	1.53	1.35	1.30	1.20	1.08	1.09	1.02	0.93	0.76	1.5	0.0	0.0	0.76	1.5
Mercury	0.00252	0.00232	0.00205	0.00197	0.00183	0.00164	0.00166	0.00156	0.00142	0.0012	0.0023	0.0	0.0	0.00116	0.0023
Nickel	0.00966	0.00889	0.00785	0.00756	0.00701	0.00627	0.00637	0.00596	0.00544	0.0044	0.009	0.0	0.0	0.0044	0.0089
Selenium	0.0525	0.0483	0.0427	0.0411	0.0381	0.0341	0.0346	0.0324	0.0296	0.024	0.048	0.0	0.0	0.024	0.048
HAPs (Total)										1.2	2.5	3.0	5.9	3.9	7.7

(1) Emissions based on the following emission factors and conversion factors for firing distillate fuel oil:

Emission Factors		Value	Reference
1,3-Butadiene	(a)	16	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Acetaldehyde		0.0	
Acrolein		0.0	
Benzene		55	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Ethylbenzene		0.0	
Formaldehyde		280	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Naphthalene		35	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Polycyclic Aromatic Hydrocarbons (PAH)		40	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Propylene Oxide		0.0	
Toluene		0.0	
Xylene		0.0	
Antimony		0.0	
Arsenic	(a)	11	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Beryllium	(a)	0.31	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Cadmium		4.8	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Chromium		11	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Lead		14	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Manganese		790	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Mercury		1.2	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Nickel	(a)	4.6	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Selenium	(a)	25	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000

(a) Based on 1/2 the detection limit; expected emissions are lower.

(2) Annual emissions based on ambient temperature of 59 °F and firing fuel oil for: 1,000 hours at 100 percent load
natural gas for 7,760 hours at 100 percent load
8,760 total hours

(3) Assumed to be representative of Polycyclic Organic Matter (POM) emissions, a regulated HAP.

(4) Annual emissions based on ambient temperature of 59 °F firing natural gas for 8,760 hours at 100 percent load

ATTACHMENT 2

Vendor Budgetary Estimate for SCR and Oxidation Catalyst

ENGELHARD

501F - Combined Cycle
CO and SCR Catalyst Systems
Engelhard Budgetary Proposal EPB00664
January 12, 2000

ENGELHARD CORPORATION
CAMET® CO CATALYST SYSTEM
NOxCAT™ VNX™ SCR NOx ABATEMENT CATALYST SYSTEM

Engelhard Corporation ("Engelhard") offers to supply to Buyer the Camet® metal substrate CO System and NOxCAT™ VNX™ ceramic substrate SCR systems summarized per the technical data and site conditions provided.

Scope of Supply
1. Engelhard **Camet®** CO catalyst in modules with internal support frame;
2. Engelhard NOxCAT™ VNX™ SCR catalyst in modules with internal support frame;
3. Ammonia Delivery System Components – 28% aqueous ammonia to skid

BUDGET PRICES: **Per Turbine** **See Schedule**

WARRANTY AND GUARANTEE:

Mechanical Warranty:	One year of operation* or 1.5 years after catalyst delivery, whichever occurs first.
Performance Guarantee:	Three (3) Years of operation* or 3.5 years after catalyst delivery, whichever occurs first. Catalyst warranty is prorated over the guaranteed life.
Expected Life	5 - 7 years

SCR SYSTEM DESIGN BASIS:

Gas Flow from:	501F CT
Gas Flow:	Horizontal
Fuel:	Natural Gas and Oil
Gas Flow Rate (At catalyst face):	See Performance data - Designed for Gas Velocities within ±15% at the reactor inlet
Temperature (At catalyst face):	Designed for Gas Temperature with maximum range ±20°F at the reactor inlet
CO Inlet (At catalyst face):	See Performance Data
CO Reduction	90%
NOx Inlet (At catalyst face):	25 ppmvd @ 15% O_2
NOx Reduction :	To 3.5 and 4.5 ppmvd @ 15%O_2
NH_3 Slip:	10 and 5 ppmvd @ 15%O_2
HRSG Cross Section	67 ft. H x 26 ft. W

ENGELHARD

~501F - Combined Cycle
CO and SCR Catalyst Systems
Engelhard Budgetary Proposal EPB00664
January 12, 2000

Performance Data

GIVEN / CALCULATED DATA	SW501F	SW501F	SW501F	SW501F	SW501F
FUEL	NG	NG	NG	NG	Oil
TURBINE EXHAUST FLOW, lb/hr	3,600,000	3,600,000	3,600,000	3,600,000	3,600,000
TURBINE EXHAUST GAS ANALYSIS, % VOL. N2	73.74	73.74	73.74	73.74	71.87
O2	12.34	12.34	12.34	12.34	11.10
CO2	3.81	3.81	3.81	3.81	5.20
H2O	9.18	9.18	9.18	9.18	10.90
Ar	0.93	0.93	0.93	0.93	0.93
GIVEN: TURBINE CO, ppmvd @ 15% O2	25	25	25	25	25
CALC.: TURBINE CO, lb/hr	100.2	100.2	100.2	100.2	113.5
GIVEN: TURBINE NOx, ppmvd @ 15% O2	25	25	25	25	42
CALC.: TURBINE NOx, lb/hr	164.6	164.6	164.6	164.6	313.2
CALC. GAS MOL. WT.	28.31	28.31	28.31	28.31	28.31
FLUE GAS TEMP. @ CO and SCR CATALYST, F (+/-20)	650	650	650	650	650
DESIGN REQUIREMENTS					
CO CATALYST CO OUT, ppmvd @ 15% O2	2.5	2.5	2.5	2.5	2.5
SCR CATALYST NOx OUT, ppmvd @ 15% O2	4.5	4.5	3.5	3.5	25
NH3 SLIP, ppmvd @ 15% O2	9	5	9	5	12
GUARANTEED PERFORMANCE DATA					
CO CATALYST CO CONVERSION, % - Min.	90.0%	90.0%	90.0%	90.0%	90.0%
CO OUT, lb/hr - Max.	10.0	10.0	10.0	10.0	11.3
CO OUT, ppmvd @ 15% O2 - Max.	2.5	2.5	2.5	2.5	2.5
CO PRESSURE DROP, "WG - Max.	1.3	1.3	1.3	1.3	1.3
SCR CATALYST NOx CONVERSION, % - Min.	82.0%	82.0%	86.0%	86.0%	40.5%
NOx OUT, lb/hr - Max.	29.6	29.6	23.0	23.0	186.4
NOx OUT, ppmvd @ 15% O2 - Max.	4.5	4.5	3.5	3.5	25
EXPECTED AQUEOUS NH3 (28% SOL.) FLOW, lb/hr	256.4	221.6	265.0	230.3	285.4
NH3 SLIP, ppmvd @ 15% O2 - Max.	9	5	9	5	12
SCR PRESSURE DROP, "WG - Max.	2.3	2.5	2.5	2.8	
CO SYSTEM	$773,000	$773,000	$773,000	$773,000	
REPLACEMENT CO MODULES	$674,000	$674,000	$674,000	$674,000	
SCR SYSTEM	$1,418,000	$1,578,000	$1,578,000	$1,738,000	
REPLACEMENT SCR MODULES	$940,000	$1,093,000	$1,093,000	$1,250,000	

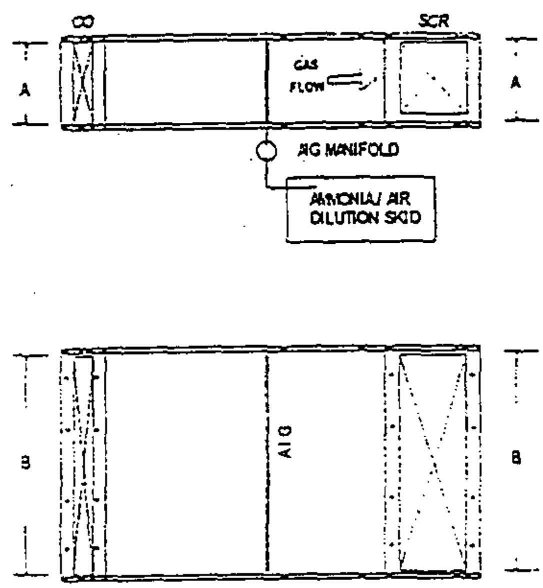
ENGELHARD

501F - Combined Cycle
CO and SCR Catalyst Systems
Engelhard Budgetary Proposal EPB00664
January 12, 2000

Scope of Supply: The equipment supplied is installed by others in accordance with Engelhard design and installation instructions.
Engelhard Camet® CO and NOxCAT™ VNX™ SCR catalyst in modules;
Internal support frames for catalyst modules - installed inside internally insulated casing (casing by others);
Ammonia Delivery System Components: 28% Aqueous Ammonia to skid
- Ammonia Injection Grid (AIG);
- AIG manifold with flow control valves ;
- NH_3/Air dilution skid: Pre-piped & wired (including all valves and fittings)
  - Two (2) dilution air fans, one for back-up purposes
  - Panel mounted system controls for:
    - Blowers (on/off/flow indicators)
    - Air/ammonia flow indicator and controller
    - System pressure indicators
    - Main power disconnect switch

Assumed Dimensions:
Reactor Cross Section

Inside Liner Width	**(A)**	**26 ft**
Inside Liner Height	**(B)**	**67 ft**



Excluded from Scope of Supply:
Ammonia storage and pumping
Internally insulated reactor Housing (HRSG Casing)
Any transitions to and from reactor
Any interconnecting field piping or wiring
Electrical grounding equipment
Utilities
Foundations
All Monitors
All other items not specifically listed in Scope of Supply

ATTACHMENT 3

SCONOx Budgetary Estimate

ALSTOM

July 12, 2000

Golder Associates
6241 NW 23rd Street
Suite 500
Gainesville, FL 32653

Attention: Mr. Steve Maltby

Re: SCONOx™ Catalytic Absorption Systems

Dear Mr. Maltby:

Alstom Power, Environmental Systems Division, is pleased to submit this budgetary proposal for the required SCONOx™ Systems for application on Heat Recovery Steam Generators (HRSG) for your combined cycle projects.

We have completed our sizing and cost estimates for the projects that you had forwarded to us for review. As you will recall, we had to hesitate on the SCONOx application for the simple cycle plant, due to temperature limits of the catalyst. Our budgetary offers for the remaining sites are summarized below.

	Engine	NOx In	NOx Out	Cost Estimate	Alstom Ref.
	501F	25 ppmvd	3.5 ppmvd	$16,712,000	133.0024

This proposal generally includes all necessary equipment and services as described in the "Scope of Work" section as a complete emissions control system package. The GA drawings attached with our proposal illustrate the proposed arrangement in greater detail. Please review this information, and the performance conditions indicated, and let us know if we can be of assistance in developing this project further. Pricing is addressed in proposal section 6.0.

If you require additional information or clarification, please feel free to contact me via e-mail or at (865) 694-5368.

Best Regards,
AP Environmental Systems Division

Noel Kuck
Product Manager

cc: Robert Hilton – AP Global DeNOx Manager
File 133.0024, Rev. 0

1409 Centerpoint Boulevard
Knoxville, Tennessee 37932-1962
Telephone (865) 693-7550
Telefax (865) 694-5203

US Operations

ALSTOM

PROPOSED SCONOx CATALYTIC ABSORPTION SYSTEMS FOR

GOLDER ASSOCIATES

GAINESVILLE, FL

Environmental Systems
Proposal Nos. 133.0024, 133.0025, 133.0029
Rev. 0

JULY 12, 2000

1.0 INTRODUCTION

Alstom Power (AP), Environmental Systems Division is pleased to provide this budgetary price quotation for the supply of SCONOx™ Catalytic Absorption Systems. This budgetary price proposa is for a SCONOx™ system, one (1) for each of three (3) gas turbines, to treat the exhaust gases from the combined cycle configurations.

This proposal is based upon the SCONOx™ system installation within the HRSG at a nominal operating temperature of 650°F. AP ESD's quotation and guarantees are based on the inlet NOx levels as stated elsewhere herein, when operating on natural gas.

AP Environmental Systems Division has licensed the SCONOx™ technology from Goal Line Environmental Technologies for NO_x abatement on combined cycle gas turbines. Goal Line is involved in catalytic research and development, and has developed processes for the control of CO, VOC, NOx, and SOx emissions from combustion processes such as turbines, boilers and engines.

The SCONOx™ system is a breakthrough in control technology that greatly reduces NO_x, CO and non-methane VOC emissions from exhaust streams without the use of ammonia. The system doe: not produce by-products that can coat boiler tubes, causing performance loss and corrosion. SCONOx™ also has the capacity to reduce emissions to lower levels as regulations change by simply adding more catalyst.

This ultra-clean technology is ideal for retrofit projects because of its wide operating temperature range (300°F to 700°F). This wide operating temperature range offers maximum flexibility in unit location and allows for installation downstream of the HRSG. Retrofit installations do not require boiler splitting and installation can be accomplished in much less time as a result.

The required utilities that are needed to run SCONOx™ (natural gas, water, steam, electricity, an ambient air) are present at most power plants; the logistics of plant operation do not change wher the SCONOx system is installed.

2.0 PROCESS DETAILS AND CONTROL

The SCONOx™ system is a breakthrough in pollution control technology that utilizes a single catalyst for the reduction of CO and NO_X. The system uses no ammonia, and can operate effectively at temperatures ranging from 300°F to 700°F; making it well suited to both new and retrofit applications.

Oxidation/Absorption Cycle

The SCONOx™ catalyst works by simultaneously oxidizing CO to CO_2, NO to NO_2, and then absorbing NO_2 onto its surface through the use of a potassium carbonate absorber coating. These reactions are shown below, and are referred to as the "Oxidation/Absorption Cycle".

$$CO + \frac{1}{2}O_2 \rightarrow CO_2$$
$$NO + \frac{1}{2}O_2 \rightarrow NO_2$$

$$2NO_2 + K_2CO_3 \rightarrow CO_2 + KNO_2 + KNO_3$$

The CO_2 in the above reactions exhausts up the stack. Note that during this cycle, the potassium carbonate coating reacts to form potassium nitrites and nitrates, which are then present on the surface of the catalyst. This reaction can be compared to a sponge absorbing water–just as a sponge absorbs water and must be wrung out periodically, the SCONOx™ catalyst must be regenerated to maintain maximum NOx absorption. The carbonate absorber coating on the surface of the catalyst absorbs nitrogen compounds, and the catalyst must enter the regeneration cycle.

Regeneration Cycle

The regeneration of the SCONOx™ catalyst, one of the features that makes the system so unique, is accomplished by passing a controlled mixture of regeneration gases across the surface of the catalyst in the absence of oxygen. The regeneration gases react with nitrites and nitrates to form water and elemental nitrogen. Carbon dioxide in the regeneration gas reacts with potassium nitrites and nitrates to form potassium carbonate, which is the absorber coating that was on the surface of the catalyst before the oxidation/absorption cycle began. This cycle is referred to as the "Regeneration Cycle", and the relevant reaction is shown below.

$$KNO_2 + KNO_3 + 4H_2 + CO_2 \rightarrow K_2CO_3 + 4H_2O + N_2$$

Water (as steam) and elemental nitrogen are exhausted up the stack instead of NO_X, anc potassium carbonate is once again present on the surface of the catalyst, allowing the oxidation/absorption cycle to begin again. There is no net gain or net loss of potassium carbonate after both the oxidation/absorption cycle and the regeneration cycle have beer completed; the process operates as a true catalyst.

Because the regeneration cycle must take place in an oxygen free environment, a section of catalyst undergoing regeneration must be isolated from exhaust gases. This is accomplished using a set of dampers, one upstream of the section being regenerated and one downstream. During the regeneration cycle, these dampers close and the regeneration gas inlet valve opens, allowing regeneration gas into the section. Tadpole type seals mounted on the sealing frame for the isolation dampers provide a durable and effective barrier against leaks during operation. At any given time, twelve (12) out of fifteen (15) catalyst shelves are in the oxidation/absorption cycle and three (3) of fifteen (15) are in the regeneration cycle. Because the same number of rows is always in the regeneration cycle, the production of regeneration gas always proceeds at a constant rate. A regeneration cycle typically is set to last for three (3) to eight (8) minutes, so each section is in the oxidation/absorption cycle for a range of twelve (12) to twenty-eight (28) minutes.

Regeneration Gas Production

The technology for producing a regeneration gas containing a dilute concentration of hydrogen from natural gas is well developed, and there are numerous reactions by which this can be accomplished. For installations below 450°F the SCONOx™ system uses an inert gas generator for the production of hydrogen and carbon dioxide. The regeneration gas will be diluted to under 4% hydrogen using steam as a carrier gas. The hydrogen design level for the typical SCONOx system is 2% hydrogen (H_2). The appropriate reaction for producing regeneration gas is listed below.

$$CH_4 + \frac{1}{2}O_2 + H_2O \rightarrow CO_2 + 3H_2$$

For installations with operating temperatures greater than 450°F, the catalyst can be regenerated by introducing a small quantity of natural gas with a carrier gas, such as steam, over a steam reforming catalyst and then into the SCONOx™ catalyst. The reforming catalyst initiates the conversion of methane to hydrogen, and the conversion is completed over the SCONOx catalyst.

