Department of
Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

April 22, 1998

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Ronald W. Tomlin
Assistant Managing Director
Lakeland Electric and Water Utilities Department
501 East Lemon Street
Lakeland, Florida 33801-5079

Re: DEP File No. 1050004-004-AC (PSD-FL-245)
250 Megawatt Combustion Turbine

Dear Mr. Tomlin:

Enclosed is one copy of the Draft Air Construction Permit, Technical Evaluation and Preliminary Determination, and Draft BACT Determination, for the referenced project at the C. D. McIntosh, Jr Power Plant located at 3030 East Lake Parker Drive, Lakeland, Polk County. The Department's Intent to Issue Air Construction Permit and the "PUBLIC NOTICE OF INTENT TO ISSUE AIR CONSTRUCTION PERMIT" are also included.

The "PUBLIC NOTICE OF INTENT TO ISSUE AIR CONSTRUCTION PERMIT" must be published within 30 (thirty) days of receipt of this letter. Proof of publication, i.e., newspaper affidavit, must be provided to the Department's Bureau of Air Regulation office within 7 (seven) days of publication. Failure to publish the notice and provide proof of publication within the allotted time may result in the denial of the permit modification.

Please submit any written comments you wish to have considered concerning the Department's proposed action to A. A. Linero, P.E., Administrator, New Source Review Section at the above letterhead address. If you have any other questions, please call Ms. Teresa Heron at 850/921-9529 or Mr. Linero at 850/921-9523.

Sincerely,

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

CHF/aal

Enclosures

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Ronald W. Jonsen
Assistant Managing Director
Lakeland Electric & Water U.D.
501 E. Lemon St.
Lakeland, Fl 33801-5079

4a. Article Number
P 265 659 339

4b. Service Type
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PS Form **3811**, December 1994 Domestic Return Receipt

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P 265 659 339

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PS Form **3800**, April 1995

105004-02-AC

In the Matter of an
Application for Permit by:

Mr. Ronald W. Tomlin, Assistant Managing Director
City of Lakeland Electric & Water Utilities
501 East Lemon Street
Lakeland, Florida 33801-5079

DEP File No. 1050004-004AC
DRAFT Permit No.: PSD-FL-245
C.D. McIntosh, Jr. Power Plant, Unit No. 5
Polk County

_____/

INTENT TO ISSUE AIR CONSTRUCTION PERMIT

The Department of Environmental Protection (Department) gives notice of its intent to issue an air construction permit (copy of DRAFT Permit attached) for the proposed project, detailed in the application specified above and the attached Technical Evaluation and Preliminary Determination, for the reasons stated below.

The applicant, City of Lakeland Electric & Water Utilities, applied on December 8,1997 to the Department for an air construction permit to construct a 250 megawatt combustion turbine with a once-through heat generator and a 1.05 million gallon fuel oil storage tank at the C.D. McIntosh, Jr. Power Plant, located at 3030 East Lake Parker Drive, Lakeland, Polk County.

The Department has permitting jurisdiction under the provisions of Chapter 403, Florida Statutes (F.S.), and Florida Administrative Code (F.A.C.) Chapters 62-4, 62-210, and 62-212. The above actions are not exempt from permitting procedures. The Department has determined that an air construction permit under the provisions for the Prevention of Significant Deterioration (PSD)of Air Quality is required for the proposed work.

The Department intends to issue this Air construction permit based on the belief that reasonable assurances have been provided to indicate that operation of these emission units will not adversely impact air quality, and the emission units will comply with all appropriate provisions of Chapters 62-4, 62-204, 62-210, 62-212, 62-296, and 62-297, F.A.C.

Pursuant to Section 403.815, F.S., and Rule 62-103.150, F.A.C., you (the applicant) are required to publish at your own expense the enclosed "Public Notice of Intent to Issue AIR CONSTRUCTION PERMIT". The notice shall be published one time only within 30 (thirty) days in the legal advertisement section of a newspaper of general circulation in the area affected. For the purpose of these rules, "publication in a newspaper of general circulation in the area affected" means publication in a newspaper meeting the requirements of Sections 50.011 and 50.031, F.S., in the county where the activity is to take place. Where there is more than one newspaper of general circulation in the county, the newspaper used must be one with significant circulation in the area that may be affected by the permit. If you are uncertain that a newspaper meets these requirements, please contact the Department at the address or telephone number listed below. The applicant shall provide proof of publication to the Department's Bureau of Air Regulation, at 2600 Blair Stone Road, Mail Station #5505, Tallahassee, Florida 32399-2400 (Telephone: 904/488-1344; Fax 904/ 922-6979) within 7 (seven) days of publication. Failure to publish the notice and provide proof of publication within the allotted time may result in the denial of the permit pursuant to Rule 62-103.150 (6), F.A.C.

The Department will issue the FINAL Permit, in accordance with the conditions of the enclosed DRAFT Permit unless a response received in accordance with the following procedures results in a different decision or significant change of terms or conditions.

The Department will accept written comments and requests for public meetings concerning the proposed DRAFT Permit issuance action for a period of 30 (thirty) days from the date of publication of "PUBLIC NOTICE OF INTENT TO ISSUE AIR CONSTRUCTION PERMIT." Written comments and requests for public meetings should be provided to the Department's Bureau of Air Regulation, 2600 Blair Stone Road, Mail Station #5505, Tallahassee, Florida 32399-2400. Any written comments filed shall be made available for public inspection. If written comments received result in a significant change in this DRAFT Permit, the Department shall issue a Revised DRAFT Permit and require, if applicable, another Public Notice.

The Department will grant a variance or waiver when the petition demonstrates both that the application of the rule would create a substantial hardship or violate principles of fairness, as each of those terms is defined in Section 120.542(2) F.S., and that the purpose of the underlying statute will be or has been achieved by other means by the petitioner.

Persons subject to regulation pursuant to any federally delegated or approved air program should be aware that Florida is specifically not authorized to issue variances or waivers from any requirements of any such federally delegated or approved program. The requirements of the program remain fully enforceable by the Administrator of the EPA and by any person under the Clean Air Act unless and until the Administrator separately approves any variance or waiver in accordance with the procedures of the federal program.

Executed in Tallahassee, Florida.

