UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

4APT-AEB

JAN 24 1994

DEPARTMENT OF ENVIRONMENTAL PROTECTION

JAN 31 1994

OFFICE OF THE SECRETARY

Mr. Clair H. Fancy, P.E., Chief
Bureau of Air Regulation
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

SUBJ: Florida Power Corporation,
Polk County (PSD-FL-195)

Dear Mr. Fancy:

This is to acknowledge receipt of the preliminary determination and draft Prevention of Significant Deterioration (PSD) permit for the above referenced facility, by your correspondence dated December 16, 1993. The proposed facility will be a 470 megawatt (MW) combined cycle facility, subject to the State Power Plant Siting Act (PPSA) and federal PSD regulations found at 40 C.F.R. Section 52.21. The proposed project will consist of two 235 MW combined cycle generating units, primarily firing natural gas. Each unit will consist of one combustion turbine, one heat recovery steam generator, and one steam turbine generator.

Your determination proposes to limit NO_x emissions from the combustion turbines through advanced dry low-NO_x combustion technology when firing natural gas and water injection when firing fuel oil, to limit SO_2 and H_2SO_4 emissions through limiting the sulfur content of the No. 2 distillate fuel oil, to limit CO, VOC, and PM/PM_{10} emissions through combustion control, and to limit arsenic, beryllium, and benzene emissions through combustion control and the use of clean fuels.

We have reviewed the package as submitted and have no adverse comments. Thank you for the opportunity to review and comment on the package. If you have any questions or comments, please contact Mr. Scott Davis of my staff at (404) 347-5014.

Sincerely yours,

Jewell A. Harper, Chief
Air Enforcement Branch
Air, Pesticides, and Toxics
Management Division

cc: S. Arif
B. Thomas, SW Dist
G. Bernyak, NPS
J. Osbourne, FPC

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

IN REPLY REFER TO:

January 19, 1994

Mr. Clair Fancy
Chief, Bureau of Air Regulation
Florida Department of
Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399

Dear Mr. Fancy:

We have reviewed the Prevention of Significant Deterioration (PSD) permit application and the Technical Evaluation and Preliminary Determination for Florida Power Corporation's (FPC) proposed project to construct and operate two gas turbines with a combined generating capacity of 470 MW. The facility would be located in Polk County, Florida, approximately 118 km southeast of Chassahowitzka Wilderness Area (WA), a Class I air quality area administered by the Fish and Wildlife Service (FWS). The proposed project would be a significant emitter of nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOC). The facility is also subject to PSD regulations for beryllium, benzene, and inorganic arsenic.

Best Available Control Technology Analysis

FPC proposes to use proper combustion controls, water injection, and advanced dry low-NO_x combustors to minimize emissions from the combustion turbines. We agree that using proper combustion controls and burning a low sulfur fuel represent the best available control technology (BACT) for PM, VOC, and SO_2. We also agree with the BACT determinations for the storage tank and the auxiliary boiler.

For minimizing NO_x emissions, we believe that either dry low-NO_x combustors, or water injection in combination with Selective Catalytic Reduction (SCR) is the BACT for new combined cycle combustion turbine projects. Dry low-NO_x combustors can reduce NO_x levels to less than 15 parts per million (ppm) when firing natural gas, while SCR can achieve flue gas NO_x concentrations as low as 6 ppm when burning gas and 9 ppm when burning oil.

Recent PSD permit applicants have been looking for ways to inherently lower emissions from combustion turbines rather than opting for add-on flue gas cleaning technologies. The BACT process is thus driving emissions from combustion turbines downward as manufacturers strive to achieve low emission levels without add-on controls. The advantages of this approach are obvious. For example, with dry low-NO_x combustors, the potential problems often cited with SCR (i.e., ammonia slip, disposal of spent catalyst, accidental release of stored ammonia, etc.) would not be a factor. Assuming this process continues and inherently lower emitting systems are developed, such an approach may be preferred from a total environmental standpoint.

Regardless of which control technology is used, we believe that permit conditions should reflect the minimum achievable NO_x emission rates. General Electric (GE) is developing processes, using either steam/water injection or dry-low NO_x combustor technology to achieve a NO_x control level of 15 ppm when firing natural gas. Accordingly, we are pleased to see the FDER proposes to accept low-NO_x burner design with a maximum NO_x emission limit of 12 ppm. We are also pleased to see the FDER may lower the limit to 9 ppm, if this lower limit can be met, in recognition that GE is developing combustors that may achieve an even lower rate of 9 ppm. Therefore, while we do not object to the FDER allowing FPC to emit at the 12 ppm NO_x rate until GE develops the combustors, we feel that the draft permit should be revised. As written now, it requires configuration of the turbines to allow application of SCR, but the permit does not indicate that SCR will required if the NO_x emission limit of 12 ppm cannot be met. We recommend that the permit require FPC to install SCR if the dry low-NO_x combustors cannot meet the 12 ppm rate. We believe SCR is feasible for this facility. The costs cited in the application are high compared to other facilities. The only reason for the higher cost appears to be the fact that FPC will use fuel oil as a backup fuel. Since oil will only be used for 500 hours, or 6 percent of the operating year, the cost should not become inflated as much as indicated. SCR should not be eliminated as an option unless the applicant demonstrates that costs are too high for other reasons than fuel oil use. We appreciate the FDER's continued initiative in ensuring that NO_x BACT determinations remain on the cutting edge of technology.

FPC proposes to use good combustion control to minimize CO emissions from the turbines. The application cites a cost for catalytic oxidation control of $6,400 per ton of CO controlled. We agree that this appears to be infeasible, however, the application does not contain supporting documentation to demonstrate that the cost is infeasible when compared to other cogeneration facilities. This documentation should be provided.

Air Quality Modeling Analysis

The Class I Air Quality analysis for the proposed FPC project was performed correctly. The modeling analysis calculated the impacts from the proposed two turbines and the auxiliary boiler on Chassahowitzka WA.

The modeling was performed with the EPA Industrial Source Complex Short Term (ISCST2) dispersion model to assess impacts for SO_2, nitrogen dioxide (NO_2), and PM at Chassahowitzka WA. The modeling was performed for 5 years (1982-86) using surface meteorology from Tampa, Florida, and upper air meteorology from Ruskin, Florida. FPC proposes to fire natural gas for 8,260 hours per year and low sulfur fuel oil for 500 hours per year. Therefore, to evaluate the maximum worst case emission scenario for the short term SO_2 and PM Class I increments, FPC was assumed to be firing oil for these short term averages. To assess annual increment consumption, the modeling was performed assuming oil firing for 500 hours and natural gas firing for the remaining 8,260 hours.

The modeling analysis indicates that the proposed FPC facility will significantly impact Chassahowitzka WA for the short term Class I SO_2 increments with a maximum concentration of 1.73 $\mu g/m^3$ and 0.27 $\mu g/m^3$ for the 3-hour and 24-hour averaging periods, respectively. The proposed project will not significantly impact Chassahowitzka WA for the short term Class I PM increment nor the NO_2, SO_2, and PM annual increments. The cumulative modeling analysis indicates numerous Class I SO_2 increment violations for the 3-hour and 24-hour averaging periods, but the proposed facility will not significantly contribute to any of these modeled violations.

The visibility analysis performed with the EPA VISCREEN model indicates that there should be no impact of a coherent visible plume at Chassahowitzka WA.