The Reformer Catalyst works to partially reform the methane regeneration gas to hydrogen (2% by volume) to be used in the regeneration of the SCONOx™ and SCOSOx™ catalysts. The reformer converts methane to hydrogen by the steam reforming reaction shown in the equation below.

$$CH_4 + 2H_2O \rightarrow 4H_2 + CO_2$$

The Reformer Catalyst is placed prior to the SCONOx™ catalyst in a Steam Reformer Reactor. The catalyst is designed for a minimum 50% conversion of methane to hydrogen.

A gradual decrease in temperature is indicative of sulfur masking. To impede the rate of catalyst masking, a Sulfur Filter is installed prior to the steam reformer reactor. The sulfur filter is placed in the inlet natural gas feed prior to the regeneration production skid. The sulfur filter consists of impregnated granular activated carbon that is housed in a stainless steel vessel. Spent media is discarded as a non-hazardous waste.

SCOSOx™ Sulfur Removal Catalyst

The SCOSOx™ Sulfur Removal Catalyst works in conjunction with the SCONOx™ system and removes sulfur compounds from the exhaust stream. The SCOSOx™ Sulfur Removal Catalyst utilizes the same oxidation/absorption cycle and a regeneration cycle as the SCONOx™ system. However, SCOSOx™ selectively removes the sulfur from the exhaust stream. Chemical reactions for the SCOSOx™ system oxidation/absorption cycle are shown below.

$CO + ½O_2 \rightarrow CO_2$
$SO_2 + ½O_2 \rightarrow SO_3$

SO_3 + SORBER $\rightarrow$ [SO_3 + SORBER]

For the SCOSOx™ process above 500°F, the reaction for the regeneration cycle is also similar to that of the SCONOx™ catalyst:

[SO_3 + SORBER] + $H_2 \rightarrow SO_2 + H_2O$

Note that the regeneration gas used for the both types of catalyst (SCONOx™ and SCOSOx™) is the same (hydrogen), allowing them to be regenerated simultaneously. The SCOSOx™ catalyst is placed upstream of the SCONOx™ catalyst, and enhances the efficiency of NO_x absorption as well as removing sulfur compounds.

SCONOx™ Control System

A Programmable Logic Controller (PLC) controls the SCONOx™ system. This controller is programmed to control all essential SCONOx™ functions, including the opening and closing of louver doors and regeneration gas inlet and outlet valves, and the maintaining of regeneration gas flow to achieve positive pressure in each section during the regeneration cycle.

A PC control program supervises the system. The control program monitors, records, and reports system performance. It sends notifications and warnings when appropriate, and it allows the user to control the system by changing set points, such as pressures, regeneration cycle times, and flows. The PLC can, however, operate independently of the control program, thus a PC crash or loss of power to the PC will not interrupt the operation of the system.

3.0 PROJECT SCOPE

The AP Environmental Systems Scope of Supply for execution of the Project will include services and equipment as described below. In general, the Scope of Supply can be defined by the following categories:

Process Design, Engineering and Design of the System
Project Management and Project Services
SCONOx™ and SCOSOx™ Catalyst
Catalyst Rack and Reactor Housing including inlet and outlet Expansion Joints
Catalyst Module Inlet and Outlet Dampers
Regeneration Gas Production and Distribution
Catalyst Removal System
Control System (PLC)

Equipment and Services Provided by Others

All required permits (air, site, construction, etc.)
Utilities:
Supply of 480 volt power to the SCONOx system
Supply of natural gas for the SCONOx system
Supply of cooling water for the SCONOx system
Supply of 600 degree steam for the SCONOx system
Supply of compressed air for the SCONOx system
Mechanical Installation of the System
Electrical Installation of the System

Equipment List

A. SCONOx™ Reactor Assembly

Each installation will have a SCONOx™ reactor assembly that will be constructed of sub-assembled modules to form the complete assembly.

Reactor Assembly Outside Dimensions (Approximate)

Length*	Width	Height
28'-0"	44'-4"	66'-10"

*Lengths include inlet and outlet plenums.

The interior dimensions each of the fifteen catalyst sections are as follows:

Catalyst Section Interior Dimensions (Approximate)

Length	Width	Height
8'-10"	41'-8"	3-'8 1/2"

Each shelf will have a set of dampers, front and back, to be closed when the shelf is in regeneration mode. Dampers will have tadpole type seals to minimize regeneration gas leakage and isolate the section during regeneration. Each shelf will have one (1) inlet regeneration gas valve and two (2) outlet regeneration gas valves, which will open sequentially when the shelf is in regeneration mode. Normal operation will regenerate three (3) shelves (20% of 15 shelves) of catalyst at any given time.

B. **Regeneration Gas Mixing Assembly**

The Regeneration Gas Mixing Assembly will contain all pressure reducing valves, flow meters, and other equipment necessary to ensure the correct ratios of inert gas and steam that are introduced into the Steam Reforming catalyst.

C. **Regeneration Gas Distribution Piping and Valves**

The regeneration gas is piped to the reformer catalyst and then to the reactor via a main header and distributed to each of the fifteen (15) shelves of catalyst. Each catalyst section has one (1) inlet regeneration gas valve and two (2) outlet regeneration gas valves at the gas entrance side of the catalyst section.

D. **SCONOx™ Catalyst**

The SCONOx™ catalyst is a proprietary catalyst manufactured by Goal Line, which simultaneously oxidizes and absorbs CO and NO_X through the use of a potassium carbonate absorber coating.

E. **SCOSOx™ Catalyst**

The SCOSOx™ catalyst is very similar to the SCONOx™ catalyst, and is also manufactured by Goal Line. The SCOSOx™ catalyst favors the absorption of sulfur compounds instead of NO_X, and works to enhance the efficiency of the SCONOx™ process in the removal of NO_X. SCOSOx™ catalyst blocks have the same cross-sectional dimensions as SCONOx™ blocks, with the design depth dependent upon sulfur content in the exhaust gas.

F. **Catalyst Removal System**

The catalyst is removed and replaced using a service platform, which is raised and lowered to any one of the catalyst shelves. A mechanical winch is used to pull the catalyst in and out of the selected shelf.

G. Control System

A programmable logic controller (PLC) runs the control system with inputs made from a PC. The PLC controls all aspects of operation for the SCONOx system. The control system is factory tested and shipped pre-wired to the extent possible. All interconnecting wiring between the control panel and the field instruments is by others.

4.0 DESIGN BASIS AND PERFORMANCE GUARANTEES

STANDARD COMMERCIAL TERMS & CONDITIONS – SCONOx

Seller's offer for the sale of SCONOx and related equipment, as more fully described in Seller's equipment description and scope of work document, ("Equipment") is subject to execution by the parties of a contract based on the General Conditions below.

GENERAL CONDITIONS

1. DRAWINGS - Buyer shall furnish Seller with all information, instructions and drawings required for the execution of the work at the Contract signing. By its tender of such documentation, Buyer represents that it is complete and accurate as of the date of furnishing the same to Seller.

   Any drawings, data, computer programs or work products and all other information supplied by Seller hereunder shall remain the confidential and proprietary property of Seller and shall be used by Buyer only for the evaluation, operation and maintenance of the Equipment. Seller shall furnish its drawings and other technical documents in accordance with the schedule proposed herein and Buyer shall review, approve and return one set within the time period agreed upon herein. Any delay caused by Buyer's failure to promptly approve drawings shall entitle Seller to an equitable adjustment in the performance dates and/or the Contract Price.

2. DELAY IN PERFORMANCE - Seller shall not be liable for any expense, loss, or damage resulting from delay or prevention of performance of Seller or his subcontractors caused by fires, floods, Acts of God, strikes, labor disputes, labor shortages, inability to secure materials or equipment or manufacturing facilities, riots, thefts, accidents, transportation delays, acts or failure to act of Government or of Buyer, major equipment breakdown, fuel shortages, or any other cause whatsoever whether similar or dissimilar to those enumerated above, beyond the reasonable control of Seller. In the event of any delay arising by reason of the foregoing, the time for performance shall be extended by a period of time equal to the time lost by reason of such delay, plus a reasonable recovery period.

   In the event of such delay in performance of Seller's obligations hereunder, resulting from causes beyond the reasonable control of Seller or causes specified above, the contract price shall be adjusted to compensate Seller for additional or increased costs or expenses occasioned thereby and other affected provisions of the contract shall be equitably adjusted.

   To the extent the Scheduled Date for Delivery of the Equipment is delayed due to the fault of Seller, then Seller shall pay Buyer mutually agreed upon liquidated damages as Buyer's sole and exclusive remedy for such delays. Seller's total liability to Buyer for the payment of liquidated damages for delays shall not exceed fifteen percent (15%) of the Contract Price.

3. **UNLOADING AND INSTALLATION** - Unloading, hauling between free delivery point of common carrier and job site, handling, and installation of the equipment to be furnished hereunder shall be provided by Buyer.

4. **RISK OF LOSS** - All risk of loss of or damage to equipment sold hereunder shall finally pass to Buyer upon delivery to the F.O.B. point specified in the contract.

5. **INSURANCE** - During the performance of the Work, Seller shall obtain and maintain the following insurance:

   A. Workmen's Compensation Insurance and Employer's Liability Insurance as required by law;

   B. Comprehensive General Liability Insurance with a limit of $1,000,000 each person and $1,000,000 each occurrence for bodily injuries and with a limit of $1,000,000 each accident for property damage.

   If Buyer so requests, Seller shall furnish Buyer with certificates or other documentary evidence of the foregoing coverage.

6. **RESPONSIBILITY OF BUYER FOR OPERATION OF EQUIPMENT** - The operation of the equipment is within the exclusive control of Buyer and Buyer shall indemnify and save Seller harmless from expense and liability (including reasonable attorneys' fees) incurred by or imposed upon Seller based upon injury to person (including death) or damage to property (including the equipment) resulting from Buyer's tests, cleaning, operation or maintenance of the equipment or from modifications to the equipment by Buyer.

7. **LIMITATION OF LIABILITY** - Notwithstanding any other provision of the contract, in no event shall Seller, its subcontractors or its suppliers be liable, whether based on contract, tort, including negligence and strict liability, or otherwise, for loss of profits or revenue, loss by reason of plant shutdown, non-operation or increased expense of operation, service interruptions, cost of purchased or replacement power, claims of customers, cost of money, loss of use of capital or revenue, damage to property (other than the equipment supplied by Seller), loss or damage arising out of or related to occupational disease or non-compliance with environmental law, or for any special, incidental or consequential loss or damage.

   Seller's liability for the payment of liquidated damages as set forth in Article 2, Delay in Performance, and Article 8, Warranty, shall not in the aggregate exceed 15% of the Contract Price.

   Seller's liability on any claim of any kind, including negligence or strict liability, for any loss or damage arising out of, or resulting from this contract, or from its performance or breach, or from the manufacture, sale, delivery, resale, installation, technical consultation, inspection, repair, operation, or use of any equipment covered by or furnished under this contract shall in no case exceed the contract price.

No claim shall be asserted against Seller, its agents, employees, subcontractors or suppliers, unless the injury, loss or damage giving rise to the claim is sustained prior to the expiration of the period of warranty specified in the contract and no suit or action thereon shall be instituted or maintained unless it is filed in a court of competent jurisdiction within one year after the date the cause of action accrues.

The provisions of this Article 7 shall govern and prevail over any inconsistent or conflicting provisions elsewhere in the Contract.

8. WARRANTY

A. Workmanship and Material - Seller warrants that all equipment and material supplied by Seller hereunder shall be free from defects in material and workmanship for the period ending one year from the date of initial operation of the equipment, or two years from the date of shipment of the equipment, whichever date first occurs ("Equipment Warranty Period").

B. Performance Guarantees- Seller guarantees the proprietary catalyst as part of SCONOx catalytic oxidation and absorption system supplied by Seller ("Proprietary Catalyst") shall perform, based upon the specified Operating Conditions set forth in Table I of Attachment 1, in accordance with the guaranteed values set forth in table II therein ("Performance Guarantees"). The Performance Guarantees shall be deemed satisfied upon demonstrating equipment performance, in accordance with the Operating Conditions, that is equal to or better than the guaranteed values in Table II. All performance testing shall be conducted in accordance with the Performance Testing and Qualifications set forth in Article 9. During Performance testing, Buyer shall provide at its expense all fuels; utilities; operating and maintenance labor, materials and services (other than equipment, Proprietary Catalyst and services supplied by Seller) as may be required. Seller further warrants that the Proprietary Catalyst shall perform in accordance with the Performance Guarantees for a period ending three years following start up, which for the purposes of this clause shall be defined as the first time gas turbine exhaust is brought into contact with the Proprietary Catalyst, subject to the provisions set forth in paragraph D below (such three year period shall be defined as "Catalyst Warranty Period"). The warranty provided hereunder shall not apply in the event (i) any of the conditions or events stated in D (4) below occur, or (ii) to the extent the Buyer or its designee is negligent in the operation of the equipment and/or SCONOx system. During the Catalyst Warranty Period, Buyer shall have the burden of showing that neither condition in (i) or (ii) shall have occurred prior to or at the time of the alleged failure of the Proprietary Catalyst to perform as warranted.

C. Remedy - Seller shall repair, replace, or modify, at its option, any part or parts of the equipment defective in workmanship or material provided that Seller receives written notice from Buyer of a nonconformity within the applicable warranty period.

In the event the equipment fails to demonstrate the Performance Guarantees, Seller shall (i) repair, replace, or modify, at its option, any equipment as required to bring it into conformity with the Performance Guarantees, or (ii) pay Buyer the mutually agreed upon liquidated damages in the event the parties agree that such liquidated damages shall apply as Buyer's sole remedy for one or more of the parameters in the Performance Guarantees. Seller's total liability to Buyer for the payment of such liquidated damages in (ii) shall not exceed fifteen percent (15%) of the Contract Price.

D. Conditions

The following provisions shall apply to all warranties provided hereunder:

(1) All replacement parts, retrofits, or replacement catalysts shall be of Seller's manufacture or supply, or approved equal. Seller's repair and replacement hereunder shall be exclusive of any removal or installation costs, freight or insurance.

(2) Repair and replacement work will be performed on a straight-time labor basis only. Any premium time resulting from an accelerated schedule required by Buyer shall be for Buyer's account.

(3) The equipment supplied by Seller shall be erected, operated and maintained according to Seller's guidelines, maintenance and Operating Manual and otherwise in accordance with good engineering and operating principles. The Proprietary Catalyst shall be supplied by Seller with a SCOSOx guard bed in front of the SCONOx catalyst. Construction and start-up of the equipment shall be in the presence of Seller's Service Representative. During operation the equipment must:

(i) operate at temperatures between 300°F and 700°F at the SCONOx system inlet flange;

(ii) operate with the SCOSOx guard bed in place and within the specified regeneration times, flow rates, flow distribution and other operating conditions recommended by Seller. (Such recommendations will be revised during the Catalyst Warranty Period as Seller deems necessary);

(iii) Not be contaminated from Seller's list of known catalyst poisons or masking agents;

(iv) Not be washed or hosed off, or exposed to water, such as would occur from a catastrophic boiler tube rupture or other equipment failures resulting from plant emergencies or weather.

(4) All Warranties and Performance Guarantees will be voided if any of the following occur:

(i) Power plant upsets or the failure of Buyer (or its designee) to operate in accordance with Seller's latest recommendations which result in operating conditions that exceed any of the above conditions listed for maintaining warranties,

(ii) Minimum temperature cannot be reliably met, orsystem has one or more excursions below 300°F or above 700°F.

(iii) Catalyst is exposed to any quantity of liquid water under any conditions.

(iv) Catalyst is exposed to any of Seller's list of contaminants in any quantity including but not limited to heavy metals, including without limitation lead, mercury, arsenic, iron, silicon, chlorides, phosphorus, or phosphates, or greater than specified quantities of sulfur(to be determined with fuel requirements).

(5) Excluded from Seller's obligations for repair and replacement herein are repairs or replacements required as a result of wear and tear of the equipment or maintenance.

(6) The above warranty does not cover, and Seller makes no warranty which extends to, damage to the Equipment due to deterioration or wear occasioned by abrasion, corrosion, erosion or chemical attack resulting from exposure to conditions that are not within the Performance Conditions set forth in this Proposal or from operation not in accordance with the Seller's instructions.

(7) During the Catalyst Warranty Period, Buyer shall maintain daily process operating reports and logs. Seller's representatives shall have access (by electronic transfer if available) to such logs, to the CEM system operating data, and to all other test and operating records, the equipment, and other information they deem necessary to satisfy themselves of the validity of a claim under this warranty.

THE WARRANTIES AND PERFORMANCE GUARANTEES AS STATED IN THIS ARTICLE 8, AND THE REMEDIES PROVIDED HEREIN FOR SELLER'S FAILURE TO ACHIEVE SUCH WARRANTIES AND GUARANTEES, ARE EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER REPRESENTATIONS, SPECIFICATIONS, WARRANTIES, GUARANTEES AND REMEDIES EITHER EXPRESS OR IMPLIED, HEREIN OR ELSEWHERE, OR WHICH MIGHT ARISE UNDER LAW OR EQUITY OR CUSTOM OF TRADE INCLUDING WITHOUT LIMITATION WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A SPECIFIED OR INTENDED PURPOSE. THE REMEDY SPECIFIED REPRESENTS THE SOLE LIABILITY OF SELLER AND THE SOLE REMEDY OF BUYER WITH RESPECT TO OR ARISING OUT OF

THE EQUIPMENT OR SERVICES WHETHER BASED ON CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY), OR OTHERWISE.