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

CERTIFICATE OF SERVICE

The undersigned duly designated deputy agency clerk hereby certifies that this INTENT TO ISSUE AIR CONSTRUCTION PERMIT (including the PUBLIC NOTICE, Technical Evaluation and Preliminary Determination, Draft BACT Determination, and the DRAFT permit) was sent by certified mail (*) and copies were mailed by U.S. Mail before the close of business on 4-24-98 to the person(s) listed:

Mr. Ronald W. Tomlin, City of Lakeland *
Ms. Farzie Shelton, City of Lakeland
Mr. Brian Beals, EPA
Mr. John Bunyak, NPS
Mr. Bill Thomas, SWD
Mr. Buck Oven, DEP
Mr. Ken Kosky, P.E., Golder Associates
Mr. Joe King, Polk County

Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Kyri Tober (Clerk) 4-24-98 (Date)

PUBLIC NOTICE OF INTENT TO ISSUE AIR CONSTRUCTION PERMIT

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

DEP File No. 1050004-002AC (PSD-FL-245)

City of Lakeland Electric and Water Utilities Department
C.D. McIntosh, Jr. Power Plant - Unit No. 5
Polk County

The Department of Environmental Protection (Department) gives notice of its intent to issue an air construction permit under the requirements for the Prevention of Significant Deterioration (PSD) of Air Quality to The City of Lakeland Electric & Water Utilities Department. The permit is to construct a 250 megawatt (MW) natural gas and distillate fuel oil-fired combustion turbine with a once-through steam generator, a 1.05 million gallon fuel oil storage tank, and a new 85-foot stack at the C.D. McIntosh, Jr. Power Plant located at 3030 East Lake Parker Drive, Lakeland, Polk County. A Best Available Control Technology (BACT) determination was required for particulate matter (PM/PM_{10}), nitrogen oxides (NO_x), volatile organic compounds (VOC) and carbon monoxide (CO) pursuant to Rules 62-212.400 and 410, F.A.C. and 40 CFR 52.21. The applicant's name and address are The City of Lakeland Electric and Water Utilities Department, 501 East Lemon Street, Lakeland, Florida 33801-5079.

The new unit is a Westinghouse 501 G, 250 MW turbine which will operate in simple cycle mode as a continuous duty unit. It will be the largest and most efficient simple cycle gas turbine installed in the United States to-date. The unit will operate primarily on natural gas and will be permitted to operate 7008 hours per year of which no more than 250 will be on 0.05 percent sulfur distillate fuel oil.

During the first three years of operation, NO_X emissions will be controlled by "Advanced Dry Low NO_X" technology combustors capable of achieving emissions of 25 parts per million by volume at 15 percent oxygen (ppm @15 % O_2). "Ultra Low NO_X" technology consisting of Piloted Ring Combustors is under development to achieve a limit of 9 ppm @15% O_2 (12 ppm averaged over 30 days) three years after start-up. Emissions of NO_X will be controlled under the minimal back-up fuel oil operation by water injection. SO_2 and PM/PM_{10} will be limited by use of clean fuels. Emissions of VOC will be controlled by good combustion practices. Emissions of CO will be similarly controlled unless the City chooses to install an oxidation catalyst.

The maximum potential annual emissions in tons per year based on the original application are summarized below. NO_X emissions will be reduced by over half after installation of the Ultra Low NO_X combustors. CO emissions will also be substantially lower as a result of the Department's BACT determination.

Pollutants	Maximum Potential Emissions	PSD Significant Emission Rate
PM/PM_{10}	41	25/15
SO_2	38	40
NO_X	863	40
VOC	93	40
CO	1264	100

An air quality impact analysis was conducted. Maximum predicted impacts due to proposed emissions from the project are less than the applicable PSD Class I and Class II significant impact levels.

The Department will issue the FINAL Permit, in accordance with the conditions of the DRAFT Permit unless a response received in accordance with the following procedures results in a different decision or significant change of terms or conditions.

The Department will accept written comments and requests for public meetings concerning the proposed DRAFT Permit issuance action for a period of 30 (thirty) days from the date of publication of this Notice. Written comments and requests for public meetings should be provided to the Department's Bureau of Air Regulation, 2600 Blair Stone Road, Mail Station #5505, Tallahassee, Florida 32399-2400. Any written comments filed shall be made available for public inspection. If written comments received result in a significant change in this DRAFT Permit, the Department shall issue a Revised DRAFT Permit and require, if applicable, another Public Notice.

The Department will issue FINAL Permit with the conditions of the DRAFT Permit unless a timely petition for an administrative hearing is filed pursuant to Sections 120.569 and 120.57 F.S. The procedures for petitioning for a hearing are set forth below. Mediation is not available for the proposed action.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative hearing in accordance with Sections 120.569 and 120.57 F.S. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department, 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida 32399-3000, telephone: 904/488-9370, fax: 904/487-4938. Petitions must be filed within fourteen days of publication of the public notice or within fourteen days of receipt of this notice of intent, whichever occurs first. A petitioner must mail a copy of the petition to the applicant at the address indicated above, at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57 F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will be only at the approval of the presiding officer upon the filing of a motion in compliance with Rule 28-5.207 of the Florida Administrative Code.

A petition must contain the following information: (a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Permit File Number and the county in which the project is proposed; (b) A statement of how and when each petitioner received notice of the Department's action or proposed action; (c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action; (d) A statement of the material facts disputed by petitioner, if any; (e) A statement of the facts that the petitioner contends warrant reversal or modification of the Department's action or proposed action; (f) A statement identifying the rules or statutes that the petitioner contends require reversal or modification of the Department's action or proposed action; and (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take with respect to the Department's action or proposed action addressed in this notice of intent.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice of intent. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

A complete project file is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at:

Florida Department of
Environmental Protection
Bureau of Air Regulation
111 S. Magnolia Drive, Suite 4
Tallahassee, Florida, 32301
Telephone: (850)488-1344
Fax: (850)922-6979

Florida Department of
Environmental Protection
Southwest District Office
3804 Coconut Drive
Tampa, Florida 33619-8218
Telephone: (813)744-6100
Fax: (813)744-6084

City of Lakeland
Electric and Water Utilities
Attention: Ms. Farzie Shelton
501 East Lemon Street
Lakeland, Florida 33801-5079
Telephone: (941)499-6603
Fax: (941)603-6335

The complete project file includes the application, technical evaluations, Draft Permit, and the information submitted by the responsible official, exclusive of confidential records under Section 403.111, F.S. Interested persons may contact the Administrator, New Resource Review Section at 111 South Magnolia Drive, Suite 4, Tallahassee, Florida 32301, or call 904/488-1344, for additional information.

TECHNICAL EVALUATION

AND

PRELIMINARY DETERMINATION

City of Lakeland Electric and Water Utilities

C. D. McIntosh, Jr. Power Plant Unit 5

250 Megawatt Combustion Turbine and
Once Through Heat Generator

Lakeland, Polk County

DEP File No. 1050004-004-AC
PSD-FL-245

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

April 22, 1998

TECHNICAL EVALUATION AND PRELIMINARY DETERMINATION

1. APPLICATION INFORMATION

1.1 Applicant Name and Address

City of Lakeland Electric and Water Utilities
501 East Lemon Street
Lakeland, Florida 33801-5079

Authorized Representative: Mr. Ronald W. Tomlin, Assistant Managing Director

1.2 Reviewing and Process Schedule

12-08-97: Date of Receipt of Application
01-05-98: DEP Incompleteness Letter
03-05-98: Received Lakeland Response to Incompleteness Letter
04-01-98 Received Combustor Development Schedules from Lakeland and Westinghouse
04-22-98: Intent Issued

2. FACILITY INFORMATION

2.1 Facility Location

The C. D. McIntosh, Jr. Power Plant is located at 3030 East Lake Parker Drive in Lakeland, Polk County. This site is approximately 90 kilometers from the Chassahowitzka National Wilderness Area, a Class I PSD Area. The UTM coordinates of this facility are Zone 17; 409.0 km E; 3106.2 km N.