Air Quality Related Values Analysis

FPC adequately addressed the effects of gaseous emissions from its proposed project on the air quality related valued (AQRVs) of Chassahowitzka WA. However, we have comments on the analysis of effects of nitrogen and sulfur deposition on the wilderness area. FPC predicted that the total sulpher and nitrogen deposition (background plus proposed project contribution) to Chassahowitzka WA would be 3.1 and 6.35 kilograms per hectare per year (kg/ha/yr), respectively. FPC states that these values are below the "green line" screening values (values below which no adverse effects to AQRVs are expected) presented in the Forest Service document, "A Screening Procedure to Evaluate Air Pollution Effects on Class I Wilderness Areas" (Fox et al., 1989). This is

not correct. The Forest Service document lists nitrogen deposition green line screening values for several Forest Service wilderness areas, which vary from 3-5 kg/ha/yr to 7-10 kg/ha/yr. FPC's total modeled concentration of 6.35 kg/ha/yr exceeds the lower Forest Service screening limits, and FPC provides no justification for choosing the higher limits. We would like to add that we find it inappropriate to apply any of the Forest Service screening values to Chassahowitzka WA. The Forest Service values were based on upland, forested ecosystems very unlike the coastal Chassahowitzka WA. The Forest Service has recognized that the screening values from the 1989 document have limited application, and are developing regional screening documents with Class I Forest Service area site-specific information. FWS also recognizes that site-specific information is necessary in order to make informed evaluations of AQRV effects, and is initiating special studies to gather information on the AQRVs of certain FWS Class I areas, including Chassahowitzka WA.

FPC provided a comprehensive summary of effects of metals emissions on vegetation. It would be more appropriate to evaluate the effects of metals on organisms higher in the food chain (e.g., fish, birds, and mammals) in which toxic accumulations are more likely to occur. Future applicants should perform this analysis for metals that are emitted in PSD significant amounts.

Thank you for providing us the opportunity to comment on the proposed project. If you have questions, please call Ms. Ellen Porter of our Air Quality Branch in Denver at 303/969-2071.

Sincerely yours,

John R. Eadie for

James W. Pulliam, Jr.
Regional Director

cc: S. Arif
J. Rogers
B. Thomas, SW Dist.
G. Harper, EPA
S. Osbourne, FPC

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Signed Hard copy

Florida Power
CORPORATION

RECEIVED
JAN 18 1994
Bureau of
Air Regulation

January 13, 1994

Mr. Preston Lewis, P.E., Supervisor
Permitting and Standards Section
Bureau of Air Regulation
Florida Department of Environmental Protection
2600 Blair Stone Rd.
Tallahassee, Florida 32399-2400

Dear Mr. Lewis:

Re: Florida Power Corporation, Polk County Project
Site Certification No. PA-92-33 ; Federal No. PSD-FL-195

This letter serves to transmit Florida Power Corporation's (FPC) comments on the Technical Evaluation and Preliminary Determination (TE/PD) for the above-referenced project, received in our office on December 21, 1993. FPC's comments are relatively minor, with the exception of two issues: 1) the inconsistency of emission totals reported among the various tables, and 2) the implied restriction of back-up fuel oil burning to a maximum of 500 hours per combustion turbine (CT), rather than 1,000 hours total for the two CTs. In order to facilitate your review, a marked-up copy of the TE/PD containing all of FPC's comments is attached.

FPC has reviewed all emissions figures reported in the TE/PD and discovered some inconsistencies. Specifically, it appears that some values are based on 40°F ambient conditions, while others are based on ambient conditions at 59°F. FPC has revised the figures to consistently reflect ambient conditions at 59°F. Further, total annual tonnage cannot be obtained by simply adding the ton per year (TPY) columns for natural gas and fuel oil. The TPY figures for natural gas and fuel oil are based on 8,760 hr/yr and 500 hr/yr, respectively. In order to get a worst-case annual TPY figure for each pollutant, the fuel oil estimates (based on 500 hr/yr) should be added to the natural gas values ratioed to 8,260 hr/yr (i.e., scale the values by 8,260/8,760).

FPC had requested a total of 1,000 hr/yr of fuel oil back-up for the 470 MW project, based on an estimate of 500 hr/yr/CT. Some language in the TE/PD seems to imply that the 500 hr/yr/CT is a maximum not to be exceeded, rather than a maximum of 1,000 hr/yr for both CTs. The overall effect of either option on the environment is the same; however, the 500 hr/yr/CT cap is more restrictive from an operational standpoint if, for example, one CT were to be out of service for an extended length of time while the site experienced natural gas curtailments. FPC requests that the restriction on fuel oil back-up simply be stated as a total cap of 1,000 hr/yr for both CTs.

The above comments are detailed further in the marked-up copy of the TE/PD attached. If you should have any questions or require additional information, please contact Scott Osbourn at (813)866-5158.

Sincerely,

Kathleen L. Small
Environmental Project Manager

Enclosure

cc:

Syed Arif	DEP-DARM
Richard T. Donelan, Jr.	DEP-OGC
Hamilton S. Oven, Jr.	DEP-Siting
Steve Palmer	DEP-Siting

ATTACHMENT 1

GENERAL OFFICE: 3201 Thirty-fourth Street South • P.O. Box 14042 • St. Petersburg, Florida 33733 • (813) 866-5151
A Florida Progress Company

Technical Evaluation
and
Preliminary Determination

Florida Power Corporation
Polk County, Florida

TWO COMBINED CYCLE COMBUSTION TURBINES
(Phase IA - 2X235 MW)

File No.: (PSD-FL-195)
(PA-92-33)

Department of Environmental Protection
Division of Air Resources Management
Bureau of Air Regulation

December 16, 1993

generating capacity (CT generators and steam turbine generators) of 470 MW, with the CTs fired primarily on natural gas, with low sulfur fuel oil as backup.

E. Project Emissions

The proposed project, combined cycle combustion turbines, will produce emissions of ~~792~~ 778 tons per year (TPY) of nitrogen oxides (NO_x); ~~56~~ 65 TPY of sulfur dioxide (SO_2); ~~722~~ 683 TPY of carbon monoxide (CO); ~~168~~ 83 TPY of particulate matter (PM/PM_{10}); ~~97~~ 91 TPY of volatile organic compounds (VOC); 0.0023 TPY of beryllium; 0.008 TPY of lead; 0.0027 TPY of mercury and 5.9 TPY of sulfuric acid mist if operated at 8760 hours per year (8,260 hours per year on natural gas and a maximum of ~~500~~ 1008 hours per year ~~per CT~~ on fuel oil) using a maximum of 0.05 percent sulfur and a maximum of 0.03 percent fuel bound nitrogen by weight in the No. 2 fuel oil. (per CT for both CTs)

II. RULE APPLICABILITY

The proposed project, construction of 470 MW of combined cycle units (SIC 4911) in Polk County, is subject to the State Power Plant Siting Act (PPSA) and preconstruction review under the provisions of Chapter 403, Florida Statutes, Chapters 17-212 and 17-4, Florida Administrative Code (F.A.C.), and 40 CFR 60 (July, 1993 version).

This facility is located in an area designated attainment for all criteria pollutants in accordance with F.A.C. Rule 17-275.400.

The proposed project will be reviewed under F.A.C. Rule 17-212.400(5), New Source Review (NSR) for Prevention of Significant Deterioration (PSD), because it will be a major new stationary source. This review consists of a determination of Best Available Control Technology (BACT) and unless otherwise exempted, an analysis of the air quality impact of the increased emissions. The review also includes an analysis of the project's impacts on soils, vegetation and visibility; along with air quality impacts resulting from associated commercial, residential and industrial growth.

The proposed facility shall be in compliance with all applicable provisions of F.A.C. Chapters 17-212 and 17-4 and the 40 CFR 60 (July, 1993 version). The proposed source shall be in compliance with all applicable provisions of F.A.C. Rules 17-210.650: Circumvention; 17-210.700: Excess Emissions; 17-296.800: Standards of Performance for New Stationary Sources (NSPS); 17-~~296~~ 297: Stationary Point Source Emission Test Procedures; and, 17-4.130: Plant Operation-Problems.

The proposed facility shall be in compliance with the New Source Performance Standards (NSPS) for Gas Turbines, Subpart GG and NSPS for Industrial Steam Generating Units, Subpart Dc, which are contained in 40 CFR 60, Appendix A, and are adopted by reference in F.A.C. Rule 17-296.800.