9. PERFORMANCE TESTING QUALIFICATIONS

The following provisions shall apply to the performance testing of Seller's equipment:

(A) All performance tests shall be executed by an independent third party experienced in such work and mutually acceptable to Buyer and Seller. Buyer will bear the costs of the performance tests.

(B) All Performance tests shall be conducted with the combined cycle gas turbine (CCGT) and heat recovery steam generator (HRSG) equipment operating and steady state conditions. [No imposed means shall be used to create test conditions different from normal operating conditions].

(C) Performance tests for emissions or steam consumption shall have a minimum duration of one hour, and shall be preceded by a one hour stabilization period. All process streams shall be sampled or measured simultaneously.

(D) Buyer will maintain all CEM system recording devices, as well as process and maintenance logs necessary to monitor operation, from the initial equipment start-up date through the final performance testing period.

(E) Buyer will notify Seller in writing at least thirty (30) days prior to the scheduled performance test date. It shall be Seller's responsibility to furnish a test observer on the scheduled date.

(F) Buyer will provide Seller with three (3) copies of the final test report, including all raw data within seven days of receipt of same.

(G) If after the final performance test run (if there is more than one) is completed, and the Performance Guarantees are not met (unless such guarantees have been previously met or waived), Buyer shall so notify Seller in writing. Upon receipt of said notice, Seller shall have the right, at its option, to replace the charge of Proprietary Catalyst in the SCONOx system and Seller shall not charge for its personnel or the replacement of Proprietary Catalyst. Buyer shall make the equipment available for Seller's replacement and retest no later than 30 days after receipt of Seller's notice of readiness to replace the catalyst. In order to enable Seller to determine the nature of the defects, if any, in the equipment or Proprietary Catalyst, Buyer shall, upon request by Seller, cause the equipment and Proprietary Catalyst to be operated for a reasonable length of time under reasonable conditions specified by Seller. If a replacement charge of Proprietary Catalyst has been placed in the SCONOx system pursuant to this paragraph, Buyer shall, at Seller's request, promptly conduct such additional test run or test runs as may be reasonably necessary to determine whether or not the Performance Guarantees have been met.

(H) All Performance testing shall be conducted within 90 days of initial equipment operation. If, through no fault of Seller, the tests cannot be performed within this time period, then the equipment shall be deemed accepted by Buyer and Seller shall have no further obligations with respect to the Performance Guarantees stated in Article 8 above. Seller shall be paid in full for the equipment and Buyer shall release any retained monies.

(I) The following methodology shall apply to all testing for all performance guarantees:

i. Number of Tests Required. A minimum of three (3) tests conducted over a seventy-two (72) hour consecutive period shall be required for evaluation.

ii. Methodology. All test runs shall be performed using either US E. P. A testing methods, specifically Methods 1, 2, 3A, 4, 7E and 10, as described in the Code of Federal Regulations, Volume 40, Part 60, Appendix A, or as otherwise mutually agreed upon protocols.

10. PATENTS - Seller, at its own expense, shall defend any suit that is brought against Buyer in a court of competent jurisdiction and is based on a claim that the equipment or any part thereof constitutes an infringement of any patent issued by the United States. Buyer shall give Seller prompt written notice of the institution of any suit and shall provide information and assistance that Seller reasonably deems necessary for the defense thereof. Seller shall pay any judgment for damages rendered against Buyer in such suit and, if the equipment or any part thereof is held to constitute an infringement and its use is enjoined, Seller, at its option and expense, shall (a) procure for Buyer the right to continue using the equipment, or (b) replace it with non-infringing equipment, or (c) modify it so it becomes non-infringing, or (d) remove the equipment and refund the purchase price.

Seller does not assume any liability for infringement due to (a) changes in the equipment made by or at the request of Buyer; or (b) engineering designs furnished by Buyer; or (c) the particular use of the equipment by Buyer; or (d) operation of the equipment not in accordance with Seller's instructions.

The foregoing sets forth the entire liability of Seller with regard to patent infringement.

11. BACKCHARGES - Seller will not be liable, whether by backcharge or otherwise, for the cost of work performed or material or equipment furnished by Buyer or by third parties unless such work and the cost thereof have been approved in writing by an authorized representative of Seller.

12. FOUNDATIONS - Seller shall provide Buyer with general arrangement drawings showing the equipment with reference to foundations, including loading diagrams and showing location of anchor bolts in the foundations. Adequate foundations, having plan

measurements in accordance with such drawings, including foundation bolts and plates, concrete work, all grouting and excavation, shall be furnished in place in due time by Buyer. Seller shall not be responsible for the depth of the footings, size or accuracy of the foundations, or the character of the materials selected for their construction or for any damages, or repairs necessary to the equipment furnished by it, caused by or resulting from defects in or settlement of the foundations.

13. PERMITS AND LICENSES - Seller shall secure and pay for all permits and licenses necessary to qualify it to fabricate the equipment.

Buyer shall secure and pay for all other permits, licenses and approvals required by any federal, state or municipal laws, ordinances, regulations or orders, including without limitation, zoning, building, use and environmental permits, licenses and approvals. Buyer shall obtain a "soft landing" or other permit condition that will allow operation of an alternate emissions control system in the event that the Equipment fails to demonstrate performance as warranted in Article 8.

14. TAXES - The prices provided for herein are exclusive of any present or future import duty, Federal, State, County, Municipal, or other sales, use, excise, gross receipts, value added or similar tax with respect to the materials, equipment, services, labor or transportation charges on such materials and equipment covered hereby, and of any inventory or property tax or similar charges with respect to the materials or equipment covered hereby after the equipment or any portion thereof is ready for shipment.

If the Seller is assessed or is required by applicable law or regulation to pay or collect any such duty, tax, or charge on account of this transaction, then such amount of tax or taxes, including any related penalties and/or interest, shall be paid by the Buyer to the Seller in addition to the prices provided herein.

If the Buyer is exempt from the payment of any applicable duty, tax or charge or has a direct payment permit with respect to such duty, tax or charge, the Buyer shall provide the Seller with a suitable copy of the appropriate certificate or permit at the time the purchase order is issued.

15. CHANGES - Seller will make such changes in the contract as are requested by Buyer and agreed to by Seller in writing. If any such change will result in increased costs to Seller, the price shall be increased to include such additional costs together with a reasonable profit thereon. In addition, if any such change will require additional time for performance of Seller's obligations, or if Seller's ability to meet its performance guarantees or other obligations may be adversely affected by such change, then the schedule, performance guarantees, and other terms and conditions of the contract shall be modified appropriately so that there will be no impairment of Seller's ability to fulfill any of its obligations to Buyer or others. In no event shall Seller be obligated to proceed with any change unless the foregoing contract modifications have been agreed upon in writing.

16. PROPRIETARY INFORMATION - Information contained in the Proposal and Contract includes proprietary information furnished to Buyer and its architect/engineer, consultant or agent for evaluation of Seller's Proposal and its performance under the contract. Neither the Proposal, the Contract nor any information contained therein nor any proprietary information furnished pursuant thereto, shall be disclosed to others or used for any other purpose without the prior written approval of Seller.

17. CANCELLATION - Either Seller or Buyer may cancel the contract at any time upon delivery of written notice if the other party: becomes insolvent, files or has filed against it a petition under the bankruptcy laws of the United States, or makes a general assignment for the benefit of its creditors, or if a receiver is appointed.

18. ASSIGNMENT - Buyer shall not assign the proposal or contract or any rights under either without the prior written consent of Seller.

19. FOREIGN SUPPLY - Seller reserves the right to furnish, at its discretion, material and components from qualified foreign suppliers.

20. ENTIRE AGREEMENT- The complete agreement of the parties with respect to the equipment is set forth in this document and in the documents expressly incorporated herein by reference. The parties further represent that neither is relying on any information not expressly contained herein. All prior communications with respect to the equipment, whether oral or written, are hereby abrogated and withdrawn.

21. APPLICABLE LAW - The contract shall be governed by the laws of the State of Tennessee without regard to its conflict of law provisions which shall be given no effect. The parties agree that Knoxville, Tennessee shall be a convenient forum for the resolution of all disputes between the parties.

22. LAWS AND REGULATIONS - Seller assumes no responsibility for compliance with federal, state or local laws and regulations, except as expressly set forth herein, and compliance with any laws and regulations relating to the Equipment and its use is the sole responsibility of the Buyer. All laws and regulations expressly incorporated into the Proposal shall be those in effect as of the date of the Proposal. In the event of any subsequent revisions or changes in said laws and regulations, Seller assumes no responsibility for compliance therewith. If Buyer desires a modification as a result of any such change or revision, it shall be treated as a Change Order and will be governed by the Changes article incorporated herein.

23. PROPOSAL ACCEPTANCE - The price and terms quoted in this offer are subject to acceptance by Buyer within a period of ninety (90) days from the date hereof.

24. PARTIAL INVALIDITY - The invalidity or unenforceability of any provision of this contract shall not affect the validity of the remaining provisions. If any provision proves to be invalid or unenforceable, the Buyer and Seller shall replace the invalid or unenforceable provision

with a valid new provision having an economic effect as close as possible to the invalid or unenforceable provision.

25. SITE CONDITIONS - Seller takes no responsibility and shall have no liability for pre-existing site conditions, including, but not limited to, sub-surface conditions, hazardous materials, structural integrity of existing steel and structures, and buried or concealed conditions. Seller shall have no liability or responsibility for any existing asbestos, lead based paint or other hazardous material. In the event asbestos, lead based paint or other hazardous material is encountered in the course of the Work; Seller shall notify Buyer and stop work in the area until Buyer abates these substances. Delays encountered as a result of hazardous materials shall result in an equitable adjustment in the contract amount and schedule.

26. SELLER'S ERECTION/START-UP ADVISOR - Seller warrants only that the services provided by its representative are based on the knowledge and the best information available at the time the services are provided. Said services shall be advisory only. In no event shall the rendering of such services impose on Seller any responsibility for installation, maintenance, or operation of any equipment nor for the defective or improper workmanship of others. Seller's representative shall not have the responsibility to direct the activities of Buyer, it's other contractors, or the employees of either, and Seller shall not be responsible for maintaining or improving schedules.

27. COMPLIANCE WITH ENVIRONMENTAL REGULATIONS - Buyer shall be solely responsible for compliance with all laws, rules and regulations governing the maintenance and operation of Buyer's facility, including equipment supplied by Seller, and including but not limited to, those laws, rules and regulations governing the presence, removal or discharge of pollutants of any kind. The Buyer will indemnify Seller with respect to any liability or cost associated with the presence, removal or discharge of pollutants of any kind.

28. HEADINGS- All headings to these General Conditions have been inserted for convenience of reference only and shall in no way affect the interpretation of this Agreement.

ATTACHMENT 1

Performance Guarantees

TABLE I: Operating Conditions - Natural Gas

	100% Load
Operating Temperature - °F	610
Flow Rate - lb/hr	3,600,000
Catalyst Inlet NO_X - ppmvd	25.0
Catalyst Inlet CO - ppmvd	25.0

TABLE II: Guaranteed Values - Natural Gas

	100% Load
O_X (ppmvd at 15% O_2)[1]	3.5
O (ppmvd at 15% O_2)[1]	2.5
ressure drop (inches w.c.) [2]	4.9

NOTES

1. Values reflect maximum emission level based on a three (3) hour rolling average measured at the stack.
2. Values reflect maximum pressure drop, as measured from the high pressure heat recovery steam generator (HRSG) outlet flange to the low pressure HRSG inlet flange, when measured and averaged over a 15 second period.
3. Values reflect maximum steam consumption for regeneration of the catalyst when measured and averaged over 24 hours.
4. Performance guarantees are expressly based on operation of the turbines in accordance with a mutually agreed upon fuel specification.

5.0 PRICING AND COMMERCIAL

AP ESD will design, fabricate, supply, and deliver, three SCONOx systems, as described in Section 3, for the budgetary prices of:

SIXTEEN MILLION SEVEN HUNDRED TWELVE THOUSAND DOLLARS
....$16,712,000 (US)

Price Notes:

1. AP price is subject to Exceptions and Clarifications described in Section 6
2. AP price is subject to Terms and Conditions contained in Section 4.
3. AP price does not include any taxes or duties.
4. AP price is based on the scope as described herein and in accordance with the drawings attached, Should design changes be required as a result of ongoing verification testing, a change in the price will be negotiated accordingly.
5. AP price is based on the Terms of Payment Below

   20% upon receipt of Order
   10% with submittal of GA's, P & ID's, and Load Diagrams
   10% with placement of P.O. for damper fabrication
   20% with placement of P.O. for SCONOx catalyst
   20% with arrival of reactor and dampers at site
   10% with arrival of all equipment at site
   10% Retention, to be released upon completion of the Performance Test, or 120 days after Initial Equipment Operation, whichever occurs first.

6. AP price is valid for ninety (90) days, but subject to escalation pending confirmation of schedule, terms of delivery, and date of execution of a contract. Catalyst pricing is subject to change at time of order in accordance with platinum price index.

6.0 SPECIFICATION EXCEPTIONS AND CLARIFICATIONS

This section is not applicable.

7.0 PROPOSAL DRAWINGS (Preliminary)

General Arrangement; 1330024-GA-400-001, Rev. AA

General Arrangement; 1330024-GA-400-002, Rev. AA

General Arrangement; 1330024-GA-400-003, Rev. AA

8.0 APPENDIX

The following preliminary information is for information, only, and is based upon the selected operating conditions for the equipment and process sizing for the proposed SCONOx system(s).

Utility Requirements	
Steam @ 600 °F, min., lbs/hr	18,184
Natural Gas, lbs/hr (scfh)	81 (1,924)

ABB ALSTOM POWER

SCONOx
SYSTEM PERFORMANCE DATA

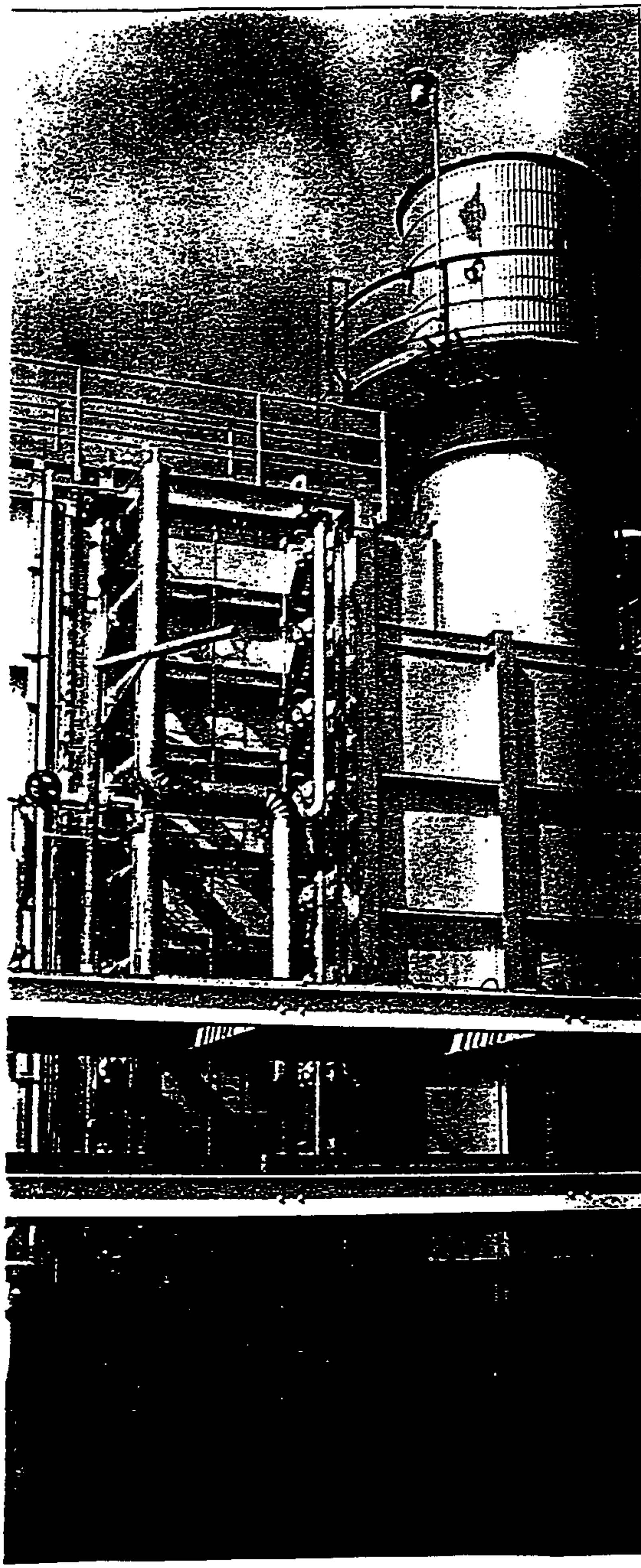
CUSTOMER INFORMATION

COMPANY	Golder Associates .
ADDRESS	6241 NW 23rd st Suite 500
CONTACT	Steve Maltby / Ken Kosky
PHONE	352-336-5600

PROJECT	Calpine - I
PROJECT #	N/A
PROPOSAL #	133.0024

SCONOX SYSTEM PERFORMANCE INFORMATION SHEET

AMBIENT TEMPERATURE	°F	62			0			0		
LOAD		BASE	w/ firing	0	BASE	0	0	BASE	0	0
FUEL										
*TYPE, NG or FO		NG	NG	0	0	0	0	0	0	0
*FLOW	Lbs/HR	78870	92819	0	0	0	0	0	0	0
MAXIMUM USAGE	DAYS/ YEAR	365	83	0	0	0	0	0	0	0
SULFUR CONT.	WT%	0.0006	0.0006	0.000846	0.000846	0.000846	0.000846	0.000846	0.000846	0.000846
CATALYST INLET										
EXHAUST GAS FLOW	Lbs/HR	3600000	3658333	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CAT. INLET TEMP.										
LOW	°F	590	590	590	590	590	590	590	590	590
HIGH	°F	610	610	610	610	610	610	610	610	610
CO - EMISSION	Lbs/HR	99.70	138.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ppmvd@15%O2	25.0	34.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOx - EMISSION	Lbs/HR	163.80	196.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ppmvd@15%O2	25.0	29.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOx - EMISSION	Lbs/HR	0.95	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ppmvd@15%O2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NM VOC	Lbs/HR	4.80	12.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ppmvd@15%O2	0.8	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CATALYST OUTLET										
CO - EMISSION	Removal. %	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
	Lbs/HR	9.97	13.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ppmvd@15%O2	2.5	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOx - EMISSION	Removal. %	86.00	88.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Lbs/HR	22.93	23.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ppmvd@15%O2	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOx - EMISSION	Lbs/HR	0.95	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ppmvd@15%O2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NM VOC	Removal. %	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
	Lbs/HR	0.48	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ppmvd@15%O2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SCONOX Catalyst Draft Loss	iwg	4.22	4.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCONOX System Draft Loss	iwg	4.90	5.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50



SCONOx™

Ammonia-Free Catalytic Absorption Systems for NOx Abatement

ABB ALSTOM POWER

There's No Better System. And No Ammonia, Either.