2.2 Standard Industrial Classification Codes (SIC)

Industry Group No.	49	Electric, Gas, and Sanitary Services
Industry No.	4911	Electric Services

2.3 Facility Category

This facility generates electric power from: two 3.5 megawatt (MW) diesel powered electric generators, one 20 MW gas and distillate-fired combustion turbine; one 90 MW gas and fuel oil-fired steam generator; one 115 MW gas and fuel oil-fired steam generator; and one 364 MW multiple (primarily coal) fuel-fired steam generator. The large 364 MW unit is serviced by a limestone sulfur dioxide scrubber.

The facility is classified as a Major or Title V Source of air pollution because emissions of at least one regulated air pollutant, such as particulate matter (PM/PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO), or volatile organic compounds (VOC) exceeds 100 TPY.

This facility is within an industry included in the list of the 28 Major Facility Categories per Table 62-212.400-1, F.A.C. Because emissions are greater than 100 TPY for at least one criteria pollutant, the facility is also a major facility with respect to Rule 62-212.400, Prevention of Significant Deterioration (PSD). Per Table 62-212.400-2, modifications at the facility resulting in emissions increases greater than 40 TPY of NO_X or SO_2, 25/15 TPY of PM/PM10, or 3 TPY of fluorides (F) require review per the PSD rules and a determination for Best Available Control Technology (BACT) per Rule 62-212.410, F.A.C.

3. PROJECT DESCRIPTION

This permit addresses the following emissions units:

EMISSION UNIT NO.	SYSTEM	EMISSION UNIT DESCRIPTION
001	Power Generation	250 Megawatt Combustion Turbine and Once Through Steam Generator
002	Fuel Storage	1.05 Million Gallon Fuel Oil Storage Tank

The City of Lakeland (City) proposes to install a nominal 230 megawatt (MW) (net) new continuous duty, simple cycle, combustion turbine (Unit 5) at the existing C.D. McIntosh, Jr. Power Plant located at 3030 East Lake Parker Drive in Lakeland, Polk County. The project includes a Westinghouse 501 G combustion turbine operating primarily on natural gas, a once-through steam generator (OTSG), and a fuel oil storage tank. There are no plans to convert the unit to combined cycle operation. However the City wishes to maintain flexibility to make such a conversion in the future. This would involve additional heat recovery components and possible inclusion of a steam cycle.

An external perspective open view of the "501 G" is shown in Figure 1. The key components are identified in Figure 2. The unit will be delivered with 16 can-annular design, Advanced Dry Low NO_X combustors. These will be replaced with the more advanced piloted ring combustors designated as Ultra Dry Low NO_X burners. The unit incorporates steam cooling of key components, such as the transition pieces and turbine blade with subsequent steam injection for power augmentation. With power augmentation, the unit will produce approximately 250 MW of electrical power.

The main fuel will be natural gas and the unit will operate up to 7008 hours per year, of which no more than 250 hours represent fuel oil operation and 1000 represent "low load" operation. Emission increases will occur for carbon monoxide (CO), sulfur dioxide (SO_2), sulfuric acid mist (H_2SO_4), particulate matter (PM/PM_{10}), volatile organic compounds (VOC) and nitrogen oxides (NO_X). Emission increases of SO_2, and H_2SO_4 will be less than their respective significant emission levels per Table 62-212.400-2, F.A.C. and do not require PSD or non-attainment new source review. PSD review is required for CO, PM/PM_{10}, NO_X, and VOC since emissions, per the application, will increase by more than their respective significant emissions levels.

4. PROCESS DESCRIPTION

Much of the following discussion is from a 1993 EPA document on Alternative Control Techniques for NO_X Emissions from Stationary Gas turbines. Project specific information is interspersed where appropriate.

A gas turbine is an internal combustion engine that operates with rotary rather than reciprocating motion. Ambient air is drawn into the 17-stage compressor of the 501 G where it is compressed by a pressure ratio of 19.2 times atmospheric pressure. The compressed air is then directed to the combustor section, where fuel is introduced, ignited, and burned. The combustion section consists of 16 separate can-annular combustors instead of a single combustion chamber.

Flame temperatures in a typical combustor section can reach 3600 degrees Fahrenheit ($^{\circ}F$). Units such as the 501 G operate at lower flame temperatures which minimize NO_X formation. The hot combustion gases are then diluted with additional cool air and directed to the turbine section at temperatures up to 2700 $^{\circ}F$. Steam cooling of key components of the 501 G minimizes the need for

less efficient air cooling. The 501 G operates at the higher turbine inlet temperatures. Energy is recovered in the turbine section in the form of shaft horsepower, of which typically more than 50 percent is required to drive the internal compressor section. The balance of recovered shaft energy is available to drive the external load unit such as an electrical generator.

There are four basic operating cycles for gas turbines. These are simple cycle, regenerative, and combined cycles. In the Lakeland project, the 501 G will operate in simple cycle mode and as a continuous duty unit (versus an intermittent duty peaking unit). Cycle efficiency, defined as a percentage of useful shaft energy output to fuel energy input, is typically 30 to 35 percent, although the 501 G being introduced into the market, claims an efficiency of 38.5 percent. In addition to shaft energy output, 1 to 2 percent of fuel input energy can be attributed to mechanical losses. The balance is exhausted from the turbine in the form of heat.

Simple cycle operation offers the lowest installed capital cost. Although the 501 G has a remarkable simple cycle efficiency, this mode represents the least efficient use of fuel and therefore the highest operating cost. Because of the presence of the OTSG for more efficient steam cooling of key components and power augmentation, the cycle is somewhat like a regenerative cycle, wherein a heat exchanger (called a regenerator or recuperator) is used to preheat combustion air.

In combined cycle operation, the gas turbine drives an electric generator while the exhausted gases are used to raise steam in a heat recovery steam generator (HRSG). In this case, most of the steam is fed to a separate steam turbine which also drives an electrical generator. Typical combined cycle efficiencies are up to 55 percent. The 501 G can achieve up to 58 percent efficiency in combined cycle operation, especially if the gas turbine and the HRSG/steam generator power a common shaft connected to a single electric generator.

Additional process information related to the can-annular combustor design, and control measures to minimize NO_X formation are given in the draft BACT determination distributed with this evaluation.

5. RULE APPLICABILITY

The proposed project is subject to preconstruction review requirements under the provisions of Chapter 403, Florida Statutes, and Chapters 62-4, 62-204, 62-210, 62-212, 62-214, 62-296, and 62-297 of the Florida Administrative Code (F.A.C.).

This facility is located in Polk County, an area designated as attainment for all criteria pollutants in accordance with Rule 62-204.360, F.A.C. The proposed project is subject to review under Rule 62-212.400., F.A.C., Prevention of Significant Deterioration (PSD), because the potential emission increases for PM/PM_{10}, CO, VOC and NO_X exceed the significant emission rates given in Chapter 62-212, Table 62-212.400-2, F.A.C.

This PSD review consists of a determination of Best Available Control Technology (BACT) for PM/PM_{10}, VOC, CO, and NO_X. An analysis of the air quality impact from proposed project upon soils, vegetation and visibility is required along with air quality impacts resulting from associated commercial, residential, and industrial growth. This project will also be reviewed for a minor modification of the existing Site Certification under the Power Plant Siting Act. A further, full review as a modification of the Site Certification will be conducted if and when the City requests authority to operate the unit in combined cycle mode and generate additional electricity from steam.