III. TECHNICAL EVALUATION

The applicant proposes to install four combined cycle combustion turbine generators at their facility in southwest Polk County. These generator systems will consist of: 1) four nominal 235 megawatt (MW) General Electric PG 7221 (FA) (or equivalent) combined cycle combustion turbines (CCCTs), with exhaust through a heat recovery steam generator (HRSG), which will be used to power a steam turbine. The initial phase (Phase IA) consists of two CTs, each equipped with one HRSG and exhausting to a separate stack, a 99 MMBtu/hr auxiliary boiler, a 1,300 kilowatt diesel generator and a 97,570 barrel fuel oil storage tank. Phase IA is targeted for a maximum combined generating capacity of 470 MW. The next phase (Phase IB) consists of two CTs, each equipped with one HRSG and exhausting to a separate stack, for a maximum combined generating capacity of an additional 470 MW.

On February 25, 1992, the Public Service Commission (PSC) determined the need for the first 470 MW of combined cycle power plants, fueled primarily with natural gas. This Order represents approval for the initial 470 MW of generation at the Polk County Site. Therefore, this PSD permit will approve only Phase IA for a total of 470 MW generating capacity. The applicant will have to submit supplemental applications for the next phase (IB) PSD permit once the PSC has granted an order approving Phase IB.

The primary fuel to the two CTs for Phase IA will be natural gas. No. 2 fuel oil with a maximum sulfur content of 0.05%, by weight, will be used as a backup fuel for a maximum of ~~800~~ 1000 hours per year ~~per CT~~. The remainder 8,260 hours will be fueled by natural gas. The emissions of nitrogen oxides (NO_x) represent a significant proportion of the total emissions generated by this project. The BACT for NO_x as determined by the Department will be met by using low-NO_x combustors to limit emissions to 12 ppmvd (corrected to 15% O_2) when burning natural gas and water injection to limit emissions to 42 ppmvd (corrected to 15% O_2) when burning fuel oil. The facility is subject to PSD and BACT for NO_x emissions because the proposed increase in annual NO_x emissions exceeds the significant emission rate. Compliance with the emission standards will be determined by stack tests and the NO_x emissions will be monitored continuously.

Particulate matter (PM/PM_{10}) emissions from the combined cycle combustion turbines will be minimized by combustion control and the use of clean fuels. The Department agrees with the applicant's rationale that there are no feasible methods to control lead, mercury, beryllium and other trace pollutants, except by limiting the inherent quality of the fuel. The facility is subject to PSD and BACT for PM/PM_{10} emissions because the proposed increase in annual PM/PM_{10} emissions exceeds the significant emission rate. Compliance will be determined by periodic stack tests ~~and the visible emissions will be continuously monitored~~.

1000 total for the two CTs. 94

SO_2 emissions will be controlled by the use of low sulfur fuel. The No. 2 fuel oil, which will be used as a back-up fuel, for up to ~~500~~ hours per year, will have a maximum sulfur content of 0.05 percent, and will produce 9 ppmvd (~~38~~ lbs/hr) SO_2 emissions per combined cycle unit corrected to 15% O_2. The use of natural gas as the primary fuel, and limited use of fuel oil represents BACT for this facility. The facility is subject to PSD and BACT for SO_2 emissions because the proposed increase in annual SO_2 emissions exceeds the significant emission rate. Compliance with the SO_2 emission standards will be demonstrated by fuel analysis, stack testing, ~~and~~ or continuous emission monitoring.

CO and VOC emissions will be minimized by combustion control to assure proper fuel mixing and complete fuel combustion. The CO emissions from the proposed combined cycle turbines with dry low-NO_x combustors are 25 ppmvd ~~@ 15% O_2~~ for natural gas firing and 30 ppmvd ~~@ 15% O_2~~ for fuel oil firing with water injection. VOC emissions have been based on exhaust concentrations of 7 ppmvd for natural gas and fuel oil firing. The facility is subject to PSD and BACT for CO and VOC emissions because the proposed increase in annual CO and VOC emissions exceeds the significant emission rate. Compliance with the emission standards will be determined by stack tests.

CO emissions are not corrected to 15% O_2

The facility is subject to the PSD regulations for beryllium, benzene and inorganic arsenic. These pollutants are caused primarily by the contaminants in the fossil fuels. Emissions will be controlled by limiting the quantity of fossil fuel that can be burned. Compliance ~~for the pollutants~~ shall be determined by ~~stack tests~~ fuel sampling and analysis. beryllium and arsenic

The following table summarizes the emissions of air pollutants subject to PSD review. The emission totals are based on 500 hours of fuel oil firing and 8260 hours per year of natural gas firing per CT, at an ambient temperature of 59°F.

Pollutant	Emissions (TPY) Gas	Oil	Total	PSD Significant Emission Rate (TPY)
NO_x	639	153	~~792~~ 778	40
SO_2	~~98~~ 87	47	~~56~~ 55	40
CO	675	47	~~722~~ 683	100
PM/PM_{10}	79	8.5	~~87.5~~ 83	15
VOC	91	~~6~~ 5.6	~~97~~ 91	40
Be	Neg.	0.0022	0.0022	0.0004
Benzene	0.93	Neg.	~~0.93~~ 0.90	Any
Arsenic	Neg.	0.0038	0.0038	Any

IV. SOURCE IMPACT ANALYSIS

A. Introduction

On August 4, 1992, Florida Power Corporation (applicant) filed an air pollution permit application for the construction of a power generating station (Polk County Site) in the southwest portion of Polk County. The Polk County Site is approximately seven miles south-southwest of Bartow and five miles west-northwest of Fort Meade. The initial phase of the project (phase IA) will consist of two combustion turbines (CT's), each equipped with one heat recovery steam generator (HRSG), creating a total capacity of 470 MW, with a future ultimate site capacity of up to 3,000 MW. The applicant originally submitted their site certification application requesting an initial phase capacity of 940 MW (i.e., four CT's and HRSG's). Since the time of that submittal, the application was only approved by the PSC for 470 MW. This air impact analysis specifically addresses an initial 940 MW of generating capacity as was originally planned by the applicant. Thus, the analysis presented here conservatively estimates the air quality impacts associated with the lesser 470 MW facility. For future increases in the generating capacity, the applicant must reevaluate all air quality impacts associated with the generating capacity above 470 MW.

and a fuel oil storage tank ?

The proposed project as reviewed consists of four combustion turbines with associated heat recovery steam generators (CT/HRSG), an auxiliary boiler, and an emergency diesel generator. For purposes of this air quality impact analysis only emissions associated with the normal operation of the project (CT/HRSGs) were evaluated.

The applicant's proposed maximum annual emissions associated with the initial phase of the project, along with the prevention of significant deterioration (PSD) significant emission rates are presented in Table 1. As presented in Table 1, PSD review was required for the pollutants carbon monoxide (CO), nitrogen oxides (NO_X), sulfur dioxide (SO_2), particulate matter (PM_{10}), total suspended particulates (TSP), volatile organic compounds (VOC), beryllium (Be), benzene (C_6H_6) and inorganic arsenic (As). In addition to the PSD pollutants, the project will also emit several air contaminants considered to be air toxics by the Department, which are presented in Table 2.

As part of the PSD review process, the Department reviewed analyses on existing air quality, PSD increment consumption (Class I and II areas), ambient air quality standards (AAQS), soils, vegetation and wildlife impacts, visibility, growth-related air quality impacts, and proposed stack heights. In addition, an air toxics analysis was conducted in accordance with the Department's draft "Air Toxics Guidelines".

B. Modeling Methodology

In support of the PSD permit application, the applicant was required to demonstrate to the Department that the proposed project would not cause or contribute to an exceedance of any federal or state AAQS, PSD increment, visibility limit or no-threat levels (Department's draft "Air Toxics Guidelines"). These demonstrations were conducted by dispersion modeling techniques pre-approved by the Department.

For modeling purposes, the applicant examined emissions from only the CTs and HRSGs under full load conditions associated with ambient air temperatures of 40°F, 72°F, and 95°F, while firing either natural gas or fuel oil. Under these operating scenarios, worst-case short-term emission rates will occur while firing fuel oil at an ambient air temperature of 40°F. Worst-case annual emissions were based ~~on the~~ firing of fuel oil for no more than 500 hours per year and natural gas for the remaining 8,260 hours per year at an ambient temperature of 40°F.