In 1997, the U.S. EPA declared SCONOx™ the Lowest Achievable Emission Rate (LAER) for NOx abatement — establishing it as the standard against which future abatement means will be judged. ABB Environmental Systems' SCONOx process for combustion turbines is based on a unique integration of proven, proprietary and patented catalytic oxidation and absorption technology. With SCONOx — unlike conventional Selective Catalytic Reduction (SCR) systems — there is no ammonia to be supplied to the system. SCONOx has zero ammonia slip, and therefore does not produce $PM_{2.5}$ constituents such as ammonium bisulfate and ammonium nitrate.

SCONOx greatly reduces emission fees and offset costs, and thus offers a simplified and lower cost permitting process for new and retrofit applications.

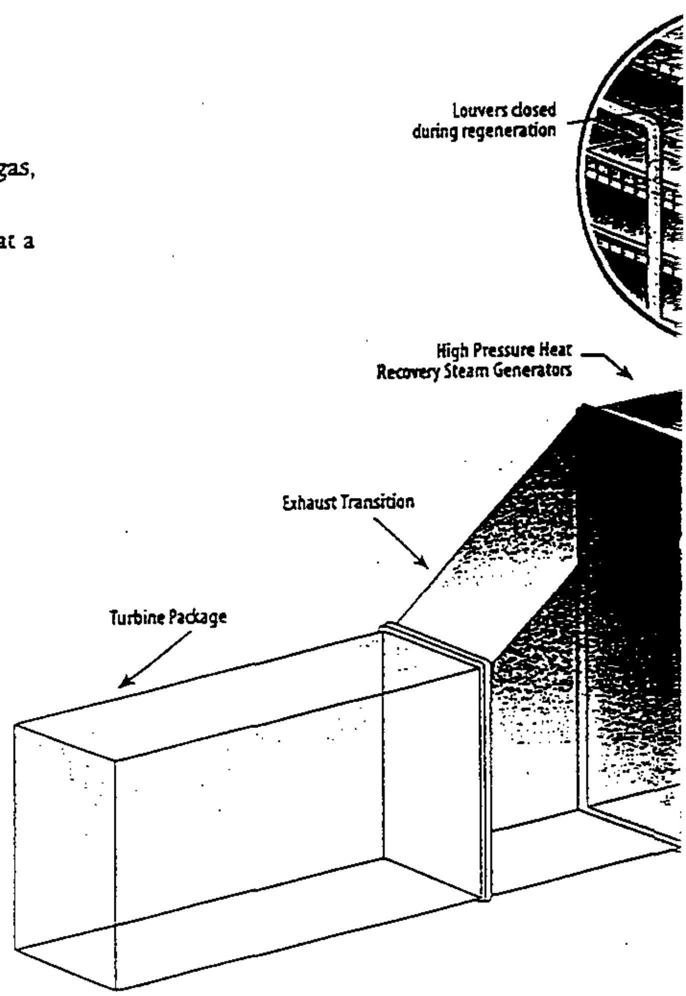
ABB Environmental Systems' SCONOx process can be designed to provide an equal or lower pressure drop than an SCR system at comparable emission levels.

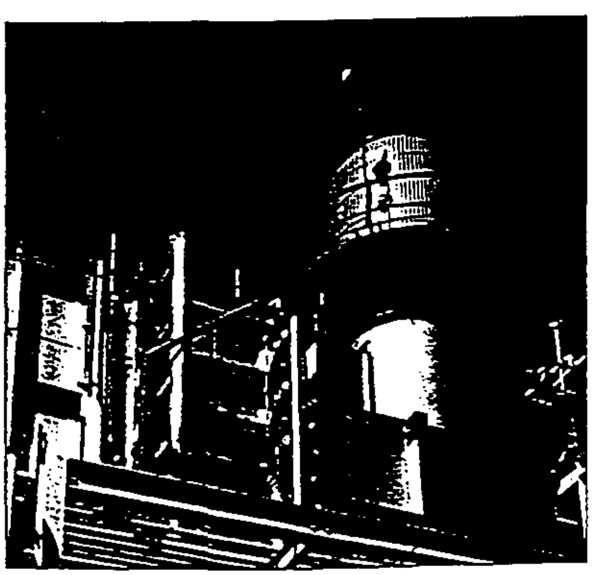
How SCONOx Works.

The SCONOx system utilizes a single catalyst for the removal of NOx, CO, and VOC. The process uses no hazardous materials — on the contrary, all utilities required to operate the system (natural gas, steam, water, ambient air, and electricity) are already present at a Combined Cycle Gas Turbine (CCGT) power plant.

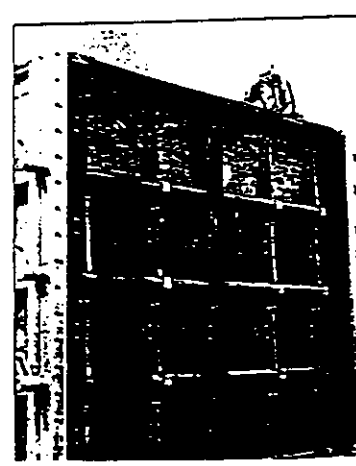
The Oxidation/Absorption Cycle

The SCONOx catalyst simultaneously oxidizes NO, CO, and VOCs. NO_2 is absorbed onto the catalyst surface through the use of a potassium carbonate coating. The SCONOx catalyst undergoes regeneration periodically to maintain maximum NOx absorption. This oxidation/absorption/regeneration system results in ultra-low emissions.





SCONOx system in place.

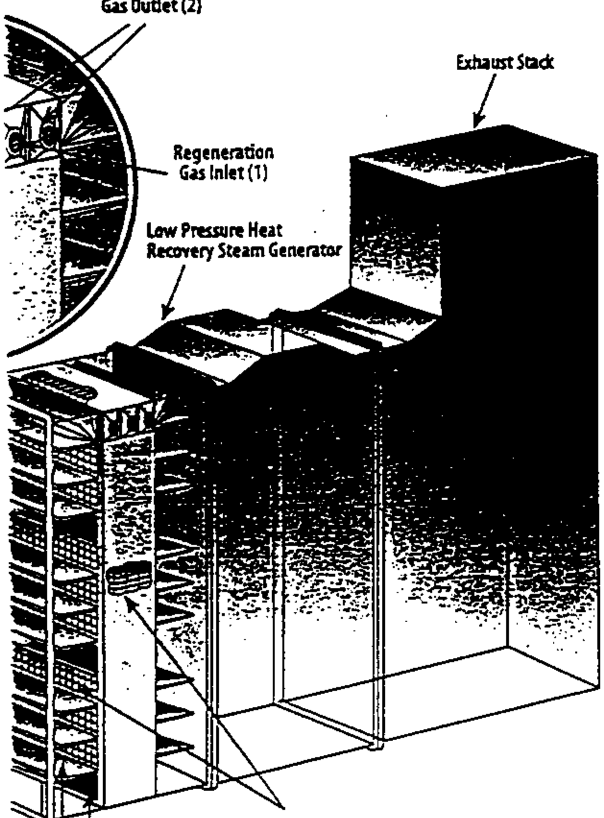


SCONOx subassemblies arrive on-site ready for installation.

The Regeneration Cycle

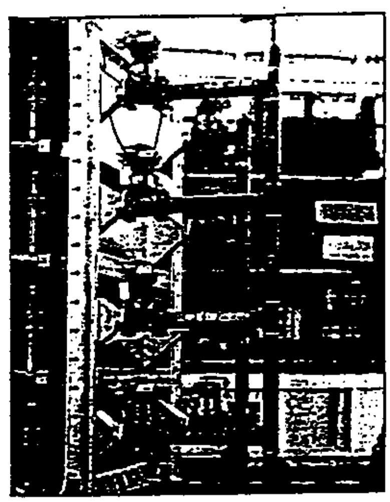
The SCONOx catalyst is regenerated by passing a controlled mixture of regeneration gases across its surface in the absence of oxygen. The regeneration gases react with the nitrites and nitrates to form water and elemental nitrogen. Carbon dioxide in the regeneration gas reacts with potassium nitrites and nitrates to form potassium carbonate — the absorber coating that was on the surface of the catalyst before the oxidation/absorption cycle began.

Water (as steam) and elemental nitrogen are exhausted up the stack, and potassium carbonate is once again present on the surface of the catalyst, allowing the oxidation/absorption cycle to begin again. There is no net gain or loss of potassium carbonate; the process operates as a true catalyst.



System Configuration

ABB Environmental Systems' typical SCONOx system arrangement has ten or fifteen sections of catalyst, although this number can vary depending on the size and special design requirements of the individual system. At any given time 80 percent of these rows are in the oxidation/absorption cycle and 20 percent are in the regeneration cycle. Because the same number of rows is always in the regeneration cycle; the production of regeneration gas always proceeds at a constant rate. A regeneration cycle is typically set to last for three to four minutes, so each section is in the oxidation/absorption cycle for fifteen to twenty minutes.



The piping system supplies regeneration gas to isolated SCONOx sections.

A system of isolation louvers for unit cycling during regeneration.

SCONOx Applications

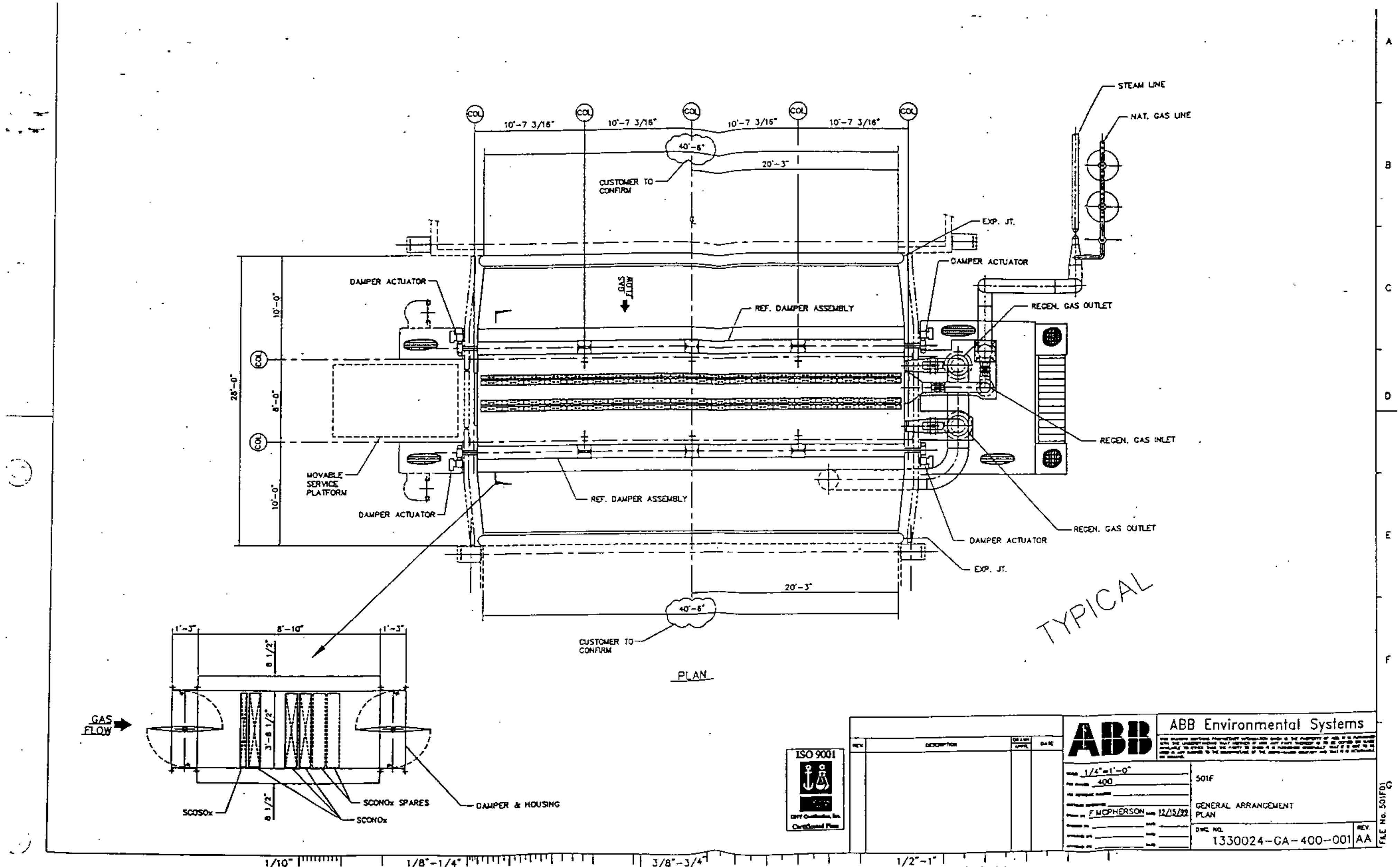
Ideally suited to both new and retrofit applications, the SCONOx system can operate effectively at temperatures ranging from 300 to 700°F and does not limit gas turbine performance. The SCONOx unit can be installed at the back end of the boiler or in the HRSG within the same envelope reserved for the SCR system.

ABB Environmental Systems will guarantee your CCGT emissions using SCONOx technology for both new and retrofit installations.

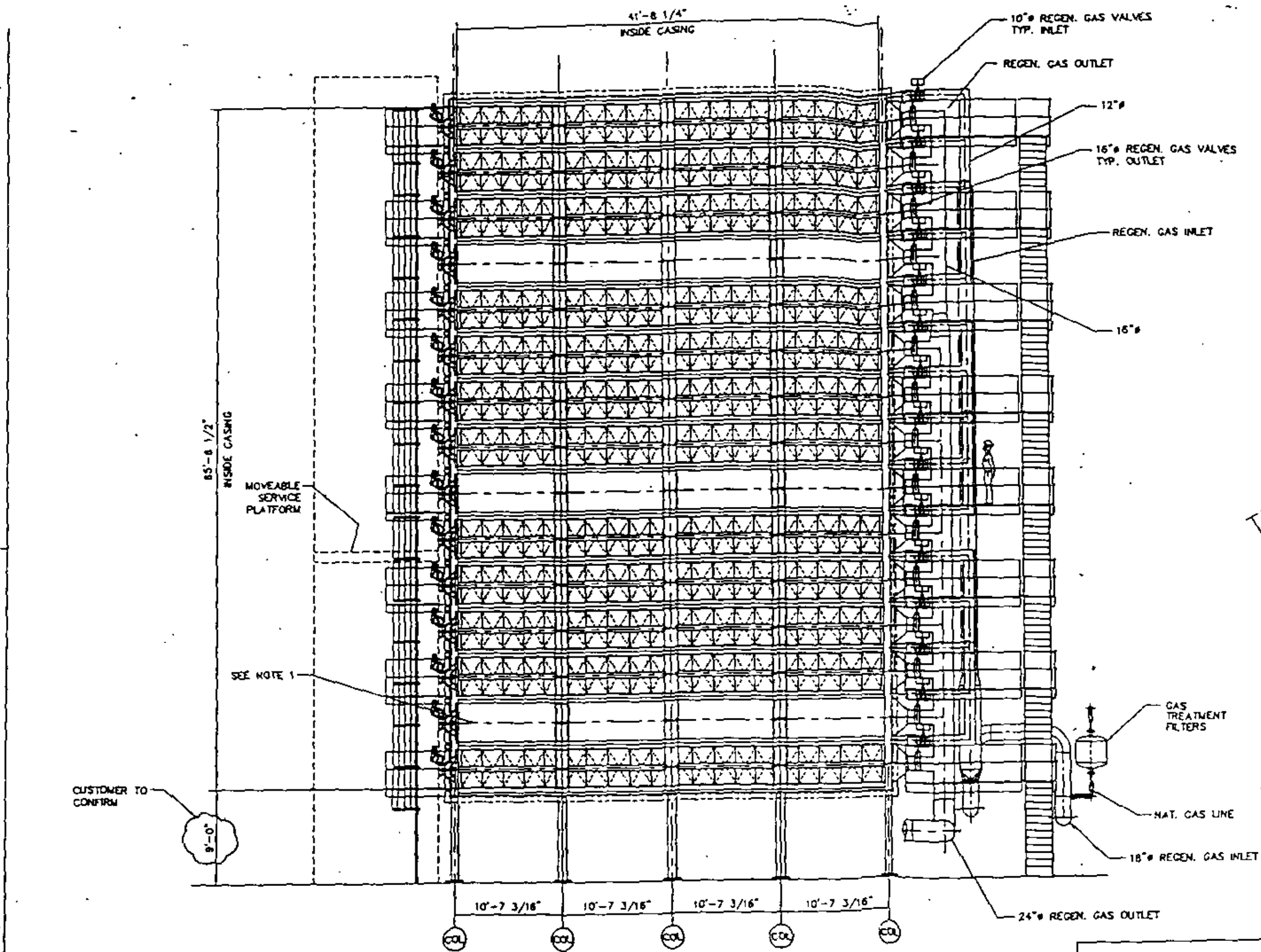
The engineers at ABB Environmental Systems are ready to go to work for you in designing, sizing, and supplying your SCONOx system. We'll even provide complete catalyst management services and emissions monitoring. Phone us soon at 800/346-8944, to learn more.