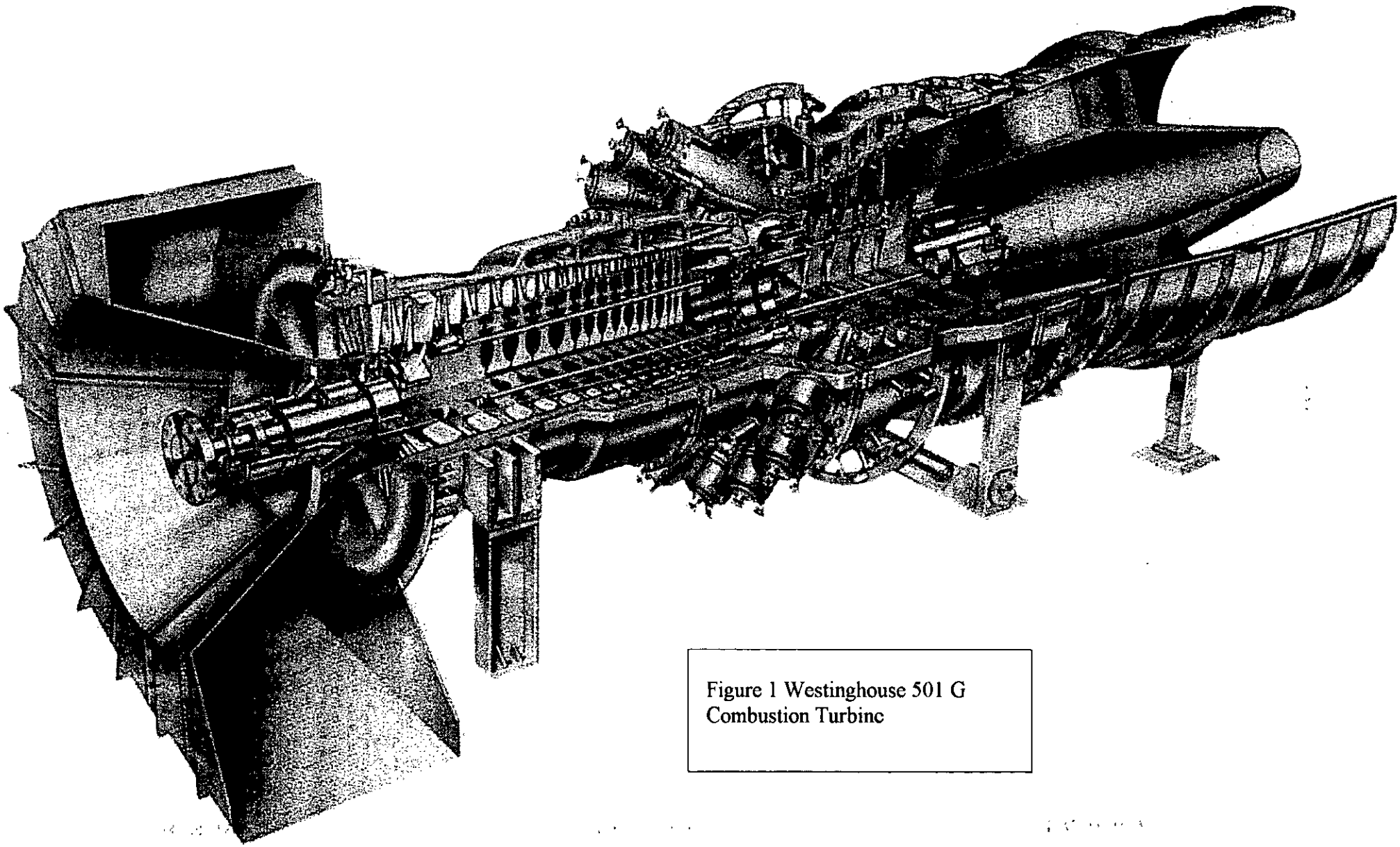


Figure 1 Westinghouse 501 G Combustion Turbine

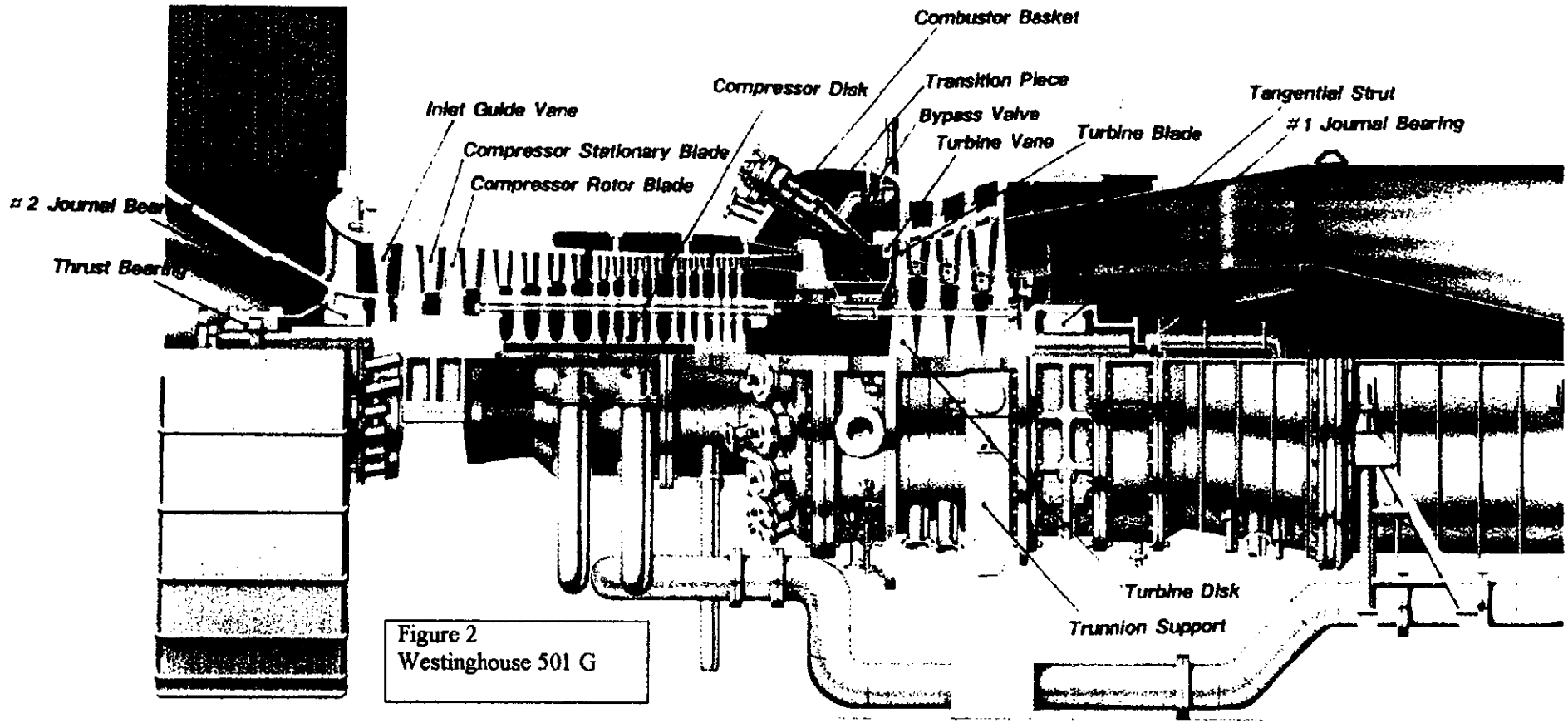


Figure 2
Westinghouse 501 G

The emission units affected by this PSD permit shall comply with all applicable provisions of the Florida Administrative Code (including applicable portions of the Code of Federal Regulations incorporated therein) and, specifically, the following Chapters and Rules:

5.1 State Regulations

Chapter 62-4	Permits.
Rule 62-204.220	Ambient Air Quality Protection
Rule 62-204.240	Ambient Air Quality Standards
Rule 62-204.260	Prevention of Significant Deterioration Increments
Rule 62-204.800	Federal Regulations Adopted by Reference
Rule 62-210.300	Permits Required
Rule 62-210.350	Public Notice and Comments
Rule 62-210.370	Reports
Rule 62-210.550	Stack Height Policy
Rule 62-210.650	Circumvention
Rule 62-210.700	Excess Emissions
Rule 62-210.900	Forms and Instructions
Rule 62-212.300	General Preconstruction Review Requirements
Rule 62-212.400	Prevention of Significant Deterioration
Rule 62-213	Operation Permits for Major Sources of Air Pollution
Rule 62-214	Requirements For Sources Subject To The Federal Acid Rain Program
Rule 62-296.320	General Pollutant Emission Limiting Standards
Rule 62-297.310	General Test Requirements
Rule 62-297.401	Compliance Test Methods
Rule 62-297.520	EPA Continuous Monitor Performance Specifications

5.2 Federal Rules

40 CFR 60	NSPS Subparts GG and Kb
40 CFR 60	Applicable sections of Subpart A, General Requirements
40 CFR 72	Acid Rain Permits (applicable sections)
40 CFR 73	Allowances (applicable sections)
40 CFR 75	Monitoring (applicable sections including applicable appendices)
40 CFR 77	Acid Rain Program-Excess Emissions (future applicable requirements)
40 CFR 52	Prevention of Significant Deterioration of Air Quality (applicable requirements)

6. SOURCE IMPACT ANALYSIS

6.1 Emission Limitations

The proposed Unit 5 will emit the following PSD pollutants (Table 212.400-2): particulate matter, sulfur dioxide, nitrogen oxides, volatile organic compounds, carbon monoxide, sulfuric acid mist, and negligible quantities of fluorides, beryllium, mercury and lead. The applicant's proposed annual emissions are summarized in the Table below and form the basis of the source impact review. The Department's proposed permitted allowable emissions for this Unit 5 are summarized in the Draft BACT document and Specific Condition Nos. 20-25 of Draft Permit PSD-FL-245.

6.2 Emission Summary

Table 1 PSD Applicability Summary			
POLLUTANTS	POTENTIAL EMISSIONS TON/YR	PSD SIGNIFICANT EMISSION RATE TON/YR	PSD REVIEW REQUIRED [c]
PM	41.3 [a,b]	25	Yes
PM10	41.3 [a, b]	15	Yes
SO_2	38.4 [b]	40	No
NO_X	863 [a]	40	Yes
CO	1264.4 [a]	100	Yes
Ozone(VOC)	93.7 [a]	40	Yes
Sulfuric Acid Mist	5.9 [b]	7	No
Total Reduced Sulfur	NEG [d]	10	No
Hydrogen Sulfide	NEG [d]	10	No
Vinyl Chloride	NEG [d]	1	No
Total Fluorides	0.01 [b]	3	No
Mercury	0.0003 [b]	0.1	No
Beryllium	0.00005 [b]	0.0004	No
Lead	less than 0.1 [b]	0.6	No

a Based on emissions from 501G operating at baseload conditions at 59 °F; firing natural gas and distillate fuel oil for 5,758 and 1,000 hours per year, respectively; and operating at 50% load firing natural gas and distillate oil for 200 and 50 hours per year, respectively.

b Based on baseload conditions at 59 F firing natural gas and distillate oil for 6,758 and 250 hours per year, respectively.

c If the netting procedure in 62-212.400(2)(d) F.A.C. results in a net emissions increase which exceeds the levels in Table 212.400-2, PSD requirements apply for the pollutants indicated.

d NEG = negligible emissions

6.3 Control Technology

Emissions control will be primarily accomplished by good combustion of clean natural gas and limited use of low sulfur (0.05 percent) distillate fuel oil. The combustors will operate in lean pre-mixed mode to minimize the flame temperature and nitrogen oxides formation potential. The initial Advanced Dry Low NO_X combustors will be replaced after three years by Ultra Low NO_X technology consisting of Piloted Ring Combustors. A full discussion is given in the Draft Best Available Control Technology (BACT) Determination (see Permit Appendix BD). The Draft BACT is incorporated into this evaluation by reference.

6.4 Air Quality Analysis

6.4.1 Introduction

The proposed project will increase emissions of four pollutants at levels in excess of PSD significant amounts: PM_{10}, CO, NO_X, and VOC. PM_{10} and NO_X are criteria pollutants and have national and state ambient air quality standards (AAQS), PSD increments, and significant impact levels defined for them. CO and VOC are criteria pollutants and have only AAQS and significant impact levels defined for them. Since the project's VOC emissions increase is less than 100 tons per year no air quality analysis is required for VOC.

The applicant's initial PM_{10}, CO and NO_X air quality impact analyses for this project predicted no significant impacts; therefore, further applicable AAQS and PSD increment impact analyses for these pollutants were not required. Based on the preceding discussion the air quality analyses required by the PSD regulations for this project are the following:

- A significant impact analysis for PM_{10}, CO and NO_X;
- An analysis of impacts on soils, vegetation, and visibility and of growth-related air quality modeling impacts.

Based on these required analyses, the Department has reasonable assurance that the proposed project, as described in this report and subject to the conditions of approval proposed herein, will not cause or significantly contribute to a violation of any AAQS or PSD increment. However, the following EPA-directed stack height language is included: "In approving this permit, the Department has determined that the application complies with the applicable provisions of the stack height regulations as revised by EPA on July 8, 1985 (50 FR 27892). Portions of the regulations have been remanded by a panel of the U.S. Court of Appeals for the D.C. Circuit in NRDC v. Thomas, 838 F. 2d 1224 (D.C. Cir. 1988). Consequently, this permit may be subject to modification if and when EPA revises the regulation in response to the court decision. This may result in revised emission limitations or may affect other actions taken by the source owners or operators." A more detailed discussion of the required analyses follows.