For each CT

For estimating ambient impacts on air quality from the proposed project, the applicant used the refined Industrial Source Complex Short-Term (ISCST) dispersion model (Version 90346) and VISCREEN Version 1.01 (88341) model. The applicant's choice of models for compliance demonstration purposes was acceptable to the Department. In conducting the ISCST modeling, the applicant ~~collocated the CTs/HRSGs~~, applied the model's building downwash option, and chose the regulatory default option, which are all acceptable to the Department.

The applicant modeled the proposed project's ambient impacts at the nearest PSD Class I area (Chassahowitzka National Wilderness Area) as well as the area surrounding the Polk County Site. The individual receptor locations used by the applicant and approved by the Department for the PSD Class I area and PSD Class II/AAQS analyses are presented in Tables 3 and 4, respectively. Meteorological data used by the applicant was supplied by the Department in the form of hourly preprocessed National Weather Service (NWS) data from Tampa, Florida and twice-daily upper air soundings from Ruskin, Florida, for the five years 1982 through 1986.

The applicant's proposed maximum annual emissions have been summarized in Tables 1 and 2. Stack parameters and emission rates for the CTs/HRSGs used by the applicant in the modeling are contained in Table 5. All sources associated with the Polk County Site are considered "increment consuming" in relation to the PSD Class I and II areas.

TABLE 1

FPC POLK PHASE IA - 470 MW
MAXIMUM POTENTIAL ANNUAL EMISSIONS
AND PSD SIGNIFICANCE VALUES

Pollutant	Proposed Maximum Emissions (tpy)	PSD Significant Emission Rate (tpy)	PSD Review Required (Yes/No)
Carbon Monoxide	~~722~~ 683	100	Yes
Nitrogen Oxides	~~792~~ 778	40	Yes
Sulfur Dioxide	~~56~~ 55	40	Yes
Particulate Matter (PM_{10})	~~88~~ 83	15	Yes
Total Suspended Particulates (TSP)	~~88~~ 83	25	Yes
Volatile Organic Compounds	~~97~~ 91	40	Yes
Lead	0.008	0.6	No
Asbestos	Neg.	0.007	No
Beryllium	0.0023	0.0004	Yes
Mercury	0.0027	0.1	No
Vinyl Chloride	Neg.	1	No
Total Fluorides	Neg.	3	No
Sulfuric Acid Mist	~~5.9~~ 5.7	7	No
Hydrogen Sulfide	Neg.	10	No
Total Reduced Sulfur	Neg.	10	No
Benzene	~~0.93~~ 0.9	Any	Yes
Inorganic Arsenic	0.0038	Any	Yes
Radionuclides	Neg.	Any	No

Note: The air quality analysis was completed considering a 940 MW facility.
tpy = Tons per year
Neg. = Negligible
Any = Any emissions are considered significant.

TABLE 2

FPC POLK PHASE I - 940 MW
OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS

Pollutant	Emission Factor[1] (lb/mmBtu)	Annual Emission[2] (tpy)
Trace Metals		
Antimony	0.0000221	0.0398
Arsenic	0.0000042	0.00756
Barium	0.0000195	0.0351
Beryllium	0.0000025	0.00450
Boron	0.0000651	0.117
Cadmium	0.0000105	0.0189
Calcium	0.000747	1.34
Chromium (Total)	0.000048	0.0854
Cobalt	0.00000906	0.0163
Copper	0.00028	0.504
Lead	0.0000089	0.0160
Magnesium	0.000232	0.418
Manganese	0.000014	0.0252
Mercury	0.000003	0.00540
Nickel	0.00017	0.306
Selenium	0.00000235	0.00423
Vanadium	0.0000696	0.125
Zinc	0.000683	1.23
Volatile Organic Compounds		
Benzene	0.000065	~~1.79~~ 1.37
Formaldehyde	0.000405	~~6.44~~ 6.11
	(0.00022)[3]	

Notes:

1. Emission factors are for fuel oil only, except for benzene which is for natural gas only.
2. Annual emissions are based on four CC units operating for 500 hours per year firing fuel oil at 40°F and 70 percent relative humidity, except for benzene which is based on 8,760 hours per year of natural gas firing.
3. Formaldehyde is also associated with natural gas combustion. Annual emissions are based on 500 hours per year firing fuel oil and 8,260 hours per year firing natural gas.

Source: EPA, 1988

TABLE 7

FPC POLK PHASE I - 940 MW
PSD CLASS I AREA INCREMENT ANALYSIS - SIGNIFICANT IMPACTS

Pollutant	Averaging Period	Maximum Predicted Concen.[1] ($\mu g/m^3$)	PSD Class I Significance Value[2] ($\mu g/m^3$)	Significant Impact (Yes/No)
Nitrogen Dioxide	Annual	0.032	0.025	Yes [4]
Particulate Matter (PM_{10} or TSP)	24-hour Annual	0.090 0.003	0.33 0.08	No No
Sulfur Dioxide	3-hour 24-hour Annual	3.45 0.53 0.002	0.48 0.07 0.0025	Yes [3] Yes [3] No

Notes:

(1) Maximum short-term values less than annual concentrations are highest, second-highest values.

(2) U. S. Fish and Wildlife Service suggested values.

(3) Proposed project had insignificant impacts on those days and times with predicted exceedances of the SO_2 increment.

(4) NO2 is not significant considering the 470 MW facility.

TABLE 10

FPC POLK PHASE I - 940 MW
MAXIMUM PREDICTED CONCENTRATIONS VERSUS FAAQS

Parameter	Avg. Time	Maximum Concentrations[1]				FAAQS ($\mu g/m^3$)
		FPC ($\mu g/m^3$)	Existing Sources ($\mu g/m^3$)	Monitored Value ($\mu g/m^3$)	Total ($\mu g/m^3$)	
CO	1-hr	27.3	N/A	11,450	11,477	40,000
	8-hr	7.7	N/A	6,870	6,878	10,000
NO_2	Ann.	0.4	N/A	25	25.4	100
SO_2	3-hr	0.0	256.7	78	334.7	1,300
	24-hr	0.1	83.2	34	117.2	260
	Ann.	0.01 ~~0.1~~	18.3	5	23.3	60
PM_{10}	24-hr	0.5	N/A	24	24.5	150
	Ann.	0.03 ~~0.0~~	N/A	17	17.0	50

FAAQS - Florida Ambient Air Quality Standards
N/A - Not Applicable Since Source had Insignificant Impacts.

(1) Maximum short-term concentrations are highest, second-highest values.

SPECIFIC CONDITIONS:

3. Only natural gas (NG) or low sulfur fuel oil shall be fired in each combustion turbine and the auxiliary boiler. Only low sulfur fuel oil shall be fired in the diesel generator. The maximum sulfur content of the low sulfur fuel oil shall not exceed 0.05 percent, by weight.

4. The maximum heat input to the auxiliary boiler shall not exceed 99 MMBtu/hr when firing NG or No. 2 fuel oil with 0.05 percent maximum sulfur content (by weight). All fuel consumption must be continuously measured and recorded for the auxiliary boiler.

5. The maximum allowable fuel oil consumption for the two turbines is 13,762,806 gallons per year, which is equivalent to an aggregate of 1,000 hours per year of operation at full load.

6. ~~FPC~~ The permittee shall have the option of installing duct module(s) suitable for possible future installation of an oxidation catalyst and/or SCR equipment on each combined cycle generating unit. In the event that the module(s) are not installed in the Heat Recovery Steam Generator (HRSG), the retrofit costs associated with not making provisions for such technology (initially) shall not be considered in any future economic evaluation to justify not installing SCR or an oxidation catalyst.

7. Fugitive dust emissions during the construction period shall be minimized by covering or watering dust generation areas.