ABB ALSTOM
POWER

1409 Centerpoint Boulevard
Knoxville, TN 37932-1962
865/693-7550 • 800/346-8944



STEAM LINE
NAT. GAS LINE
COL
10'-7 3/16"
40'-6"
20'-3"
CUSTOMER TO CONFIRM
EXP. JT.
DAMPER ACTUATOR
GAS FLOW
REF. DAMPER ASSEMBLY
REGEN. GAS OUTLET
REGEN. GAS INLET
MOVABLE SERVICE PLATFORM
28'-0"
10'-0"
8'-0"
TYPICAL
PLAN
1'-3"
8'-10"
8 1/2"
3'-8 1/2"
SCOSOx
SCONOx SPARES
SCONOx
DAMPER & HOUSING
ISO 9001
ABB
ABB Environmental Systems
1/4"=1'-0"
400
F MCPHERSON
12/15/99
501F
GENERAL ARRANGEMENT PLAN
1330024-GA-400-001
AA
FILE No. 501F01
1/10"
1/8"-1/4"
3/8"-3/4"
1/2"-1"



OUTLET ELEVATION

TYPICAL

NOTES
1. DURING NORMAL OPERATION ONE DAMPER PER GROUP OF FIVE SECTIONS IS CLOSED FOR REGENERATION.

ISO 9001

REV.	DESCRIPTION	DRAWN APPR.	DATE

ABB Environmental Systems

3/16"=1'-0"
400
F MCPHERSON 12/17/98

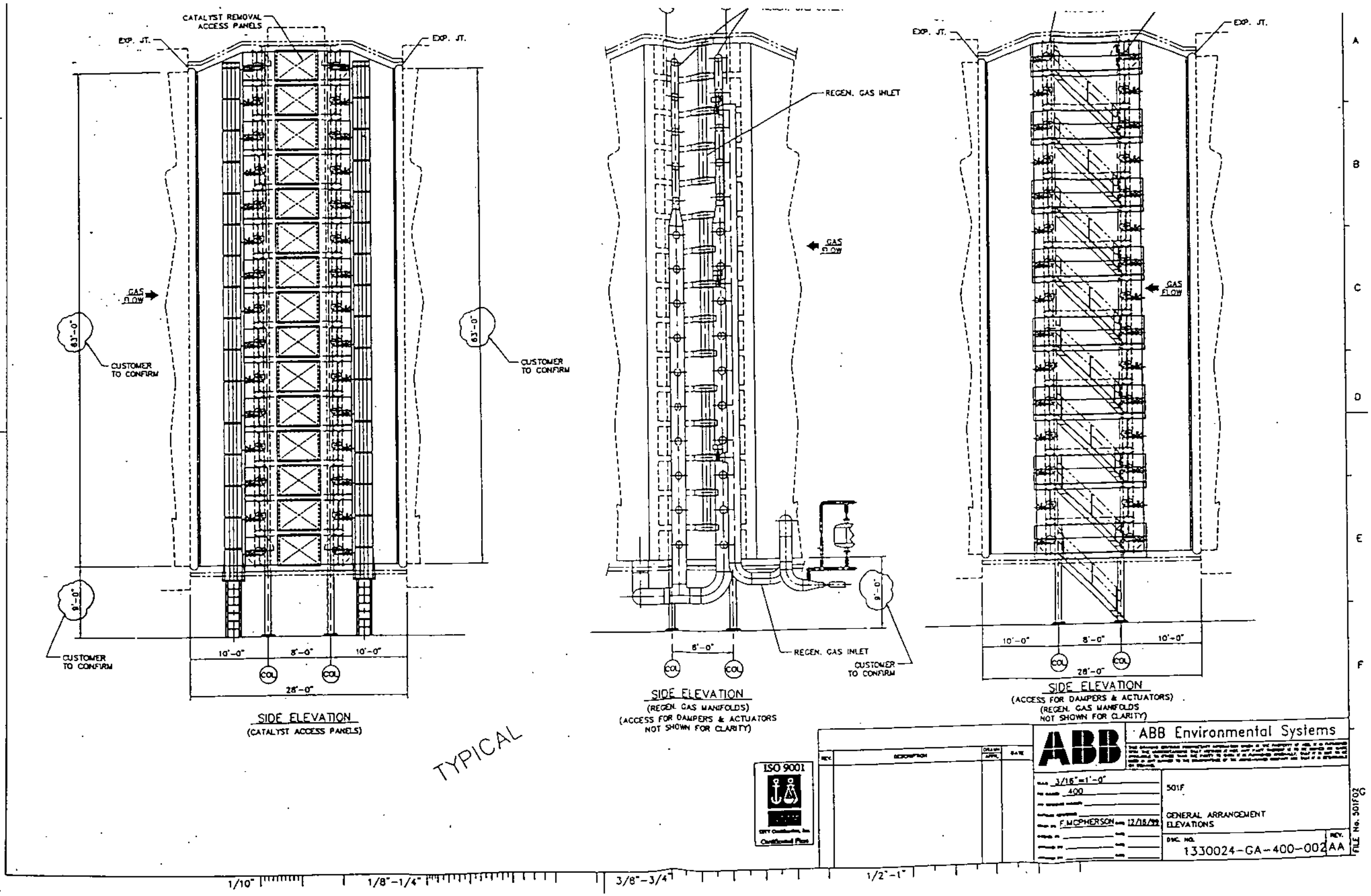
501F

GENERAL ARRANGEMENT
OUTLET ELEVATION

DWG. NO. 1330024-GA-400-003 REV. AA

FILE No. 501F03

1/10" 1/8"-1/4" 3/8"-3/4" 1/2"-1"


CATALYST REMOVAL ACCESS PANELS
EXP. JT.
GAS FLOW
CUSTOMER TO CONFIRM
63'-0"
9'-0"
10'-0"
8'-0"
28'-0"
COL
SIDE ELEVATION
(CATALYST ACCESS PANELS)
REGEN. GAS INLET
SIDE ELEVATION
(REGEN. GAS MANIFOLDS)
(ACCESS FOR DAMPERS & ACTUATORS NOT SHOWN FOR CLARITY)
SIDE ELEVATION
(ACCESS FOR DAMPERS & ACTUATORS)
(REGEN. GAS MANIFOLDS NOT SHOWN FOR CLARITY)
TYPICAL
ISO 9001
ABB Environmental Systems
3/16"=1'-0"
400
F.MCPHERSON
12/18/99
501F
GENERAL ARRANGEMENT ELEVATIONS
1330024-GA-400-002
AA
FILE No. 501F02
1/10"
1/8"-1/4"
3/8"-3/4"
1/2"-1"

ATTACHMENT 4

Tables 4-5a and 4-6a
Revised Table 4-8

Table 4-5a. Capital Cost for Selective Catalytic Reduction (SCR) and SCONOx for Westinghouse 501F Combustion Turbine in Combined Cycle Configuration

Cost Component	SCR-Costs	SCONOx -Costs	Basis of Cost Component
Direct Capital Costs			
SCR Associated Equipment	$1,578,000	$16,712,000	Vendor Based Estimates
Ammonia Storage Tank	$126,865	$0	$35 per 1,000 lb mass flow developed from vendor quotes
Flue Gas Ductwork	$44,505	$69,725	Vatavauk,1990
Instrumentation	$50,000	$50,000	Additional NO_x Monitor and System
Taxes	$94,680	$1,002,720	6% of Associated Equipment and Catalyst
Freight	$78,900	$835,600	5% of Associated Equipment
Total Direct Capital Costs (TDCC)	$1,972,951	$18,670,045	
Direct Installation Costs			
Foundation and supports	$157,836	$1,493,604	8% of TDCC ; OAQPS Cost Control Manual
Handling & Erection	$276,213	$2,613,806	14% of TDCC ; OAQPS Cost Control Manual
Electrical	$78,918	$746,802	4% of TDCC ; OAQPS Cost Control Manual
Piping	$39,459	$373,401	2% of TDCC ; OAQPS Cost Control Manual
Insulation for ductwork	$19,730	$186,700	1% of TDCC ; OAQPS Cost Control Manual
Painting	$19,730	$186,700	1% of TDCC ; OAQPS Cost Control Manual
Site Preparation	$5,000	$5,000	Engineering Estimate
Buildings	$15,000	$15,000	Engineering Estimate
Total Direct Installation Costs (TDIC)	$611,885	$5,621,014	
Total Capital Costs (TCC)	$2,584,836	$24,291,059	Sum of TDCC and TDIC
Indirect Costs			
Engineering	$197,295	$1,867,005	10% of TDCC; OAQPS Cost Control Manual
PSM/RMP Plan	$50,000	$0	Engineering Estimate
Construction and Field Expense	$98,648	$933,502	5% of TDCC; OAQPS Cost Control Manual
Contractor Fees	$197,295	$1,867,005	10% of TDCC; OAQPS Cost Control Manual
Start-up	$39,459	$373,401	2% of TDCC; OAQPS Cost Control Manual
Performance Tests	$19,730	$186,700	1% of TDCC; OAQPS Cost Control Manual
Contingencies	$59,189	$560,101	3% of TDCC; OAQPS Cost Control Manual
Total Indirect Capital Cost (TInCC)	$661,615	$5,787,714	
Total Direct, Indirect and Capital Costs (TDICC)	$3,246,450	$30,078,773	Sum of TCC and TInCC

Mass Flow of Combustion Turbine

Table 4-6b. Annualized Cost for SCR and SCONOx for Westinghouse 501F Combustion Turbine in Combined Cycle Configuration

Cost Component	Costs	SCONOx -Costs	Basis of Cost Component
Direct Annual Costs			
Operating Personnel	$18,720	$37,440	24 hours/week at $15/hr for SCR; SCONOx 2 times SCR costs
Supervision	$2,808	$5,616	15% of Operating Personnel;OAQPS Cost Control Manual
Ammonia	$292,815	$0	$300 per ton for Aqueous NH_3
PSM/RMP Update	$15,000	$0	Engineering Estimate
Inventory Cost	$40,004	$80,008	Capital Recovery (10.98%) for 1/3 catalyst for SCR; SCONOx 2 times SCR
Catalyst Cost	$364,333	$546,500	3 years catalyst life; Based on Vendor Budget Estimate for SCR; 1.5 times for SCONOx
Contingency	$22,010	$20,087	3% of Direct Annual Costs; SCONOx the same as SCR
Total Direct Annual Costs (TDAC)	$755,690	$689,651	
Energy Costs			
Electrical	$28,032	$70,080	80kW/h for SCR @ $0.04/kWh times Capacity Factor; 200 kW for SCONOx
MW Loss and Heat Rate Penalty	$334,045	$835,112.70	0.3% of MW output for SCR; EPA, 1993 (Page 6-20); 0.75% for SCONOx
Steam Costs for SCONOx		$705,663	18,184 lb/hr 600 °F, 85 psig, steam; 90% boiler eff.; $3/mmBtu
Natural Gas for SCONOx		$49,347	81 lb/hr; 0.044 lb/scf; 1,020 Btu/scf; $3/mmBtu
Total Energy Costs (TEC)	$362,077	$1,660,202	
Indirect Annual Costs			
Overhead	$188,606	$25,834	60% of Operating/Supervision Labor and Ammonia
Property Taxes	$32,465	$300,788	1% of Total Capital Costs
Insurance	$32,465	$300,788	1% of Total Capital Costs
Annualized Total Direct Capital	$356,460	$3,302,649	10.98% Capital Recovery Factor of 7% over 15 years times sum of TDICC
Total Indirect Annual Costs (TIAC)	$609,995	$3,930,058	
Total Annualized Costs	$1,727,762	$6,279,911	Sum of TDAC, TEC and TIAC
Cost Effectiveness	$2,570	$9,341	NO_x Reduction Only

Table 4-8. Maximum Potential Incremental Emissions (TPY) with Selective Catalytic Reduction and SCONOx in Combined Cycle Operation

	Incremental Emissions (tons/year) of SCR			Incremental Emissions (tons/year) of SCONOx		
Pollutants	Primary	Secondary	Total	Primary	Secondary	Total
Particulate	9.19	0.19	9.38		1.36	1.36
Sulfur Dioxide		0.07	0.07		0.51	0.51
Nitrogen Oxides	672.27	3.51	675.78	672.27	25.05	697.32
Carbon Monoxide		2.10	2.10		15.03	15.03
Volatile Organic Compounds		0.14	0.14		0.98	0.98
Ammonia	111.19					
Total:	792.65	6.01	798.66	672.27	42.94	715.21
Carbon Dioxide (additional from gas firing)		3,331.41	3,331.41		23,798.34	23,798.34

Basis:

Lost Energy (mmBtu/year) 52,601 SCR 375,763 SCONOx

Secondary Emissions (lb/mmBtu): Assumes natural gas firing in NO_x controlled steam unit.

Particulate	0.0072
Sulfur Dioxide	0.0027
Nitrogen Oxides w/LNB	0.1333
Carbon Monoxide	0.0800
Volatile Organic Compounds	0.0052

Reference: Table 1.4-1 and 1.4-2, AP-42, Version 2/98

ATTACHMENT 5

Increased Performance (5 Percent)

Table A-13a. Design Information and Stack Parameters for FPC Hines-2 Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Distillate, 100 % Load - 5% Increased Performance

Parameter		Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Combustion Turbine Performance					
Gross power output (MW) - Estimated		201.5	193.8	187.3	171.3
Gross heat rate (Btu/kWh, LHV) - Calculated		9,513	9,101	9,109	9,094
(Btu/kWh, HHV) - Calculated		10,945	10,470	10,480	10,463
Heat Input (MMBtu/hr, LHV) - Calculated		1,917	1,763	1,707	1,557
(MMBtu/hr, HHV) - Calculated		2,205	2,029	1,963	1,792
(MMBtu/hr, HHV) - Provided		2,205	2,029	1,963	1,792
Fuel heating value (Btu/lb, LHV)		17,290	17,290	17,290	17,290
(Btu/lb, HHV)		19,892	19,892	19,892	19,892
(HHV/LHV)		1.150	1.150	1.150	1.150
CT Exhaust Flow					
Mass Flow (lb/hr) (Increased by 5%)		4,018,170	3,864,441	3,736,355	3,415,748
		3,826,829	3,680,420	3,558,433	3,253,093
Temperature (°F) - Estimated		1,070	1,100	1,110	1,130
Moisture (% Vol.)		7.12	7.74	8.79	11.04
Oxygen (% Vol.)		11.99	11.99	11.78	11.40
Molecular Weight		28.78	28.68	28.56	28.32
Fuel Usage					
Fuel usage (lb/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu (Fuel Heat Content, Btu/lb (LHV))					
Heat input (MMBtu/hr, LHV)		1,917	1,763	1,707	1,557
Heat content (Btu/lb, LHV)		17,290	17,290	17,290	17,290
Fuel usage (lb/hr)- calculated		110,849	101,987	98,700	90,080
- provided (increased by 5%)		110,849	101,987	98,700	90,080
(gallons/hr) - calculated lb/gal=	7.1	15,612	14,364	13,901	12,687
HRSC Stack					
CT - Stack height (ft)		125	125	125	125
Diameter (ft)		19	19	19	19
Turbine Flow Conditions					
Turbine Flow (acfm) = [(Mass Flow (lb/hr) x 1,545 x (Temp. (°F)+ 460°F)] / [Molecular weight x 2116.8] / 60 min/hr					
Mass flow (lb/hr)		4,018,170	3,864,441	3,736,355	3,415,748
Temperature (°F)		1,070	1,100	1,110	1,130
Molecular weight		28.78	28.68	28.56	28.32
Volume flow (acfm)- calculated		2,598,971	2,556,614	2,498,464	2,333,177
(ft3/s)- calculated		43,316	42,610	41,641	38,886
HRSC Stack Flow Conditions					
Velocity (ft/sec) = Volume flow (acfm) / [((diameter)^2/4) x 3.14159] / 60 sec/min					
CT Temperature (°F)		270	270	270	270
CT volume flow (acfm)		1,240,032	1,196,364	1,161,706	1,071,207
Diameter (ft)		19	19	19	19
Velocity (ft/sec)- calculated		72.9	70.3	68.3	63.0

Note: Universal gas constant = 1,545 ft-lb(force)/°R; atmospheric pressure = 2,116.8 lb(force)/ft^2; 14.7 lb/ft^3
Turbine inlet relative humidity is 20% at 35 °F, 60% at 59 and 75 °F, and 50% at 95 °F.
Source: Siemens/Westinghouse 2000.