6.4.2 Models and Meteorological Data Used in the Significant Impact Analysis

The EPA-approved Industrial Source Complex Short-Term (ISCST3) dispersion model was used to evaluate the pollutant emissions from the proposed project. The model determines ground-level concentrations of inert gases or small particles emitted into the atmosphere by point, area, and volume sources. The model incorporates elements for plume rise, transport by the mean wind, Gaussian dispersion, and pollutant removal mechanisms such as deposition. The ISCST3 model allows for the separation of sources, building wake downwash, and various other input and output features. A series of specific model features, recommended by the EPA, are referred to as the regulatory options. The applicant used the EPA recommended regulatory options. Direction-specific downwash parameters were used for all sources for which downwash was considered. The stacks associated with this project all satisfy the good engineering practice (GEP) stack height criteria.

Meteorological data used in the ISCST3 model consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper air soundings from the National Weather Service (NWS) stations at Tampa International Airport, Florida (surface data) and Ruskin, Florida (upper air data). The 5-year period of meteorological data was from 1987 through 1991. These NWS stations were selected for use in the study because they are the closest primary weather stations to the study area and are most representative of the project site. The surface observations included wind direction, wind speed, temperature, cloud cover, and cloud ceiling.

For determining the project's significant impact area in the vicinity of the facility and if there are significant impacts from the project on any PSD Class I area, the highest predicted short-term concentrations and highest predicted annual averages were compared to their respective significant impact levels.

6.4.3 Significant Impact Analysis

Initially, the applicant conducts modeling using only the proposed project's emissions. If this modeling shows significant impacts, further modeling is required to determine the project's impacts on the existing air quality and any applicable AAQS and PSD increments. Receptors were placed within 12 km of the facility, which is located in a PSD Class II area, and the Chassahowitzka National Wilderness Area (CNWA) which is a PSD Class I area located approximately 91 km to the northwest of the project at its closest point. The receptor grid for predicting maximum concentrations in the vicinity of the project was a polar receptor grid comprised of 648 receptors. This grid included receptors located on 18 radials extending out from the proposed gas turbine stack location. Along each radial, 36 receptors were located at 10° intervals and distances of 0.1, 0.25, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0 and 12.0 km from the proposed stack location. For predicting impacts at the CNWA, 13 discrete receptors along the border of the PSD Class I area were used. For each pollutant subject to PSD and also subject to PSD increment and/or AAQS analyses, this modeling compares maximum predicted impacts due to the project with PSD significant impact levels to determine whether significant impacts due to the project are predicted in the vicinity of the facility or in the CNWA. The tables below show the results of this modeling.

Maximum Project Air Quality Impacts for Comparison to the PSD Class II Significant Impact Levels in the Vicinity of the Facility

Pollutant	Averaging Time	Max Predicted Impact (ug/m3)	Significant Impact Level (ug/m3)	Significant Impact?
PM_{10}	Annual	0.03	1	NO
	24-hour	0.4	5	NO
CO	8-hour	9	500	NO
	1-hour	39	2000	NO
NO_2	Annual	0.1	1	NO

Maximum Project Air Quality Impacts for Comparison to the PSD Class I Significant Impact Levels (CNWA)				
Pollutant	Averaging Time	Max. Predicted Impact at Class I Area (ug/m3)	Proposed EPA Significant Impact Level (ug/m3)	Significant Impact?
PM_{10}	Annual	0.007	0.2	NO
	24-hour	0.13	0.3	NO
NO_2	Annual	0.02	0.1	NO

The results of the significant impact modeling show that there are no significant impacts predicted from emissions from this project; therefore, no further modeling was required.

6.4.4 Impacts Analysis

Impact Analysis Impacts On Soils, Vegetation, And Wildlife

The maximum ground-level concentrations predicted to occur for PM_{10}, CO, NO_X, and VOC as a result of the proposed project, including background concentrations and all other nearby sources, will be below the associated AAQS. The AAQS are designed to protect both the public health and welfare. As such, this project is not expected to have a harmful impact on soils and vegetation in the PSD Class II area. An air quality related values (AQRV) analysis was done by the applicant for the Class I area. No significant impacts on this area are expected.

Impact On Visibility

A regional haze analysis was done which shows that the proposed project will not result in adverse impacts on visibility in the PSD Class I area.

Growth-Related Air Quality Impacts

The proposed project is being constructed to meet current electric demands. Additional growth a direct result of the additional electric power provided by the project is not expected The project will be constructed and operated with minimum labor and associated facilities and is not expected to significantly affect growth in the area. Therefore, no additional growth impacts are expected as a result of the proposed project.

Air Toxics Air Quality Impacts

The maximum predicted impacts of regulated and non-regulated toxic air pollutants that are proposed to be emitted by the project are all less than the Department's draft Ambient Reference Concentrations (ARC).

7. CONCLUSION

Based on the foregoing technical evaluation of the application and additional information submitted by the applicant, the Department has made a preliminary determination that the

proposed project will comply with all applicable state and federal air pollution regulations, provided the Department's BACT determination is implemented.

A. A. Linero, P.E.
Teresa Heron, Review Engineer
Cleve Holladay, Meteorologist

PERMITTEE:

City of Lakeland
Department of Electric & Water Utilities
501 East Lemon Street
Lakeland, Fl 33801-5079

File No.	1050004-004-AC
FID No.	1050004-004
SIC No.	4911
Permit No.	PSD-FL-245
Expires:	December 31, 1999

Authorized Representative:
Ronald W. Tomlin
Assistant Managing Director

PROJECT AND LOCATION:

Permit for the construction of 250 megawatt (MW) simple cycle, gas-fired, stationary combustion turbine (CT), a once-through steam generator, and a 1.05 million gallon storage tank for back-up distillate fuel oil. Conditions are included for possible future conversion to a 350 megawatt combined cycle installation including a heat recovery steam generator provided there are no increases in emissions associated with the conversion. The turbine is designated as Unit No. 5 and will be located at the C.D. McIntosh, Jr., Power Plant, 3030 East Lake Parker Drive, Lakeland, Polk County. UTM coordinates are: Zone 17; 409.0 km E; 3106.2 km N.

STATEMENT OF BASIS:

This construction permit is issued under the provisions of Chapter 403 of the Florida Statutes (F.S.), and Chapters 62-4, 62-204, 62-210, 62-212, 62-296, and 62-297 of the Florida Administrative Code (F.A.C.). The above named permittee is authorized to modify the facility in accordance with the conditions of this permit and as described in the application, approved drawings, plans, and other documents on file with the Department of Environmental Protection (Department).

Attached appendices and Tables made a part of this permit:

Appendix BD	BACT Determination
Appendix GC	Construction Permit General Conditions

Howard L. Rhodes, Director
Division of Air Resources
Management

SECTION I. FACILITY INFORMATION

SUBSECTION A. FACILITY DESCRIPTION

The existing facility includes: two small diesel powered electric generators; one small gas and distillate-fired combustion turbine; one 90 MW gas and fuel oil-fired steam generator; one 115 MW gas and fuel oil-fired steam generator; and one 364 MW multiple (primarily coal) fuel-fired steam. This permit is for the installation of: a 250 MW simple cycle, gas-fired, stationary combustion turbine; a once-through steam generator; a 1.05 million gallon storage tank for back-up (0.05 percent sulfur) distillate fuel oil; and an 85-foot stack. It is possible that in the future the turbine will be converted by the addition of a heat recovery steam generator and a new stack to a 350 MW combined cycle operation without increases in emissions.