8. If site construction does not commence on Phase IA (470 MW) within 18 months of issuance of this certification, then FPC may request an extension of the 18-month period, provided that such request is received by the Department's Bureau of Air Regulation at least 90 days prior to the expiration date. Such a request shall identify the progress made toward commencement of the construction of the site and the expected time required to start and complete construction of the initial phase. The Department may grant the extension upon a satisfactory showing that the extension is justified.

Units to be constructed or modified in later phases of the project will be reviewed under the supplementary review process of the Power Plant Siting Act. If site construction has not commenced within 18 months of issuance of this certification, then FPC shall obtain from DEP a review and, if necessary, a modification of the BACT determination and allowable emissions for the unit(s) on which construction has not commenced [40 CFR 52.21(r)(2)].

SPECIFIC CONDITIONS:

B. Emission Limits

1. The maximum allowable emissions from two CTs, when firing natural gas or low sulfur fuel oil, in accordance with the BACT determination, shall not exceed the following, at 59° F (except during periods of start up, shutdown, malfunction and load change):

EMISSIONS LIMITATIONS

POLLUTANT	FUEL	BASIS(g)	LB/HR/CT(a)	TPY(b)
NO_X	Gas	12 ppmvd(h)	73	639
	Oil	42 ppmvd(c)	305	153
VOC (d)	Gas	7 ppmvw	10.4	91
	Oil	7 ppmvw	11.2	5.6
CO	Gas	25 ppmvd	77	675
	Oil	30 ppmvd	93	47
PM/PM_{10}	Gas		9	79
	Oil(e)		17	8.5
SO_2	Gas		0.99	8.7
	Oil (f)		94	47
Visible ~~Emissions~~ Emissions	Gas	10 percent opacity		
	Oil	20 percent opacity		

a. Emission limitations in LB/HR/CT are blocked 24-hour averages (midnight to midnight). Pollutant emission rates may vary depending on ambient conditions and the CT characteristics. Manufacturer's curves for the emission rate correction to other temperatures at different loads shall be provided to DEP for review 90 days after selection of the CT. Subject to approval by the Department for technical validity applying sound engineering principles, the manufacturer's curves shall be used to establish pollutant emission rates over a range of temperatures for the purpose of compliance determination.

b. Annual emission limits (TPY) for natural gas are based on a total of two CTs operating at full load 8,760 hours per year (i.e., NO_X - 73 lbs/hr X 2 CTs X 8,760 hrs/yr X 1 ton/2,000 lbs = 639 TPY). Annual emission limits (TPY) for fuel oil are based on full load operation for a total of 1,000 hours per year for the two CTs (i.e., NO_X - 305 lbs/hr X 1,000 hrs/yr X 1 ton/2,000 lbs = 153 TPY).

SPECIFIC CONDITIONS:

g. The values are the computational basis for the lb/hr numbers, which are the actual emission limitations. Once a combustion turbine manufacturer has been selected, it may be necessary to modify this basis. If this basis is to be modified, a professional engineer-certified equivalency analysis by the manufacturer must be submitted to the Department. The equivalency analysis will recommend an emissions normalizing basis (i.e., lb/hr, lb/MMBtu, lb/MWh, or ppmvd) and associated emissions appropriate for the specific manufacturer's equipment. If the equivalency analysis demonstrates an impact equal to or less than the current lb/hr limit, the Department shall amend the conditions to reflect the alternate basis. The characteristics and parameters of the CT selected will be reflected in other permit conditions, where appropriate.

h. 12 ppmvd at 15 percent O_2, not ISO corrected. The ISO corrected value is 15 ppmvd at 15 percent O_2. Compliance will be determined through the initial and annual compliance tests required in Condition ~~XXX~~.C.1.

2. The following CT emissions, determined by BACT, are tabulated for PSD purposes:

ESTIMATED EMISSIONS

POLLUTANT	METHOD OF CONTROL	Basis(b)
Benzene	~~Natural Gas~~ Fuel Quality	BACT
Inorganic Arsenic	No. 2 Fuel Oil(a)	BACT
Beryllium	No. 2 Fuel Oil(a)	BACT
Mercury	No. 2 Fuel Oil(a)	(c)
Pb	No. 2 Fuel Oil(a)	(c)

a. The No. 2 fuel oil shall have a maximum sulfur content of 0.05 percent.

b. Since these pollutants are inherent constituents in the fuel, the basis for control will be by specifying that only natural gas and No. 2 fuel oil can be fired at the facility.

c. Below PSD significant emission levels.

SPECIFIC CONDITIONS:

3. ~~FPC~~ The permittee will install a dry low NO_x combustion turbine (CT). ~~FPC~~ The permittee shall make every practicable effort to achieve with that CT the lowest possible NO_x emission rate but must not exceed 73 lbs/hr (based on 12 ppmvd at 15 percent O_2 and 59° F) per CT (24-hour average, not including down time) on a continuous basis when firing natural gas.

4. After the initial compliance tests on the CTs (estimated to be in January, 1999), ~~FPC~~ the permittee shall operate a certified continuous emissions monitor for NO_x emissions, and collect 12 months of monitoring data. The monitor will at a minimum meet the requirements of 40 CFR 60 Appendix F quality assurance procedures. Within 17 months after the initial compliance test FPC shall prepare and submit for the Department's review an engineering report regarding the collection and the analysis of the data gathered from the monitor. In addition, this report shall include a conclusion regarding the lowest NO_x emission rate which can be consistently achieved with a reasonable operating margin taking into account long-term performance expectations and assuming good operating and maintenance practices. The report shall also include results of the testing requirements of Appendix F procedures and the actual CEM data for the period of the study in an acceptable format.

5. One month after submittal of the engineering report (estimated to be by June 2000), the Department will make a determination based on the engineering report submitted by FPC on the revised NO_x emission limits. If the data demonstrate that a NO_x emission rate of less than 73 lb/hr (based on 12 ppmvd at 15 percent O_2 and 59°F) is consistently achievable, the NO_x emission limits may be adjusted accordingly, but not lower than 55 lb/hr (based on 9 ppmvd at 15 percent O_2 and 59°F).

6. Excess emissions from a turbine resulting from start up, shutdown, malfunction, or load change shall be acceptable providing (1) best operational practices to minimize emissions are adhered to and (2) the duration of excess emissions shall be minimized but in no case exceed two hours in any 24 hour period unless specifically authorized by the Department for a longer duration. The permittee shall provide a general description of the procedures to be followed during periods of start up, shutdown, malfunction, or load change to ensure that the best operational practices to minimize emissions will be adhered to and the duration of any excess emissions will be minimized. The description should be submitted to the Department along with the initial compliance test data. The description may be updated as needed by submitting such update to the Department within thirty (30) days of implementation.

SPECIFIC CONDITIONS:

compliance is based on a 24 hr block average, not a "continuous" instantaneous readout.

2. CEMS data shall be recorded and reported in accordance with Chapter 17-297.500, F.A.C., 40 CFR 60 and 40 CFR 75. The record shall include periods of start up, shutdown, and malfunction. ~~Continuous~~ Compliance with condition XIII B.1. for NO_X shall be determined on a mass emission rate basis (LB/HR).

delete

3. A malfunction means any sudden and unavoidable failure of air pollution control equipment or process equipment to operate in a normal or usual manner. Failures that are caused entirely or in part by poor maintenance, careless operation or any other preventable upset condition or preventable equipment breakdown shall not be considered malfunctions.

4. The procedures under 40 CFR 60.13 and 40 CFR 75 shall be followed for installation, evaluation, and operation of all CEMS.

5. For purposes of the reports required under this permit, excess emissions are defined as any calculated ~~average~~ emission rate, as determined pursuant to Condition XIII.B.6 ~~herein~~, which exceeds the applicable emission limits in Condition XIII.B.1.

E. Notification, Reporting and Recordkeeping

1. To determine compliance with the natural gas and fuel oil firing heat input limitation, the permittee shall maintain daily records of natural gas and fuel oil consumption for each turbine and the heating value for each fuel. All records shall be maintained for a minimum of two years after the date of each record and shall be made available to representatives of the Department upon request.