Table A-14a. Maximum Emissions for Criteria Pollutants for FPC Hines-2 Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Distillate, 100 % Load - 5% Increased Performance

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer				
Basis (excludes H_2SO_4), lb/hr	43	39.6	38.3	34.8
Emission rate (lb/hr)- provided	43.0	39.6	38.3	34.8
Particulate from SCR = Sulfur trioxide (formed from conversion of SO_2) converts to ammonium sulfate (=PM10)				
Particulate from conversion of SO_2 = SO_2 emissions (lb/hr) x Conversion SO_2 to SO_3 x lb SO_3/lb SO_2 x Conversion of SO_3 x lb SO_3 to $(NH_4)_2SO_4$ x $(NH_4)_2SO_4$/lb SO_3				
SO_2 emission rate (lb/hr)- calculated	110.8	102.0	98.7	90.1
Conversion (%) from SO_2 to SO_3	10	10	10	10
MW SO_3/SO_2 (80/64)	1.3	1.3	1.3	1.3
Conversion (%) from SO_3 to $(NH_4)_2(SO_4)$	100	100	100	100
MW $(NH_4)_2SO_4$/SO_3 (132/80)	1.7	1.7	1.7	1.7
Particulate (lb/hr)- calculated	22.86	21.03	20.36	18.58
Particulate (lb/hr) from CT + SCR	65.9	60.6	58.7	53.4
Particulate (tons/year) from CT + SCR	32.9	30.3	29.3	26.7
Sulfur Dioxide (lb/hr) = Natural gas (lb/hr) x sulfur content (%/100) x (lb SO_2/lb S)				
Fuel Sulfur Content	0.05%	0.05%	0.05%	0.05%
Fuel use (lb/hr)	110,849	101,987	98,700	90,080
lb SO_2/lb S (64/32)	2	2	2	2
Emission rate (lb/hr) - calculated	110.8	102.0	98.7	90.1
- provided (Increased 5%)	99.75	99.75	98.7	90.3
(TPY)	55.42	50.99	49.35	45.04
Nitrogen Oxides (lb/hr) = NOx(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 x Volume flow (acfm) x 46 (mole. wgt NOx) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 5.9 x 1,000,000 (adj. for ppm)]				
Basis, ppmvd @15% O_2	15	15	15	15
Moisture (%)	7.12	7.74	8.79	11.04
Oxygen (%)	11.99	11.99	11.78	11.4
Turbine Flow (acfm)	1,240,032	1,196,364	1,161,706	1,071,207
Turbine Exhaust Temperature (°F)	270	270	270	270
Emission rate (lb/hr) - calculated	121.2	114.9	111.4	101.5
- provided (Increased 5%)	122.7	114.9	111.2	101.5
(TPY)	61.4	57.4	55.6	50.8
Carbon Monoxide (lb/hr) = CO(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft2 x Volume flow (acfm) x 28 (mole. wgt CO) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvd	30	30	30	30
Moisture (%)	7.12	7.74	8.79	11.04
Turbine Flow (acfm)	1,240,032	1,196,364	1,161,706	1,071,207
Turbine Exhaust Temperature (°F)	270	270	270	270
Emission rate (lb/hr) - calculated	108.9	104.4	100.2	90.1
- provided (Increased 5%)	117.6	111.3	107.1	95.6
(TPY)	58.8	55.7	53.6	47.8
VOCs (lb/hr) = VOC(ppmvw) x 2116.8 lb/ft2 x Volume flow (acfm) x 16 (mole. wgt as methane) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvw	10	10	10	10
Turbine Flow (acfm)	1,240,032	2,556,614	2,498,464	2,333,177
Turbine Exhaust Temperature (°F)	270	1,100	1,110	1,130
Emission rate (lb/hr) - calculated	22.34	21.56	20.93	19.30
- provided (Increased 5%)	23.1	22.1	22.1	20.0
(TPY)	11.6	11.0	11.0	10.0
Lead (lb/hr) = NA				
Emission Rate Basis (lb/10^{12} Btu)	10.8	10.8	10.8	10.8
Emission rate (lb/hr)	0.0238	0.0219	0.0212	0.0194
(TPY)	0.0119	0.0110	0.0106	0.0097

Note: ppmvd = parts per million, volume dry; O_2 = oxygen.

Source: Siemens/Westinghouse, 2000; Golder Associates, 2000; EPA, 1996 (AP-42 draft revisions)

Table A-15a. Maximum Emissions for Other Regulated PSD Pollutants for FPC Hines-2 Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Distillate, 100 % Load - 5% Increased Performance

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
2,3,7,8 TCDD Equivalents (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis (a), lb/10^{12} Btu	3.80E-04	3.80E-04	3.80E-04	3.80E-04
Heat Input Rate (MMBtu/hr)	2.20E+03	2.03E+03	1.96E+03	1.96E+03
Emission Rate (lb/hr)	8.38E-07	7.71E-07	7.46E-07	7.46E-07
(TPY)	4.19E-07	3.85E-07	3.73E-07	3.73E-07
Beryllium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis (a), lb/10^{12} Btu	0.331	0.331	0.331	0.331
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	7.30E-04	6.72E-04	6.50E-04	6.50E-04
(TPY)	3.65E-04	3.36E-04	3.25E-04	3.25E-04
Fluoride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis (b), lb/10^{12} Btu	32.54	32.54	32.54	32.54
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	7.18E-02	6.60E-02	6.39E-02	6.39E-02
(TPY)	3.59E-02	3.30E-02	3.19E-02	3.19E-02
Hydrogen Chloride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis (c), lb/10^{12} Btu	2.07E+02	2.07E+02	2.07E+02	2.07E+02
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	4.56E-01	4.19E-01	4.06E-01	4.06E-01
(TPY)	2.28E-01	2.10E-01	2.03E-01	2.03E-01
Mercury (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis (a), lb/10^{12} Btu	6.26E-01	6.26E-01	6.26E-01	6.26E-01
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	1.38E-03	1.27E-03	1.23E-03	1.23E-03
(TPY)	6.90E-04	6.35E-04	6.15E-04	6.15E-04
Sulfuric Acid Mist = Fuel Use (lb/hr) x sulfur (S) content (fraction) x conversion of S to H_2SO_4 (%) x MW H_2SO_4/MW S (98/32)				
Fuel Usage (cf/hr)	110,849	101,987	98,700	90,080
Sulfur (lb/hr)	55.42	50.99	49.35	45.04
lb H_2SO_4/lb S (98/32)	3.0625	3.0625	3.0625	3.0625
Conversion to H_2SO_4 (%) (d)	10	10	10	10
Emission Rate (lb/hr)	16.97	15.62	15.11	13.79
(TPY)	8.49	7.81	7.56	6.90

Sources: (a) EPA, 2000; (b) EPA, 1981; (c) 4 ppm assumed based on ASTM D2880
(d) assumed based on combustion estimates from GE

Table A-16a. Maximum Emissions for Hazardous Air Pollutants for FPC Hines-2 Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Distillate, 100 % Load - 5% Increased Performance

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
Arsenic (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	1.10E+01	1.10E+01	1.10E+01	1.10E+01
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	2.43E-02	2.23E-02	2.16E-02	2.16E-02
(TPY)	1.21E-02	1.12E-02	1.08E-02	1.08E-02
Benzene (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	55	55	55	55
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	1.21E-01	1.12E-01	1.08E-01	1.08E-01
(TPY)	6.06E-02	5.58E-02	5.40E-02	5.40E-02
Cadmium (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	4.8	4.8	4.8	4.8
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	1.06E-02	9.74E-03	9.42E-03	9.42E-03
(TPY)	5.29E-03	4.87E-03	4.71E-03	4.71E-03
Chromium (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	11	11	11	11
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	2.43E-02	2.23E-02	2.16E-02	2.16E-02
(TPY)	1.21E-02	1.12E-02	1.08E-02	1.08E-02
Formaldehyde (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	2.80E+02	2.80E+02	2.80E+02	2.80E+02
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	2.31E+00	5.68E-01	5.50E-01	5.50E-01
(TPY)	1.16E+00	2.84E-01	2.75E-01	2.75E-01
Napthalene (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	35	35	35	35
Heat Input Rate (MMBtu/hr)	2.20E+03	2.03E+03	1.96E+03	1.96E+03
Emission Rate (lb/hr)	7.72E-02	7.10E-02	6.87E-02	6.87E-02
(TPY)	3.86E-02	3.55E-02	3.44E-02	3.44E-02
Manganese (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	790	790	790	790
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	1.74E+00	1.60E+00	1.55E+00	1.55E+00
(TPY)	8.71E-01	8.01E-01	7.76E-01	7.76E-01
Nickel (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	4.6	4.6	4.6	4.6
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	1.01E-02	9.33E-03	9.03E-03	9.03E-03
(TPY)	5.07E-03	4.67E-03	4.52E-03	4.52E-03
1, 3 Butadiene (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	1.60E+01	1.60E+01	1.60E+01	1.60E+01
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	0.035279974	0.032459447	0.031413446	0.031413446
(TPY)	0.017639987	0.016229724	0.015706723	0.015706723
Selenium (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	25	25	25	25
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	5.51E-02	5.07E-02	4.91E-02	4.91E-02
(TPY)	2.76E-02	2.54E-02	2.45E-02	2.45E-02
Polycyclic Aromatic Hydrocarbons (lb/hr) = Basis (lb/10¹² Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10¹² Btu				
Basis (a), lb/10¹² Btu	40	40	40	40
Heat Input Rate (MMBtu/hr)	2,205	2,029	1,963	1,963
Emission Rate (lb/hr)	8.82E-02	8.11E-02	7.85E-02	7.55E-02
(TPY)	4.41E-02	4.06E-02	3.93E-02	3.93E-02

Sources: (a) EPA, 2000

Table A-26a. Toxic Air Pollutant Emission Factors and Emissions for Combustion Turbine when Firing Natural Gas
FPC Hines Energy Complex - Power Block 2 (Siemens Westinghouse 501 F) - 5% Increased Performance

Parameter		Emission Rate (lb/hr) firing Natural Gas for Operating Conditions of									Natural Gas Maximum Annual Emissions (TPY) (2)	
		100 % Load			80 % Load			60 % Load				
Ambient Temperature (°F)		20 °F	59 °F	90 °F	20 °F	59 °F	90 °F	20 °F	59 °F	90 °F		
HIR (MMBtu/hr)		2,112	1,921	1,791	1,652	1,534	1,419	1,347	1,280	1,178	1 CT	2 CTs
HAPs (Section 112(b) of Clean Air Act)												
1,3-Butadiene		0.00091	0.00083	0.00077	0.00071	0.00066	0.00061	0.00058	0.00055	0.00051	0.0036	0.0072
Acetaldehyde		0.084	0.077	0.072	0.066	0.061	0.057	0.054	0.051	0.047	0.34	0.67
Acrolein		0.0135	0.0123	0.0115	0.0106	0.0098	0.0091	0.0086	0.0082	0.0075	0.054	0.108
Benzene		0.0253	0.0231	0.0215	0.0198	0.0184	0.0170	0.0162	0.0154	0.0141	0.101	0.20
Ethylbenzene		0.0676	0.0615	0.0573	0.0529	0.0491	0.0454	0.0431	0.0410	0.0377	0.269	0.54
Formadehyde		0.317	0.288	0.269	0.248	0.230	0.213	0.202	0.192	0.177	1.26	2.5
Naphthalene		0.00275	0.00250	0.00233	0.00215	0.00199	0.00184	0.00175	0.00166	0.00153	0.0109	0.022
Polycyclic Aromatic Hydrocarbons (PAH)	(3)	0.00465	0.00423	0.00394	0.00363	0.00337	0.00312	0.00296	0.00282	0.00259	0.0185	0.037
Propylene Oxide		0.0612	0.0557	0.0519	0.0479	0.0445	0.0412	0.0391	0.0371	0.0342	0.244	0.49
Toluene		0.070	0.063	0.059	0.055	0.051	0.047	0.044	0.042	0.039	0.278	0.56
Xylene		0.135	0.123	0.115	0.106	0.098	0.091	0.086	0.082	0.075	0.54	1.08
Antimony		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercury		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Selenium		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HAPs (Total)											3.12	6.2

(1) Emissions based on the following emission factors and conversion factors for firing natural gas:

Emission Factors		Value	Reference
1,3-Butadiene	(a)	0.43	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000
Acetaldehyde		40	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000
Acrolein		6.4	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000
Benzene		12	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000
Ethylbenzene		32	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000
Formadehyde		150	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000, Database
Naphthalene		1.3	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000
Polycyclic Aromatic Hydrocarbons (PAH)		2.2	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000
Propylene Oxide	(a)	29	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000
Toluene		33	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000, Database
Xylene		64	$lb/10^{12}$ Btu; AP-42,Table 3.1-3, EPA 2000
Antimony		0.0	
Arsenic		0.0	
Beryllium		0.0	
Cadmium		0.0	
Chromium		0.0	
Lead		0.0	
Manganese		0.0	
Mercury		0.0	
Nickel		0.0	
Selenium		0.0	

(a) Based on 1/2 the detection limit; expected emissions are lower.

(2) Annual emissions based on ambient temperature of 59 °F firing natural gas for 8760 hours at 100 percent load.
(3) Assumed to be representative of Polycyclic Organic Matter (POM) emissions, a regulated HAP.

Table A-27a. Toxic Air Pollutant Emission Factors and Emissions for Combustion Turbine when Firing Natural Gas and Fuel Oil
FPC Hines Energy Complex - Power Block 2 (Siemens Westinghouse 501 F) - 5% Increased Performance

Parameter		Emission Rate (lb/hr) firing Distillate Fuel Oil for Operating Conditions of: 100 % Load			80 % Load			65 % Load		
Ambient Temperature (°F)		20 °F	59 °F	105 °F	20 °F	59 °F	105 °F	20 °F	59 °F	105 °F
HIR (MMBtu/hr)		2,205	2,029	1,792	1,644	1,524	1,364	1,285	1,296	1,182
HAPs (Section 112(b) of Clean Air Act)										
1,3-Butadiene		0.0353	0.0325	0.0287	0.0263	0.0244	0.0218	0.0222	0.0207	0.019
Acetaldehyde		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acrolein		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene		0.121	0.112	0.099	0.090	0.084	0.075	0.076	0.071	0.065
Ethylbenzene		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Formaldehyde		0.617	0.568	0.502	0.460	0.427	0.382	0.388	0.363	0.331
Naphthalene		0.0772	0.0710	0.0627	0.0575	0.0533	0.0477	0.0485	0.0454	0.0414
Polycyclic Aromatic Hydrocarbons (PAH)	(3)	0.088	0.081	0.0717	0.0658	0.0610	0.0546	0.0554	0.0518	0.0473
Propylene Oxide		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Xylene		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antimony		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic		0.0243	0.0223	0.0197	0.0181	0.0168	0.0150	0.0152	0.0143	0.0130
Beryllium		0.000684	0.000629	0.000556	0.000510	0.000472	0.000423	0.000429	0.000402	0.000366
Cadmium		0.01058	0.00974	0.00860	0.00789	0.00732	0.00655	0.00665	0.00622	0.00567
Chromium		0.0243	0.0223	0.0197	0.0181	0.0168	0.0150	0.0152	0.0143	0.0130
Lead		0.0309	0.0284	0.0251	0.0230	0.0213	0.0191	0.0194	0.0181	0.0165
Manganese		1.74	1.60	1.42	1.30	1.20	1.08	1.09	1.02	0.93
Mercury		0.00265	0.00243	0.00215	0.00197	0.00183	0.00164	0.00166	0.00156	0.00142
Nickel		0.01014	0.00933	0.00824	0.00756	0.00701	0.00627	0.00637	0.00596	0.00544
Selenium		0.0551	0.0507	0.0448	0.0411	0.0381	0.0341	0.0346	0.0324	0.0296
HAPs (Total)										

Parameter	Maximum Annual Emissions (TPY): Distillate Fuel Oil (2) 1 CT	2 CTs	Natural Gas (4) 1 CT	2 CTs	Natural Gas and Fuel Oil (2) 1 CT	2 CTs
1,3-Butadiene	0.016	0.032	0.0036	0.0072	0.019	0.039
Acetaldehyde	0.0	0.0	0.34	0.67	0.298	0.60
Acrolein	0.0	0.0	0.054	0.108	0.048	0.095
Benzene	0.056	0.11	0.101	0.20	0.145	0.29
Ethylbenzene	0.0	0.0	0.268	0.54	0.239	0.48
Formaldehyde	0.25	0.6	1.26	2.5	1.40	2.8
Naphthalene	0.036	0.07	0.0109	0.022	0.045	0.090
Polycyclic Aromatic Hydrocarbons (PAH)	0.041	0.08	0.0185	0.037	0.057	0.11
Propylene Oxide	0.0	0.0	0.244	0.49	0.216	0.43
Toluene	0.0	0.0	0.278	0.56	0.246	0.49
Xylene	0.0	0.0	0.54	1.08	0.48	0.95
Antimony	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic	0.011	0.022	0.0	0.0	0.0112	0.022
Beryllium	0.00031	0.0006	0.0	0.0	0.00031	0.00063
Cadmium	0.0049	0.010	0.0	0.0	0.0049	0.010
Chromium	0.011	0.022	0.0	0.0	0.0112	0.022
Lead	0.014	0.028	0.0	0.0	0.014	0.028
Manganese	0.80	1.6	0.0	0.0	0.80	1.6
Mercury	0.0012	0.0024	0.0	0.0	0.00122	0.0024
Nickel	0.0047	0.009	0.0	0.0	0.0047	0.0093
Selenium	0.025	0.051	0.0	0.0	0.025	0.051
HAPs (Total)	1.3	2.6	3.1	6.2	4.1	8.1

(1) Emissions based on the following emission factors and conversion factors for firing distillate fuel oil:

Emission Factors		Value	Reference
1,3-Butadiene	(a)	16	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Acetaldehyde		0.0	
Acrolein		0.0	
Benzene		55	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Ethylbenzene		0.0	
Formaldehyde		280	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Naphthalene		35	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Polycyclic Aromatic Hydrocarbons (PAH)		40	lb/10^{12} Btu; AP-42, Table 3.1-4, EPA 2000
Propylene Oxide		0.0	
Toluene		0.0	
Xylene		0.0	
Antimony		0.0	
Arsenic	(a)	11	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Beryllium	(a)	0.31	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Cadmium		4.8	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Chromium		11	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Lead		14	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Manganese		790	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Mercury		1.2	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Nickel	(a)	4.6	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000
Selenium	(a)	25	lb/10^{12} Btu; AP-42, Table 3.1-5, EPA 2000

(a) Based on 1/2 the detection limit; expected emissions are lower.