Emissions from Unit 5 will be initially controlled by Advanced Dry Low NO_X combustors, steam injection when firing fuel oil, use of inherently clean fuels, and good combustion practices. Ultimately the combustors will be replaced and nitrogen oxides emissions reduced by more sophisticated Ultra Low NO_X burners. Otherwise emissions will be reduced by the addition of a selective catalytic reduction (SCR) system.

SUBSECTION B. EMISSION UNITS

This permit addresses the following emission units:

EMISSION UNIT NO.	SYSTEM	EMISSION UNIT DESCRIPTION
001	Power Generation	250 Megawatt Combustion Turbine and Once Through Steam Generator
002	Fuel Storage	1.05 Million Gallon Fuel Oil Storage Tank

SUBSECTION C. REGULATORY CLASSIFICATION

The facility is classified as a Major or Title V Source of air pollution because emissions of at least one regulated air pollutant, such as particulate matter (PM/PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO), or volatile organic compounds (VOC) exceeds 100 tons per year (TPY).

This facility is within an industry included in the list of the 28 Major Facility Categories per Table 62-212.400-1, F.A.C. Because emissions are greater than 100 TPY for at least one criteria pollutant, the facility is also a Major Facility with respect to Rule 62-212.400, Prevention of Significant Deterioration (PSD). Per Table 62-212.400-2, modifications (such as the construction of Unit 5) at the facility resulting in emissions increases greater than 40 TPY of NO_X or SO_2, 25/15 TPY of PM/PM_{10}, or 3 TPY of fluorides (F) require review per the PSD rules and a determination for Best Available Control Technology (BACT) per Rule 62-212.410, F.A.C.

This facility is also subject to the provisions of Title IV, Acid Rain, Clean Air Act as amended in 1990.

SECTION I. FACILITY INFORMATION

SUBSECTION D. PERMIT SCHEDULE

- 04/xx/98 Notice of Intent published in the Lakeland _____
- 04/23/98 Distributed Intent to Issue Permit
- 12/08/97 Received Application

SUBSECTION E. RELEVANT DOCUMENTS:

The documents listed below are the basis of the permit. They are specifically related to this permitting action, but not all are incorporated into this permit. These documents are on file with the Department.

- Application received on December 8, 1997
- Department letters dated January 5, January 12, and March 9, 1998
- Comments and letters from the National Park Service dated January 6, January 12, April 2 and April 15, 1998.
- EPA letters dated February 10 and March 6, 1998
- City of Lakeland letters dated March 4, March 11, and March 31, 1998
- Letters from Westinghouse dated March 25, March 30, and March 31, 1998
- Department's Intent to Issue and Public Notice Package dated April 22, 1998
- Department's Final Determination and Best Available Control Technology Determination dated May xx, 1998

SECTION II. EMISSION UNIT(S) GENERAL REQUIREMENTS

GENERAL AND ADMINISTRATIVE REQUIREMENTS

1. Regulating Agencies: All documents related to applications for permits to construct, operate or modify an emissions unit should be submitted to the Bureau of Air Regulation (BAR), Florida Department of Environmental Protection (FDEP), at 2600 Blairstone Road, Tallahassee, Florida 32399-2400 and phone number (850)488-1344. All documents related to reports, tests, and notifications should be submitted to the DEP Southwest District office (DEPSW), 3804 Coconut Palm Drive, Tampa, Florida 33619 and phone number 813/744-6100.
2. General Conditions: The owner and operator is subject to and shall operate under the attached General Permit Conditions G.1 through G.15 listed in Appendix GC of this permit. General Permit Conditions are binding and enforceable pursuant to Chapter 403 of the Florida Statutes. [Rule 62-4.160, F.A.C.]
3. Terminology: The terms used in this permit have specific meanings as defined in the corresponding chapters of the Florida Administrative Code.
4. Forms and Application Procedures: The permittee shall use the applicable forms listed in Rule 62-210.900, F.A.C. and follow the application procedures in Chapter 62-4, F.A.C. [Rule 62-210.900, F.A.C.]
5. Modifications: The permittee shall give written notification to the Department when there is any modification to this facility. This notice shall be submitted sufficiently in advance of any critical date involved to allow sufficient time for review, discussion, and revision of plans, if necessary. Such notice shall include, but not be limited to, information describing the precise nature of the change; modifications to any emission control system; production capacity of the facility before and after the change; and the anticipated completion date of the change. [Chapters 62-210 and 62-212]
6. Expiration: Approval to construct shall become invalid if construction is not commenced within 18 months after receipt of such approval, or if construction is discontinued for a period of 18 months or more, or if construction is not completed within a reasonable time. The Department may extend the 18-month period upon a satisfactory showing that an extension is justified. [40 CFR 52.21(r)(2)].
7. BACT Determination: In accordance with paragraph (4) of 40 CFR 52.21(j) the Best Available Control Technology (BACT) determination shall be reviewed and modified as appropriate in the event of a conversion to combined cycle operation. This paragraph states: "For phased construction project, the determination of best available control technology shall be reviewed and modified as appropriate at the latest reasonable time which occurs no later than 18 months prior to commencement of construction of each independent phase of the project. At such time, the owner or operator of the applicable stationary source may be required to demonstrate the adequacy of any previous determination of best available control technology for the source."

This reassessment will be conducted for this project only if the conversion to combined cycle operation is accompanied by any increases in heat input limits, hours of operation, oil firing, low or baseload operation, short-term or annual emission limits, or similar changes. [40 CFR 52.21(j)(4)]

8. Application for Title V Permit: An application for a Title V operating permit, pursuant to Chapter 62-213, F.A.C., must be submitted to the DEP's Bureau of Air Regulation, and a copy to the Department Southwest District office (DEPSW). [Chapter 62-213, F.A.C.]

9. New or Additional Conditions: Pursuant to Rule 62-4.080, F.A.C., for good cause shown and after notice and an administrative hearing, if requested, the Department may require the permittee to conform to new or additional conditions. The Department shall allow the permittee a reasonable time to conform to the new or additional conditions, and on application of the permittee, the Department may grant additional time. [Rule 62-4.080, F.A.C.]

10. Annual Reports: Pursuant to Rule 62-210.370(2), F.A.C., Annual Operation Reports, the permittee is required to submit annual reports on the actual operating rates and emissions from this facility. Annual operating reports shall be sent to the DEP's Southwest District office by March 1st of each year.

11. Stack Testing Facilities: Stack sampling facilities shall be installed in accordance with Rule 62-297.310(6), F.A.C.

12. Permit Extension: The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Bureau of Air Regulation prior to 60 days before the expiration of the permit (Rule 62-4.090, F.A.C.).

13. Quarterly Reports: Quarterly excess emission reports, in accordance with 40 CFR 60.7 (7) (c) (1997 version), shall be submitted to the DEP's Southwest District office.