2. The project shall comply with all the applicable requirements of Chapter 17, F.A.C., and 40 CFR 60 Subparts A and GG. The requirements shall include:

a. 40 CFR 60.7(a)(1) - By postmarking or delivering notification of the start of construction no more than 30 days after such date.

b. 40 CFR 60.7(a)(2) - By postmarking or delivering notification of the anticipated date of the initial start up of each CT and the auxiliary steam boiler not less than 30 days prior to such date.

c. 40 CFR 60.7(a)(3) - By postmarking or delivering notification of the actual start up of each turbine and the auxiliary steam boiler within 15 days after such date.

Best Available Control Technology (BACT) Determination
Florida Power Corporation
Polk County
PSD-FL-195
PA-92-33

The applicant proposes to install two combined cycle combustion turbine generators at their facility in southwest Polk County about seven miles south-southwest of Bartow in an initial phase. These generator systems will consist of: 1) two nominal 235 megawatt (MW) General Electric PG7221(FA) (or equivalent) combined cycle combustion turbines (CCCTs), with exhaust through a heat recovery steam generator (HRSG), which will be used to power a steam turbine. The initial phase (Phase IA) consists of two CTs, each equipped with one HRSG and exhausting to a separate stack, a 99 MMBtu/hr auxiliary boiler, a 1,300 kW diesel generator and a 97,570 barrel fuel oil storage tank. Phase IA is targeted for a maximum combined generating capacity of 470 MW. The CTs will be fired with natural gas and low sulfur fuel oil with a sulfur content not to exceed 0.05 percent, by weight, as a backup in Phase IA. Phase IB, which is not covered by this BACT determination, will add 470 MW of additional natural gas fired generating capacity and is to consist of two additional 235 MW CC units. At ultimate site capacity, the project will have a generating capacity of approximately 3,000 MW, consisting of 2,000 MW of coal gasification CC units and 1,000 MW of primarily natural gas fired CC units.

Construction and startup of the proposed 470 MW CC units of Phase IA at the Polk County Site will occur over a four-year period. The first CC unit will begin commercial startup in November 1998 and the second CC unit will begin commercial startup in November 1999. A simplified flow chart for the operation of a 235 MW CC unit is shown in Figure 1.

The applicant has indicated the maximum annual air pollutant emission rates associated with the initial phase (470 MW), based on 100 percent capacity factor and type of fuel fired, to be as follows:

	Emissions (TPY)					PSD Significant Emission Rate (TPY)
	CCCT[1]		Auxiliary Boiler[2]		PSD Diesel Generator[2]	
Pollutant	Oil	Gas	Oil	Gas	Oil	
NO_x	~~159~~ 153	~~628~~ 639	0.99	0.495	2.65	40
SO_2	~~49~~ 47	~~8.5~~ 8.7	0.264	0.0032	0.044	40
PM/PM_{10}	8.5	~~74~~ 79	0.245	0.025	0.025	25/15
CO	~~48~~ 47	~~661~~ 675	0.245	0.245	0.60	100
VOC	~~65~~ 5.6	~~93~~ 91	0.05	0.025	0.14	40
H_2SO_4	5	0.9	0.0041	4.95E-5	6.5 E-4	7
Arsenic	0.0038	neg.	2.08E-5	neg.	3.7 E-6	---
Beryllium	0.0023	neg.	1.25E-5	neg.	2.2 E-6	0.0004
Mercury	0.0027	neg.	1.50E-5	neg.	2.6 E-6	0.1
Lead	0.008	neg.	4.41E-5	neg.	1.8 E-6	0.6
Benzene	neg.	~~0.95~~ 0.93	neg.	3.3E-4	neg.	Any

1 - 500 hours on fuel oil and ~~8260~~ 3760 hours on gas at 59°F.
2 - 100 hours operation per year on each fuel.

Emission estimates are based on

Florida Administrative Code (F.A.C.) Rule 17-212.400, Stationary Source Preconstruction Review, requires a BACT review for all regulated pollutants emitted in an amount equal to or greater than the significant emission rates listed in the previous table.

Date of Receipt of a BACT Application
August 4, 1992

BACT Determination Requested by the Applicant

Combined Cycle Combustion Turbines

	Fuel	
Pollutant	Natural Gas	Fuel Oil
NO_x	12 ppmvd @ 15% O_2 Dry Low NO_x Burners	42 ppmvd @ 15 % O_2 Water Injection Limited fuel oil operation.
SO_2	Firing with Natural Gas	Low Sulfur Fuel Oil (0.05 %, by weight) Limited ~~Annual~~ fuel oil Operation
CO	25 ppmvd Combustion Control	30 ppmvd Combustion Control Limited fuel oil operation
VOC	7 ppmvw Combustion Control	7 ppmvw Combustion Control
PM/PM_{10}	Combustion Control	Combustion Control Limited fuel oil operation
Beryllium	Combustion Control	Combustion Control Limited fuel oil operation
Inorganic Arsenic	Combustion Control	Combustion Control Limited fuel oil operation
Benzene	Combustion Control	N/A

Auxiliary Boiler

Pollutant	Control
NO_x	Low NO_x Burners and Combustion Controls, Limited Operation on fuel oil
SO_2	Natural Gas Firing, Use of Fuel Oil with a Sulfur Content not to Exceed 0.05 % by Weight, and Limited Operation on fuel oil.

H_2SO_4	Natural Gas Firing, Use of Fuel Oil with a Sulfur Content not to Exceed 0.05 % by Weight, and Limited Operation
CO	Combustion Control, limited fuel oil operation
VOC	Combustion Control, limited fuel oil operation
PM/PM_{10}	Combustion Control, limited fuel oil operation
Beryllium	Combustion Control, limited fuel oil operation
Inorganic Arsenic	Combustion Control, limited fuel oil operation
Benzene	Combustion Control

Diesel Generator

Pollutant	Control
NO_x	Timing retardation & limited annual operation
SO_2	Low sulfur fuel oil & limited annual operation
CO	Good combustion control & limited annual operation
VOC	Good combustion control & limited annual operation
PM/PM_{10}	Good combustion control & limited annual operation
Beryllium	Good combustion control & limited annual operation
Inorganic Arsenic	Good combustion control & limited annual operation

Fuel Oil Storage

VOC Emissions	~~Bottom Loading~~/Submerged Filling

BACT Determination Procedure

In accordance with F.A.C. Chapter 17-212.410, Best Available Control Technology Review, Stationary Source - Preconstruction Review, this BACT determination is based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems,

and techniques. In addition, the regulations state that in making the BACT determination the Department shall give consideration to:

(a) Any Environmental Protection Agency determination of Best Available Control Technology pursuant to Section 169, and any emission limitation contained in 40 CFR Part 60 (Standards of Performance for New Stationary Sources) or 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants).

(b) All scientific, engineering, and technical material and other information available to the Department.

(c) The emission limiting standards or BACT determinations of any other state.

(d) The social and economic impact of the application of such technology.

The EPA currently stresses that BACT should be determined using the "top-down" approach. The first step in this approach is to determine for the emission source in question the most stringent control available for a similar or identical source or source category. If it is shown that this level of control is technically or economically infeasible for the source in question, than the next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections.

The air pollutant emissions from combined cycle power plants can be grouped into categories based upon what control equipment and techniques are available to control emissions from these facilities. Using this approach, the emissions can be classified as follows:

- Combustion Products (e.g., particulates and trace metals). Controlled generally by good combustion of clean fuels.
- Products of Incomplete Combustion (e.g., CO and VOCs). Control is largely achieved by proper combustion techniques.
- Acid Gases (e.g., SO_2, NO_x). Controlled generally by gaseous control devices and fuel quality.