(2) Annual emissions based on ambient temperature of 59 °F and firing fuel oil for: 1,000 hours at 100 percent load
natural gas for 7,760 hours at 100 percent load
8,760 total hours

(3) Assumed to be representative of Polycyclic Organic Matter (POM) emissions, a regulated HAP.

(4) Annual emissions based on ambient temperature of 59 °F firing natural gas for 8,760 hours at 100 percent load

II: WATER

A. Industrial Wastewater (IWW) Comments and Questions

<u>**IWW Comment 1**</u>

On page 2.3.2-7, FPC states that seven consecutive quarters of ground water sampling and analysis have been completed at the facility. Only the analysis for samples collected on 3/13/00, first quarter 2000, was included in Appendix 10.5.2. FPC has made a request for the Department to reduce ground water monitoring parameters. The District requested FPC submit a trend analysis for those parameters that they wish to have removed. The requested information has not been submitted at the time of this review. We recommend that this information be included as part of the supplemental site certification application review.

Response:

This comment is substantially similar to a comment contained in the Department's industrial waste inspection report of July 20, 2000. FPC re-submitted all of the requested data in its October 17, 2000 response to that inspection report. FPC intends to address the issue of ground water monitoring parameter reduction in the context of post-certification review for Power Block 1, in accordance with the procedure set forth in Condition XVIII.A.10 of existing Site Certification PA 92-33. No additional reduction in the groundwater monitoring requirements is being sought as part of this Supplemental Site Certification Application and, therefore, the information is not duplicated here.

IWW Comment 2

FPC indicates in the application that they will be doubling the amount of RO brine discharged to the brine pond. Condition XVII.G.2.e. of the facility's site certification provides details for evaluating the impact of the brine on the disposal pond. This condition specifies pre-operation and operational phase programs. Joe May, FDEP Technical Services, stated that FPC performed pre-operational characterization during the initial site certification process, however, there are no records in the district files that the operational phase program was implemented. On page 5.3-7, FPC states that they are still conducting the brine pond study and will submit the results to the Department. If this study is the same as that required by the site certification, we recommend it be reviewed as part of the supplemental site certification application.

Response:

As stated in the original Site Certification Application and the Supplemental Site Certification Application and as noted by the District reviewer, there is the potential for the volume of releases to the brine pond to increase, possibly doubling, due to the addition of Power Block 2. However, please note that there will be no change to the characteristics of this waste stream resulting from this increase in volume. The remainder of Comment 2 is substantially duplicative of the Department's July 20, 2000 industrial waste inspection report. FPC's response to this comment was included in its October 17, 2000 response to this inspection report. The technical requirements for the pre-operational clay characterization and five-year post operational clay / brine interaction study are specified in Condition XVII.G. of the existing certification. The required study is continuing under the original conditions of certification, independent of the Supplemental Site Certification Application for Power Block 2.

IWW Comment 3

A review of district files indicates the following:

- ***The comprehensive operation plan required under Condition XVII.G.2.h. of the facility's site certification could not be located in the district files nor could the Departmental letter approving the plan.***
- ***The waste stream characterizations for the cooling pond and brine pond required under Condition XVIII.A.8. of the facility's site certification could not be located in the district's files.***

We recommend that this information be submitted to both the District and Tallahassee staff.

Response:

This comment was also addressed in FPC's October 17, 2000 response to the Department's July 20, 2000 industrial waste inspection report. As stated in FPC's October 17, 2000 response to that report, all of the information and submittals mentioned in the District's comment have been submitted in accordance with the requirements of the existing site certification and duplicate copies were attached to FPC's October 17, 2000 response.

IWW Comment 4

FPC mentions chemical and biocide wastes in section 3.6 of the supplemental site certification application. A characterization of these waste streams should be submitted.

Response:

The application of chemicals and biocides for the closed-cycle Cooling Pond water treatment for the Hines Energy Complex's entire 3000 MW of ultimate site capacity was reviewed and approved in the original site certification. Section 3.6 of the Supplemental Site Certification Application simply repeats that initial information for purposes of providing an overview of the Project. In accordance with the requirements of that existing site certification (Condition XVIII.A.8.), FPC has characterized this waste stream and submitted that data to the Department as part of the post-certification review process. These waste streams are discharged only to the zero discharge Cooling Pond and, therefore, do not enter waters of the state. The application of new chemicals or biocides is not proposed as part of this Supplemental Site Certification Application.

IWW Comment 5

FPC discusses oil spill prevention in section 3.6.7 of the supplemental site certification application. FPC should provide a discussion of procedure for discharging oil tank secondary containment to the cooling water pond.

Response:
FPC's as-built plans for dike area drainage facilities were previously submitted by FPC and reviewed and approved by the Department under the post-certification review procedures of Condition III.H. of the original site certification. (See FPC October 1, 1999 submittal to FDEP – As-Built Plans and Certification of Facilities. Additional copies will be provided upon request.) As was illustrated by the above-referenced plans, dike drainage is discharged from the liner's integrated sump to the plant oil / water separator, which then discharges to the Cooling Pond. Please note that no additional oil tank capacity or construction is being requested under the Supplemental Site Certification Application. Therefore, no changes in FPC's procedure for releasing dike drainage are being proposed as part of this Supplemental Site Certification Application.

IWW Comment 6

The potential for water quality concerns (i.e.: nutrients, chlorophyll, etc.) associated with the release of water from old clay settling areas to surface waters should be addressed.

Response:

FPC is not proposing to dewater any clay settling areas or to discharge dewatering effluent to waters of the state in association with the Power Block 2 Supplemental Site Certification Application. If the offsite discharge of dewatering effluent from any clay settling areas is proposed by FPC in the future, then appropriate federal approvals will be obtained at that time, and any necessary modification to the Hines Energy Complex certification will be in accordance with the post-certification review procedures set forth in the original site certification and the Florida Electrical Power Plant Siting Act.

IWW Comment 7

In section 4.2 of the supplemental site certification application, FPC discusses dewatering activities. It should be noted that under NPDES, any dewatering activity, which discharges to surface waters, must obtain approval under Chapter 62-621, F.A.C.

Response:
It is so noted.

General Comment:

This staff assessment is preliminary and is designed to assist in the review of the application prior to final agency action. The comments provided herein are not the final position of the department and may be subject to revision pursuant to additional information and further review.

Response:
It is so noted. However, any further sufficiency review questions must comply with the provisions of Rule 62-17.081, F.A.C.

B. Groundwater Comment

<u>Comment</u>

The monitoring wells that are present were installed with the intention of incorporating the planned addition of Power Block Two. The submittal should address the additional monitoring parameters needed for fuel oil wastewater effluent cooling pond discharge.

Response:

The design and construction of the fuel oil dike drainage facilities was approved under the post-certification review procedures of Condition III.H. of the original site certification. (See FPC October 1, 1999 submittal to FDEP – As-Built Plans and Certification of Facilities. Additional copies will be provided upon request.) The previously performed waste stream characterization for the Cooling Pond, as well as the quarterly monitoring of the site groundwater wells, have incorporated the necessary parameters to characterize any impact to the Cooling Pond or to groundwater from discharges of dike drainage to the Cooling Pond for full site build-out. Since no additional fuel storage facilities or changes to fuel type are proposed in this Supplemental Site Certification Application, additional groundwater monitoring parameters are not necessary at this time.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT (SWFWMD)

SWFWMD Comment 1

The current Supplemental Site Certification Application (SSCA) No. PA92-33SA refers to and contains documentation of the Water Use Permit (WUP) No 2011407.000, as the WUP associated with the above-mentioned SSCA. The referenced WUP number is associated with the Florida Power Corporation (FPC)'s Polk City Combined Cycle Facility, whereas the current SSCA relates to the FPC's Hines Energy Complex. The WUP associated with this site is WUP No. 2010944.000. Accordingly, the correct WUP number and documentation associated with the current SSCA needs to be provided. [40D-2.091 F.A.C., 40D-2.101, F.A.C., 40D-2.301, F.A.C., 2.1.1, Basis of Review for Water Use Permit Applications.]

Response:

The Hines Energy Complex is the official name of the facility, which was formerly known as the Polk County Site. WUP No. 2011407.000 is a General Water Use Permit that FPC obtained after issuance of the original certification to use a then existing well on the site for general maintenance purposes. FPC is no longer using this well and will therefore request to retire the permit in the near future. FPC understands from recent conversations with SWFWMD Bartow Service Office staff that WUP No. 2010944.000 is the internal tracking designation for Hines Energy Complex water use issues. In that regard, FPC will use this number in future correspondence with the District, taking into account that the applicable water use conditions for the facility are incorporated in Condition XXVI of existing Site Certification PA 92-33.

SWFWMD Comment 2

It is unclear how the proposed drainage enhancement for Camp Branch (areas N-11A, N-13, N-9B) will reach Tiger Bay or Camp Branch in the post-reclamation condition. The Storage/Release Mode diagram (Figure 3.3.6-2) depicts the temporary water crop system for those areas. Under that system, water from these areas is shown as flowing to water crop areas N-11B and N-16W. A flow diagram that depicts the proposed post-reclamation drainage enhancement for Camp Branch must be provided. In addition, an estimate of the expected timing, frequency and volume of the proposed drainage enhancement and provide a comparison with existing or estimated flow data for Camp Branch is necessary. [40D-2.091, F.A.C., 40D-2.101, F.A.C., 40D-2.301, F.A.C., 2.1.1, Basis of Review for Water Use Permit Applications.]

Response:

Figure 3.8.6-2[1] depicts the temporary use of several parcels to provide cooling water for the N-16 Cooling Pond. However, please note that the N-11A, N-13 and N-9B parcels are currently being reclaimed to provide, along with the Tiger Bay parcel, the onsite watershed for Camp Branch. At the point in time that proper stabilization (revegetation) of these reclaimed areas is complete, all drainage from these parcels will be diverted by means of a control structure at the southern end of the N-9B parcel. (See Attachment 1, Figure 3.8.6-3.) This diversion of surface water flows to Camp Branch was previously considered and approved in the original certification. (See In Re: Application for Power Plant Certification – Florida Power Corporation Polk County Site – PA 92-33, Finding of Fact 64, Recommended Order issued 12-3-93, adopted by Final Order of the Siting Board issued 1-27-94, which provides in pertinent part, "Certain non-industrial areas within the Polk County site will be designed, however, to provide offsite drainage to enhance flows to McCullough Creek and Camp Branch. . . . Drainage from parcels N-11A, N-13, N-9B, Tiger Bay East and Tiger Bay will enhance flows to Camp Branch. . . . The net effect of the drainage enhancement plans will be to equal or improve flows to . . . Camp Branch over the baseline condition for the site.") Consistent with the Memorandum of Agreement between the District and the Florida Department of Environmental Protection Bureau of Mine Reclamation (BOMR), FPC has already fulfilled its Basis of Review requirements by submitting reclamation plans, including a complete hydrology analysis, for these areas. These plans have been approved by BOMR in accordance with the post-certification requirements of the original Site Certification (PA 92-33), Condition III.H. A copy of the plans will be provided upon request.

[1] This agency comment refers to a non-existent Figure 3.3.6-2. The figure referenced in the comment appears to be Figure 3.8.6-2, which depicts the water crop system's storage / release mode.

SWFWMD Comment 3

The applicant needs to demonstrate that the proposed water crop system will not affect the hydration of wetlands within the Tiger Bay area. [40D-2.091, F.A.C., 40D-2.101, F.A.C., 40D-2.301, F.A.C., Basis of Review for Water Use Permit Applications.]

Response:
The water crop system is designed to assist in providing an adequate water supply for the N-16 Cooling Pond. The original Site Certification Application for the site contained information substantiating that, at normal operating level, the Cooling Pond will provide hydration for Tiger Bay. During review of the Site Certification Application in 1993, FPC agreed with the District suggestion to construct sand drains every 200 feet along the toe of the south dam of N-16 to provide a constant supply of seepage from the cooling pond to Tiger Bay. These sand drains were constructed in accordance with the approved plans and are currently functioning successfully. These enhancements, in conjunction with the reclamation drainage enhancements described in FPC's response to SWFWMD Comment 2 above, will provide the necessary hydration to the Tiger Bay area. These systems will continue to function independent of the operation of any other water crop areas on the site.

SWFWMD Comment 4

The expected frequency and volume of the proposed McCullough Creek drainage enhancement must be provided and estimated. The applicant also needs to compare this with any existing or estimated flow data for McCullough Creek. [40D-2.091 F.A.C., 40D-2.101, F.A.C., 40D-2.301, F.A.C., 2.1.1, Basis of Review for Water Use Permit Applications.]

Response:

The plans and hydrologic analysis for the McCullough Creek Drainage Enhancement Project were reviewed and approved in the original certification (See In Re: Application for Power Plant Certification – Florida Power Corporation Polk County Site – PA 92-33, Finding of Fact 64, Recommended Order issued 12-3-93, adopted by Final Order of the Siting Board issued 1-27-94, which provides in pertinent part, "Certain non-industrial areas within the Polk County site will be designed, however, to provide offsite drainage to enhance flows to McCullough Creek and Camp Branch. Flow to McCullough Creek will be enhanced by drainage from parcel SA-10, an offsite portion of the Estech Silver City Plant Site, and the southerly portion of parcel SA-12. . . . The net effect of the drainage enhancement plans will be to equal or improve flows to McCullough Creek . . . over the baseline condition for the site."), and subsequently amended in accordance with the Post-Certification review requirements of the original Site Certification. The final component of this project is the SA-10 parcel reclamation program, which is currently under construction.

SWFWMD Comment 5

Excess water from storm events collected in the water crop areas is proposed to be released to Six Mile Creek, as ultimately a flow enhancement to the Peace River. An estimate of the expected frequency and volume of these discharges to Six Mile Creek needs to be provided along with a comparison with existing and historic flow data for Six Mile Creek. [40D-2.091 F.A.C., 40D-2.101, F.A.C., 40D-2.301, F.A.C., 2.1.1, Basis of Review for Water Use Permit Applications.]

Response:

The issue of off-site drainage was previously resolved in the original certification for the Hines Energy Complex site (formerly the FPC Polk County site). With regard to off-site drainage to Six Mile Creek, the Final Order of the Siting Board provides in pertinent part:

> FPC has agreed to explore the possibility of restoring drainage to Six Mile Creek if onsite water cropping produces more water than FPC needs for power plant operations and if such drainage can be accomplished without additional permits.