Grouping the pollutants in this manner facilitates the BACT analysis because it enables the equipment available to control the type or group of pollutants emitted and the corresponding energy, economic, and environmental impacts to be examined on a common basis. Although all of the pollutants addressed in the BACT analysis may be subject to a specific emission limiting standard as a result of PSD review, the control of "nonregulated" air

pollutants is considered in imposing a more stringent BACT limit on a "regulated" pollutant (i.e., particulates, sulfur dioxide, fluorides, sulfuric acid mist, etc.), if a reduction in "nonregulated" air pollutants can be directly attributed to the control device selected as BACT for the abatement of the "regulated" pollutants.

BACT POLLUTANT ANALYSIS

COMBUSTION PRODUCTS

Particulate Matter (PM/PM_{10})

The design of the CCCT system ensures that particulate emissions will be minimized by combustion control and the use of clean fuels. The particulate emissions from the combustion turbines when burning natural gas and fuel oil will not exceed 9 lbs/hr/CT (gas) and 17 lbs/hr/CT (oil) for the PG7221(FA) (or equivalent).

Particulate/PM_{10} emissions are controlled for the auxiliary boiler by firing with natural gas or with No. 2 fuel oil with a sulfur concentration not to exceed 0.05%, by weight. Use of the specified fuels is considered BACT for particulate emissions from the auxiliary boiler and will result in opacity within the allowable NSPS limit of 20 percent (40 CFR 60 Subpart Dc).

Beryllium and Arsenic (Be, As)

The Department agrees with the applicant's rationale that there are no feasible methods to control beryllium, arsenic and other trace pollutants, except by limiting the inherent quality of the fuel.

PRODUCTS OF INCOMPLETE COMBUSTION

Carbon Monoxide (CO) and Volatile Organic Compounds (VOC)

The emissions of carbon monoxide exceed the PSD significant emission rate of 100 TPY. The applicant has indicated that the carbon monoxide emissions from the proposed combined cycle turbines with dry low-NO_x combustors are 25 ppmvd ~~at 15% O2~~ for natural gas firing and 30 ppmvd ~~at 15% O2~~ for fuel oil firing with water injection. Volatile organic compound emissions have been based on exhaust concentrations of 7 ppmvw for natural gas and fuel oil firing.

The majority of BACT emissions limitations have been based on combustion controls for carbon monoxide and volatile organic compounds minimization. Additional control is achievable through the use of catalytic oxidation. Catalytic oxidation is a

post-combustion control that has been employed in CO nonattainment areas where regulations have required CO emission levels to be less than those associated with wet injection. These installations have been required to use LAER technology and typically have CO limits in the 10-ppm range (corrected to dry conditions).

In an oxidation catalyst control system, CO emissions are reduced by allowing unburned CO to react with oxygen at the surface of a precious metal catalyst such as platinum. ~~Combustion~~ of CO starts at about 300°F, with efficiencies above 90 percent occurring at temperatures above 600°F. Catalytic oxidation occurs at temperatures 50 percent lower than that of thermal oxidation, which reduces the amount of thermal energy required. For CT/HRSG combinations, the oxidation catalyst can be located directly after the CT or in the HRSG. Catalyst size depends upon the exhaust flow, temperature, and desired efficiency.

The application of oxidation catalyst is not technically feasible for gas turbines fired with fuel oil due to the oxidation of sulfur compounds and excessive formation of H_2SO_4 mist emissions. Catalytic oxidation has not been demonstrated on a continuous basis when using fuel oil.

Use of oxidation catalyst technology would be feasible for natural gas-fired unit; however, the cost effectiveness of $6,384 per ton of CO/VOC removed for the PG7221(FA) (or equivalent) unit will have an economic impact on this project.

The applicant has proposed bottom loading/submerged filling for control of VOC emissions from the fuel oil storage tank. The proposed controls are consistent with other BACT determinations.

ACID GASES

Nitrogen Oxides (NO_X)

The emissions of nitrogen oxides represent a significant proportion of the total emissions generated by this project, and need to be controlled if deemed appropriate. As such, the applicant presented an extensive analysis of the different available technologies for NO_X control.

The applicant has stated that BACT for nitrogen oxides will be met by using dry low-NO_X combustors to limit emissions to 12 ppmvd (corrected to 15% O_2) when burning natural gas and water injection to limit emissions to 42 ppmvd (corrected to 15% O_2) when burning fuel oil.

A review of the EPA's BACT/LAER Clearinghouse indicates that the lowest NO_X emission limit established to date for a combustion turbine is 4.5 ppmvd at 15% oxygen. This level of control was accomplished through the use of water injection and a selective catalytic reduction (SCR) system.

Selective catalytic reduction is a post-combustion method for control of NO_X emissions. The SCR process combines vaporized ammonia with NO_X in the presence of a catalyst to form nitrogen and water. The vaporized ammonia is injected into the exhaust gases prior to passage through the catalyst bed. The SCR process can achieve up to ~~90%~~ reduction of NO_X with a new catalyst. As the catalyst ages, the ~~maximum~~ NO_X reduction will decrease ~~to approximately 86 percent~~ efficiency while holding ammonia slip emissions constant. 80%

The effect of exhaust gas temperature on NO_X reduction depends on the specific catalyst formulation and reactor design. Generally, SCR units can be designed to achieve effective NO_X control over a 100-~~300~~ 225°F operating window within the bounds of 450-800°F, ~~although recently developed zeolite-based catalysts are claimed to be capable of operating at temperatures as high as 950°~~. (new) we had 600-750°F

Most commercial SCR systems operate over a temperature range of about 600-750°F. At levels above and below this window, the specific catalyst formulation will not be effective and NO_X reduction will decrease. Operating at high temperatures can permanently damage the catalyst through sintering of surfaces. Increased water vapor content in the exhaust gas (as would result from water or steam injection in the gas turbine combustor) can shift the operating temperature window of the SCR reactor to slightly higher levels. increases the oxidation of SO_2 to SO_3 and

As stated by the applicant, the exhaust temperatures of the proposed combined cycle CTs for this site are between 950°F to 1100°F. At temperatures of 1,000°F and above, the zeolite catalyst (reported to operate within 600°F to 950°F) will be irreparably damaged. ~~Either~~ catalyst can be located in the appropriate temperature range in the HRSG but the applicant has stated that effective SCR operation will be difficult to maintain under significant load and ambient temperature variations. In this case, application of an SCR system appears to be technically feasible. (new)

However,
Although technically feasible, the applicant has also rejected using SCR on the combined cycle units because of economic, energy, and environmental impacts. The applicant has identified the following limitations:

a) Reduced power output.

b) Emissions of unreacted ammonia (slip).

c) Increased sulfuric acid mist emissions

d c) Disposal of hazardous waste generated (spent catalyst).

e d) Ammonium bisulfate and ammonium sulfate particulate emissions (ammonium salts) due to the reaction of NH_3 with SO_3 present in the exhaust gases. . .
increasing PM_{10} emissions

f e) Cost effectiveness for the application of SCR technology to the Polk County project was considered to be $10,587 per ton of NO_x removed when compared to use of dry low-NO_x combustors.

Since SCR has been determined to be BACT for several combined cycle facilities, the EPA has clearly stated that there must be unique circumstances to consider the rejection of such control on the basis of economics.

In a recent letter from EPA Region IV to the Department regarding the permitting of a combined cycle facility (Tropicana Products, Inc.), the following statement was made:

> "In order to reject a control option on the basis of economic considerations, the applicant must show why the costs associated with the control are significantly higher for this specific project than for other similar projects that have installed this control system or in general for controlling the pollutant."

For fuel oil firing, the cost associated with controlling NO_x emissions must take into account the potential operating problems that can occur with using SCR in the oil firing mode.

A concern associated with the use of SCR on combined cycle projects is the formation of ammonium bisulfate. For the SCR process, ammonium bisulfate can be formed due to the reaction of sulfur in the fuel and the ammonia injected. The ammonium bisulfate formed has a tendency to plug the tubes of the heat recovery steam generator leading to operational problems. As this is the case, SCR has been judged to be technically infeasible for oil firing in some previous BACT determinations.

The latest information available now indicates that SCR can be used for oil firing provided that adjustments are made in the ammonia to NO_x injection ratio. For natural gas firing operation, NO_x emissions can be controlled with up to a 90 percent efficiency using a 1 to 1 or greater ammonia injection ratio. By lowering the injection ratio for oil firing, testing has indicated that NO_x can be controlled with efficiencies ranging from 60 to ~~80~~ percent. When the injection ratio is lowered there is not a problem with ammonium bisulfate formation since essentially all of the ammonia is able to react with the nitrogen oxides present in the combustion gases. Based on this strategy SCR has been both proposed and established as BACT for oil fired combined cycle facilities with

NO_X emission limits ranging from 11.7 to 25 ppmvd depending on the efficiency of control established.

The applicant has indicated that the total levelized annual operating cost to install SCR for this project at 100 percent capacity factor and burning natural gas is $9,825,000. Taking into consideration the total annual cost, a cost/benefit analysis of using SCR can now be developed.

[Phase IA is half]

For the PG7221(FA) (or equivalent) combined cycle combustion turbine, based on the information supplied by the applicant, it is estimated that the maximum annual NO_X emissions using dry low NO_X combustors will be 1,446 tons/year (assuming 8,260 and 500 hours of operation per year while firing natural gas and fuel oil, respectively and at 72°F and 80% relative humidity). Assuming that SCR would reduce the NO_X emissions from 25 ppmvd to 6 ppmvd when firing natural gas and from 42 ppmvd to 15 ppmvd when firing fuel oil, 681 tons of NO_X would be emitted annually. When this reduction of 765 TPY in comparison with the application of dry low-NOx combustors is taken into consideration with the total levelized annual operating cost differential of $8,099,000; the cost per ton of controlling NO_X is $10,587. These calculated costs are higher than has previously been approved as BACT.

w/ 4 CTs quartering

A review of the latest DEP BACT determinations show limits of 15 ppmvd (natural gas) using low-NO_X combustor technology for combined cycle turbines. General Electric is currently developing programs using both steam/water injection and dry low NO_X combustor to achieve NO_X emission control level of 9 ppm when firing natural gas. ~~This technology will be available at the latest by 1998, according to a GE representative.~~

This is strictly hearsay and will be demonstrated by our study. No need to include this here!

Sulfur Dioxide(SO_2)

The applicant has stated that sulfur dioxide (SO_2) emissions when firing fuel oil will be controlled by using fuel oil with a maximum sulfur content of 0.05% by weight. This will result in an annual emission rate of 49 tons SO_2 per year (operating at 500 hours per year) plus 8.5 tons SO_2 per year when firing natural gas.

In accordance with the "top down" BACT review approach, only two alternatives exist that would result in more stringent SO_2 emissions. These include the use of a lower sulfur content fuel oil or the use of wet lime or limestone-based scrubbers, otherwise known as flue gas desulfurization (FGD).

In developing the NSPS for stationary gas turbines, EPA recognized that FGD technology was inappropriate to apply to these combustion units. EPA acknowledged in the preamble of the proposed NSPS that "Due to the high volumes of exhaust gases, the cost of flue gas

desulfurization (FGD) to control SO_2 emissions from stationary gas turbines is considered unreasonable." EPA reinforced this point when, later on in the preamble, they stated that "FGD... would cost about two to three times as much as the gas turbine."(23). The economic impact of applying FGD today would be no different.

Furthermore, the application of FGD would have negative environmental and energy impacts. Sludge would be generated that would have to be disposed of properly, and there would be increased utility (electricity and water) costs associated with the operation of a FGD system. Finally, there is no information in the open literature to indicate that FGD has ever been applied to stationary gas turbines burning distillate oil.

The elimination of flue gas control as a BACT option then leaves the use of low sulfur fuel oil as the next option to be investigated. The use of No. 2 fuel oil with a 0.05% sulfur by weight, as proposed by the applicant, is acceptable as BACT for this project.

The auxiliary boiler is expected to operate 100 hours per year or less. The applicant is proposing to control SO_2 and acid gas emissions by firing with natural gas or No. 2 fuel oil with a sulfur content of 0.05% or less, by weight, and by using low NO_x burners and combustion controls. this is accepted as BACT

BACT Determination by DEP

Combined Cycle Combustion Turbines

NO_x Control

The information that the applicant presented and Department calculations indicate that the cost per ton of controlling NO_x for these turbines, $10,587, is significantly high compared to other BACT determinations which require SCR. Based on the information presented by the applicant, the Department believes that the use of SCR for NO_x control is not justifiable as BACT at this time.

A review of the permitting activities for combined cycle proposals across the nation indicates that SCR has been required and most recently proposed for installations with a variety of operating conditions (i.e., natural gas, fuel oil, and various capacity factors). Although, the cost and other concerns expressed by the applicant are valid, the Department, in this case, is willing to accept water injection and dry low-NO_x burner design as BACT for this project.

BACT

The emission limits for the Florida Power Corporation Polk County Phase 1A project of two combined cycle units for 470 MW are thereby established as follows:

470 MW COMBINED CYCLE COMBUSTION TURBINES

Pollutant	Emission Standards/Limitations Oil(a)	Gas(b)	Method of Control
NO_x	42 ppmvd(d) @ 15% O_2	12 ppmvd @ 15% O_2(c)	Water Injection on oil / Dry Low NO_x Combustor on gas ~~Water Injection/Dry Low NO_x Combustor~~
CO	30 ppmvd	25 ppmvd	Combustion controls Limited fuel oil operation
PM & PM_{10}	34 lbs/hr	18 lbs/hr	Combustion controls Limited fuel oil operation
SO_2	~~195~~ 138 lbs/hr	~~2.1~~ 2.0 lbs/hr	No. 2 Fuel Oil (0.05% S)
VOC	7 ppmvw	7 ppmvw	Combustion controls
Be	2.6×10^{-6} lbs/MMBtu		Fuel Quality
As	4.2×10^{-6} lbs/MMBtu		Fuel Quality
Benzene	6.5×10^{-5} lbs/MMBtu		Fuel Quality

~~(a) No. 2 fuel oil with a maximum of 0.05% sulfur by weight.~~
~~(b) Natural gas/fuel oil 8260/500 hours per year.~~

Auxiliary Steam Boiler

The auxiliary steam boiler will be operated in an infrequent or emergency mode. However BACT for these facilities typically limits NO_x emissions from boilers to 0.1 lb/MMBtu and 0.2 Lb/MMBtu for natural gas and oil firing, respectively. The applicant has proposed to meet these levels.

Sulfur Dioxide emissions limitations for the auxiliary steam boiler are established by firing natural gas or limiting the No. 2 fuel oils sulfur content to 0.05%, by weight. The Department accepts the controls proposed as BACT for the auxiliary boiler.

(a) No. 2 fuel oil with a maximum of 0.05% sulfur by weight. Fuel oil firing not to exceed a total of 1,000 hours per year for the two turbines.
(b) Natural gas firing of 8,760 hours per year.
(c) Interim limit. May be retained or lowered (as low as 9 ppmvd at 15% O_2) based on the results of a study of the first 12 months of commercial operation.
(d) At a fuel bound nitrogen content of 0.015 percent. Adjusted to higher values (up to 48 ppmvd @ 15 percent O_2) for higher fuel bound nitrogen content (up to 0.030 percent)

Fuel Oil Storage Tank

Fuel Oil Storage	Control Technology
VOC	~~Bottom loading~~/Submerged Filling

In accordance with F.A.C. 17-212.410(2), the determination of BACT shall be reviewed and modified as appropriate at the latest reasonable time ~~not later than~~ at least 18 months prior to commencement of construction, as defined in F.A.C. 17-212.200 of each independent phase of the project. At such time, the owner or operator of the facility is required to demonstrate the adequacy of any previous determination of BACT.

Details of the Analysis May be Obtained by Contacting:

Douglas G. Outlaw, BACT Coordinator
Department of Environmental Protection
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Recommended by:

C. H. Fancy, P.E., Chief
Bureau of Air Regulation

Date 1993

Approved by:

Virginia B. Wetherell, Secretary
Dept. of Environmental Protection

Date 1993