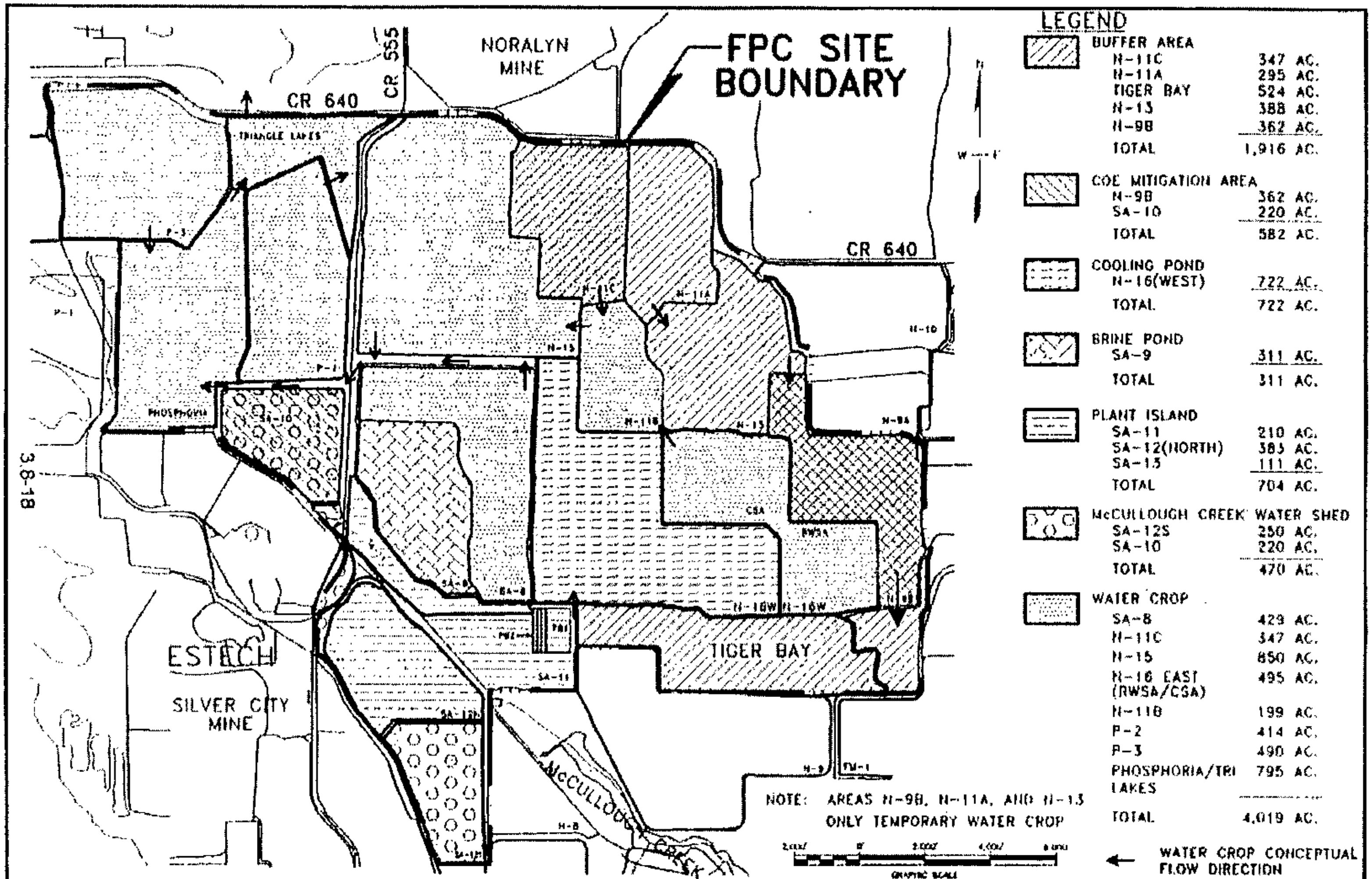
(See In Re: Application for Power Plant Certification – Florida Power Corporation Polk County Site – PA 92-33, Finding of Fact 64, Recommended Order issued 12-3-93, adopted by Final Order of the Siting Board issued 1-27-94.) The only area of the site that is designated as water shed for the Six Mile Creek system is the Phosphoria Mine Area west of County Road 555. This area was mined by IMC-Agrico under a mineral lease from FPC and its reclamation by IMC is in the final phase at this time. Upon completion of the reclamation project by IMC, all drainage from the area will be potentially available for discharge to the north to the Six Mile Creek system on IMC's Noralyn Mine. However, since FPC has been approved to use the Phosphoria Mine as a water crop area for the life of the Hines Energy Complex facility (Id. at Finding of Fact 65), FPC plans to utilize some of the runoff from Phosphoria, when needed, as water supply for the Cooling Pond. This water would be withdrawn from the reclaimed lakes immediately south of State Road 640, and either returned to FPC's water crop impoundments on the east side of County Road 555 or returned directly to the Cooling Pond for plant uses. These lakes at the northern boundary of Phosphoria are the final holding areas for the Phosphoria Mine drainage, prior to its discharge via culverts under the road to the north. Therefore, any withdrawals from the lakes will create no negative impacts to the reclaimed environmental systems within the reclaimed Phosphoria mine area.

With respect to water crop areas other than Phosphoria, it is FPC's intent to utilize water from these areas as a primary supply of cooling water for the Hines Cooling Pond. However, if necessary during periods of excessive

(Response to SWFWMD Comment 5, continued):
rainfall, FPC may need to discharge excess impounded water (from water crop areas) to Six Mile Creek. Such discharges would occur only as necessary to maintain safe freeboard levels within water crop impoundments, in accordance with FPC's dam safety procedures. Because surface water discharges from water crop areas will occur only on an as-needed basis, based almost entirely on rainfall conditions, FPC is unable at this time to project the frequency and duration of the releases. However, please note that any releases to Six Mile Creek will be routed through areas that are designed and constructed in accordance with the requirements of the original site certification and subsequent post-certification approvals. Releases to Six Mile Creek from water crop areas east of CR 555 would be routed via existing ditches and culverts through reclaimed Phosphoria areas west of CR 555.

Attachment 1

Figure 3.8.6-3



Florida Power CORPORATION

Hines Energy Complex

FIGURE 3.8.6-3

STORAGE/RELEASE MODE (POST RECLAMATION)

Department of Environmental Protection

Jeb Bush
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

August 23, 2000

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. W. Jeffrey Pardue
Director Environmental Services Department
Florida Power Corporation
PO Box 14042
St. Petersburg, Florida 33733-4042

Re: Request for Additional Information
DEP File No. 1050234-004-AC (PSD-FL-296)
Hines Energy Complex, Power Block 2

Dear Mr. Pardue:

On July 24, 2000 the Department received your application and complete fee for an air construction/PSD permit for the construction of two combustion turbines to create Power Block 2 at the existing Hines Energy Complex. The application is incomplete. In order to continue processing your application, the Department will need the additional information requested below. Should your response to any of the below items require new calculations, please submit the new calculations, assumptions, reference material and appropriate revised pages of the application form.

1. Please provide the air quality impact modeling data files for Department review. The Department may have additional questions related to air quality modeling after review of this information.

2. Please provide the CO concentrations for natural gas firing and fuel oil firing at the outlet of the turbine/inlet of the HRSG, for conditions of 50% and 60% of full load, or provide curves that cover these operating conditions. Also provide mass emission estimates for these loads.

3. Please provide the vendor's quote used in the cost effectiveness analysis for selective catalytic reduction. This quote must be for this project and not a scaled estimate from another project, or from a turbine of different size or manufacturer.

4. Based upon the hours of operation and load levels requested in the application, the Department is likely to require control of CO with an oxidation catalyst to an expected level of 6 ppmvd @ 15% O_2 or less. Please address, if you wish, any changes to your requested allowable operation given this possibility.

5. Please provide the vendor's quote used in the cost effectiveness analysis for oxidation catalyst for CO control, and provide a cost effectiveness estimate using this quote. This quote must be for this project and not an estimate from another project, or from a turbine of different size or manufacturer.

6. The Department has advised other applicants that it considers SCONOx to be a commercially available technology. Please obtain a vendor quote from Alstom Power for SCONOx with commercial and performance guarantees similar to that of the SCR system with an oxidation catalyst, and provide a cost effectiveness estimate using this quote. This quote must be for this project and not an estimate from another project, or from a turbine of different size or manufacturer.

7. Please provide an updated estimate of HAP emissions for this project and include complete supporting information for any emission factors and assumptions used in the estimate. The application does not indicate whether this project is major for HAPs. Please address.

8. Provide an estimate of the duration and quantity of emissions under expected startup and shutdown scenarios. How many (and what duration) startup and shutdown cycles are anticipated per day, month, and year for each

combustion turbine? The Department plans to address excess emissions from startup and shutdown in its BACT determination.

9. The maximum heat input rate at 59°F of 1830 mmBtu/hr, firing gas, and 1932 mmBtu/hr, firing oil, (HHV) is less than the newly increased allowable maximum heat input rate of 1915 mmBtu/hr, firing gas, and 2020 mmBtu/hr, firing oil, (HHV) for the turbines for Power Block 1. Please address and revise the estimated potential mass emissions if the requested maximum heat input rate is revised in this application.
10. What are the actual CO and NOx concentrations at the outlet of the turbines of Power Block 1 over the range of operating conditions requested for Power Block 2?
11. Are there any other proposed emissions units related to this project such as fuel heaters, cooling towers, fuel storage tanks? Will emissions increase at any existing emissions units as a result of this project?
12. Please provide supporting information for the SAM emissions factor.
13. What are cases A, B, C and D in Table A-25?
14. Please provide more information to support the estimate of costs of instrumentation considered in the cost estimate for CO catalyst. Also, provide more detail regarding the estimate for heat rate penalty in your analysis.

The Department will resume processing your application after receipt of the requested information. Rule 62-4.050(3), F.A.C. requires that all applications for a Department permit must be certified by a professional engineer registered in the State of Florida. This requirement also applies to responses to Department requests for additional information of an engineering nature. Material changes to the application should also be accompanied by a new certification statement by the authorized representative or responsible official. Permit applicants are advised that Rule 62-4.055(1), F.A.C. now requires applicants to respond to requests for information within 90 days. If there are any questions, please call me at 850/921-9519. Matters regarding modeling issues should be directed to Cleve Holladay (meteorologist) at 850/921-8986.

Sincerely,

Joseph Kahn, P.E.
New Source Review Section

/jk

cc: Gregg Worley, EPA
John Bunyak, NPS
Bill Thomas, P.E., DEP SWD
Ken Kosky, P.E., Golder Associates, Inc.
Buck Oven, DEP SCO

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1. Article Addressed to:

Mr. W. Jeffrey Pardue
Director Environmental
Services Dept.
Florida Power Corp.
P. O. Box 14042
St. Petersburg, FL 33733-4042

COMPLETE THIS SECTION ON DELIVERY

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C. Signature AUG 2 5 2000

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Name *(Please Print Clearly) (to be completed by mailer)*
W. JEFFREY PARDUE, FL POWER CORP.
Street, Apt. No.; or PO Box No.
PO BOX 14042
City, State, ZIP+4
ST. PETERSBURG FL 33733-4042

PS Form 3800, July 1999 See Reverse for Instructions

Florida Power
CORPORATION

RECEIVED

AUG 16 2000

BUREAU OF AIR REGULATION

August 14, 2000

Mr. Al Linero, P.E.
Bureau of Air Regulation
Florida Department of Env. Protection
2600 Blairstone Road
Tallahassee, Florida 32399-2400

RE: Florida Power Corporation
Hines Energy Complex
Power Block 2
Supplemental Site Certification Application, PA 92-33SA

Dear Mr. Linero:

During initial agency review of the Supplemental Site Certification Application (SSCA) for Hines Power Block 2, a minor error in the compilation of the document has been discovered. The purpose of this letter is to correct this error and to avoid any confusion as parties continue with their evaluations of the document. There is no effect on the accuracy of the information provided.

In Volume 1, behind Tab 9, "Coordination," there may be several copies of a drawing entitled "Figure 3.2.1 – 1: Preliminary Ultimate Site Arrangement – Case A, Six Combined Cycle Units." These pages should be removed from the SSCA. This drawing should be located only in Volume 2, behind Tab 10.4.1.2.

This letter of clarification is also being provided to all recipients of the SSCA and all counsel to agency parties. If you have any questions, you may call me at 727-826-4121.

Sincerely,

Patricia Q. West

Patricia Q. West
Manager, Environmental Programs

One Power Plaza • 263 – 13th Avenue South • St. Petersburg, FL 33701-5511
P.O. Box 14042 • St. Petersburg, FL 33733-4042 • (727) 820-5151
A Florida Progress Company

Florida Department of
Environmental Protection

Memorandum

RECEIVED
AUG 09 2000
BUREAU OF AIR REGULATION

TO: Power Plant Siting Review Committee

FROM: Buck Oven

DATE: August 9, 2000

SUBJECT: Florida Power Corp. Hines Energy Complex - Power Block 2
PA 92-33SA, Module 8043

The Department has received a supplemental application for certification of Power Block 2 at the FPC Hines Energy Complex in Polk County. Please review the application for Sufficiency (completeness) and advise me by September 12, 2000. Please keep in mind that this is a supplemental application. Some information in the original application submitted as FPC Polk County Site will still be relevant. Some of the Conditions of Certification (COC) for the units of Power Block 1 and the site as a whole will apply. This will also be an opportunity to review the COC and to update them as may be appropriate.

If you have questions, call me at Suncom 277-2822.

cc: Tim Parker
Geof Mansfield
Joe Bakker
Mary Jean Yon
Al Linero

Florida Power
CORPORATION

DEPARTMENT OF
ENVIRONMENTAL PROTECTION

AUG 08 2000

SITING COORDINATION

August 7, 2000

Mr. Buck Oven
Siting Office
Florida Dept. of Env. Protection
2600 Blairstone Road
Tallahassee, Florida 32399-2400

Dear Mr. Oven:

RE: Florida Power Corporation
Hines Energy Complex
Power Block 2
Supplemental Site Certification Application to PA 92-33

Florida Power Corporation (FPC) is pleased to submit to the Department FPC's Supplemental Site Certification Application for Hines Power Block 2 to be located at the Hines Energy Complex in Polk County.

Pursuant to Section 403.517, F.S., of the Florida Electrical Power Plant Siting Act, Chapter 403, Part II, F.S., FPC is seeking supplemental certification for the construction and operation of Power Block 2. This addition is a 530 MW (nominal) combined cycle facility fired by natural gas with distillate oil as a back-up fuel. Ultimate site capacity of 3000 MW was approved for the Hines Energy Complex in 1994 (DEP Case No. PA 92-33). The Conditions of Certification were subsequently modified in December 1995, August and December 1997.

The application for supplemental certification addresses the environmental and socioeconomic impacts and benefits of Hines Power Block 2 by providing information in accordance with the Department's "Instruction Guide for Certification Applications: Electrical Power Plant Site, Associated Facilities, and Transmission Lines", DER Form 17-1.211(1), F.A.C. Since the Hines Energy Complex site has been previously certified for an ultimate site capacity of 3,000 MW, this application focuses on the specific impacts and benefits associated with the construction and operation of Power Block 2 on this site. The Siting Board has previously determined that

FPC's Hines Energy Complex site is consistent and in compliance with the land use plans and zoning regulations of Polk County. Accordingly, a separate compilation on land use and zoning approvals is not included with this application.

FPC looks forward to working you and the agency staff participating in the certification process. Should you, your staff, or any agency representatives have any questions concerning this application or FPC's project, please do not hesitate to contact me at: (727) 826-4121.

Sincerely,

Patricia Q. West

Patricia Q. West
Manager

Enclosure

Department of
Environmental Protection

Jeb Bush
Governor

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

David B. Struhs
Secretary

August 2, 2000

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

Mr. John Bunyak, Chief
Policy, Planning & Permit Review Branch
NPS – Air Quality Division
Post Office Box 25287
Denver, Colorado 80225

RE: Florida Power Corporation
Hines Energy Complex – Power Block 2
PSD-FL-296
Facility ID No. 1050234-004-AC

Dear Mr. Bunyak:

Enclosed for your review and comment is an application for construction of a PSD source. The applicant, Florida Power Corporation, proposes the addition of Power Block 2 at their existing Hines Energy Complex in Polk County, Florida.

Your comments may be forwarded to my attention at the letterhead address or faxed to the Bureau of Air Regulation at 850/922-6979. If you have any questions, please contact the project engineer, Joe Kahn, at 850/921-9519.

Sincerely,

Al Linero, P.E.
Administrator
New Source Review Section

AAL/jka

Enclosures

FLORIDA

Jeb Bush
Governor

Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

David B. Struhs
Secretary

August 2, 2000

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

Mr. Gregg Worley, Chief
Air, Radiation Technology Branch
Preconstruction/HAP Section
U.S. EPA – Region 4
61 Forsyth Street
Atlanta, Georgia 30303

RE: Florida Power Corporation
Hines Energy Complex – Power Block 2
PSD-FL-296
Facility ID No. 1050234-004-AC

Dear Mr. Worley:

Enclosed for your review and comment is an application for construction of a PSD source. The applicant, Florida Power Corporation, proposes the addition of Power Block 2 at their existing Hines Energy Complex in Polk County, Florida.

Your comments may be forwarded to my attention at the letterhead address or faxed to the Bureau of Air Regulation at 850/922-6979. If you have any questions, please contact the project engineer, Joe Kahn, at 850/921-9519.

Sincerely,

Al Linero, P.E.
Administrator
New Source Review Section

AAL/jka

Enclosures

SENDER: *COMPLETE THIS SECTION*

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1. Article Addressed to:

Mr. Greg Worley
Air, Radiation Technical Branch
US EPA - Region 4
61 Forsyth St.
Atlanta, GA 30303

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Mr. Greg Worley
Air, Radiation Technical Branch
US EPA - Region 4
61 Forsyth St.,
Atlanta, GA 30303

PS Form 3800, July 1999 See Reverse for Instructions