SECTION III. EMISSION UNIT(S) SPECIFIC CONDITIONS

APPLICABLE STANDARDS AND REGULATIONS:

1. Unless otherwise indicated in this permit, the construction and operation of the subject emission unit(s) shall be in accordance with the capacities and specifications stated in the application. The facility is subject to all applicable provisions of Chapter 403, F.S. and Florida Administrative Code Chapters 62-4, 62-103, 62-204, 62-210, 62-212, 62-213, 62-214, 62-296, 62-297; and the applicable requirements of the Code of Federal Regulations Section 40, Parts 60, 72, 73, and 75.
2. Issuance of this permit does not relieve the facility owner or operator from compliance with any applicable federal, state, or local permitting requirements or regulations. [Rule 62-210.300, F.A.C.]
3. These emission units shall comply with all applicable requirements of 40CFR60, Subpart A, General Provisions including:
   - 40CFR60.7, Notification and Recordkeeping
   - 40CFR60.8, Performance Tests
   - 40CFR60.11, Compliance with Standards and Maintenance Requirements
   - 40CFR60.12, Circumvention
   - 40CFR60.13, Monitoring Requirements
   - 40CFR60.19, General Notification and Reporting requirements
4. Emission Unit 001, Power Generation, consisting of a 250 megawatt combustion turbine with a once-through steam generator shall comply with all applicable provisions of 40CFR60, Subpart GG, Standards of performance for Stationary Gas Turbines, adopted by reference in Rule 62-204.800(7)(b), F.A.C. The Subpart GG requirement to correct test data to ISO conditions applies. However, such correction is not used for compliance determinations with the BACT standard(s).
5. Emission Unit 002, Fuel Storage, consisting of a 1.05 million gallon distillate fuel oil storage tank shall comply with all applicable provisions of 40CFR60, Subpart Kb, Standards of performance for Storage Tanks, adopted by reference in Rule 62-204.800, F.A.C.
6. All notifications and reports required by the above specific conditions shall be submitted to the DEP's Southwest District office.

GENERAL OPERATION REQUIREMENTS

7. Fuels: Only pipeline natural gas or maximum 0.05 percent sulfur No. 2 distillate fuel oil shall be fired in this unit. [Applicant Request, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)]

SECTION III. EMISSION UNIT(S) SPECIFIC CONDITIONS

8. Capacity: The maximum heat input rates, based on the lower heating value (LHV) of each fuel to Unit 5 at ambient conditions of 59°F temperature, 60% relative humidity, 100% load, and 14.7 psi pressure shall not exceed 2,174 million Btu per hour (mmBtu/hr) when firing natural gas, nor 2,236 mmBtu/hr when firing No. 2 fuel oil. These maximum heat input rates will vary depending upon ambient conditions and the combustion turbine characteristics. Manufacturer's curves corrected for site conditions or equations for correction to other ambient conditions shall be provided to the Department of Environmental Protection (DEP) within 45 days of completing the initial compliance testing. [Design, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)]

9. Unconfined Particulate Emissions: During the construction period, unconfined particulate matter emissions shall be minimized by dust suppressing techniques such as covering and/or application of water or chemicals to the affected areas, as necessary.

10. Plant Operation - Problems: If temporarily unable to comply with any of the conditions of the permit due to breakdown of equipment or destruction by fire, wind or other cause, the owner or operator shall notify the Permitting Authority as soon as possible, but at least within (1) working day, excluding weekends and holidays. The notification shall include: pertinent information as to the cause of the problem; the steps being taken to correct the problem and prevent future recurrence; and where applicable, the owner's intent toward reconstruction of destroyed facilities. Such notification does not release the permittee from any liability for failure to comply with the conditions of this permit and the regulations. [Rule 62-4.130, F.A.C.]

11. Operating Procedures: Operating procedures shall include good operating practices and proper training of all operators and supervisors. The good operating practices shall meet the guidelines and procedures as established by the equipment manufacturers. All operators (including supervisors) of air pollution control devices shall be properly trained in plant specific equipment. [Rule 62-4.070(3), F.A.C.]

12. Circumvention: The owner or operator shall not circumvent the air pollution control equipment or allow the emission of air pollutants without this equipment operating properly. [Rules 62-210.650, F.A.C.]

Hours of Operation

13. Hours of operation for the stationary gas turbine and once through steam generator shall not exceed 7008 hours per year. [Applicant Request, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)]

14. Hours of operation for the stationary gas turbine and once through steam generator shall not exceed 250 hours per year while firing distillate fuel oil. [Applicant Request, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)]

Control Technology

15. Westinghouse Second Generation Advanced Dry Low NO_X (DLN) combustors (or equivalent) shall be installed on the stationary combustion turbine to control nitrogen oxides (NO_X) emissions while firing natural gas. [Design, Rule 62-4.070, F.A.C.]

16. The initial combustors shall be replaced with Westinghouse Ultra Low NO_X (ULN) Piloted Ring Combustors within 36 months after start-up to accomplish further NO_X control unless a high temperature selective catalytic reduction (Hot SCR) system or a low temperature SCR system is installed within 36 months. [Design, Rules 62-4.070 and 62-212.410, F.A.C.]

17. The permittee shall design the stationary gas turbine, ducting, possible future heat recovery steam generator, and stack(s) to accommodate installation of SCR equipment or oxidation catalyst in the event that the ULN technology fails to achieve the NO_X or carbon monoxide (CO) limits given in Specific Condition No. 21 and 22 within 36 months after start-up. [Rule 62-4.070, F.A.C.]

18. A water injection system shall be installed for use when firing No. 2 fuel oil for control of NO_X emissions. [Design, Rules 62-4.070 and 62-212.410, F.A.C.]

19. The Advanced DLN and ULN systems shall each be tuned upon initial operation to optimize emissions reductions and shall be maintained to minimize NO_X emissions and CO emissions. Operation of the Advanced DLN or ULN systems in the diffusion firing mode shall be minimized when firing natural gas. [Rule 62-4.070, and 62-210.650 F.A.C.]

EMISSION LIMITS AND STANDARDS

20. The following emission limits based shall apply upon completion of the initial performance tests: Best Available Control Technology (BACT). Following is a summary of the BACT determination by DEP. Values for NO_X are corrected to 15% O_2. [Rule 62-212.410, F.A.C.]

Operational Mode	NO_X (ppm)	CO (ppm)	VOC (ppm)	PM/Visibility (% Opacity)	Technology and Comments
Simple Cycle	25 - NG 42 - FO	25 - NG or 10 - Ox Cat 90 - FO	4 - NG 10 - FO	10	Adv. DLN on gas. WI on oil. Applies first 36 months after startup. Clean fuels, good combustion
Simple Cycle	9 - NG 12 - (30 day) 42 - FO	25 - NG or 10 - Ox Cat 90 - FO	4 - NG 10 - FO	10	ULN on gas. WI on oil. Applies after 36 months operation. Clean fuels, good combustion
Simple Cycle	9 - NG 15 - FO	25 - NG or 10 - Ox Cat 90 - FO	4 - NG 10 - FO	10	Hot SCR. Applies after 36 months if 9 ppm NOX not achievable by ULN. Clean fuels, good combustion.
Combined Cycle	7.5 - NG 15 - FO	25 - NG or 10 - Ox Cat 90 - FO	4 - NG 10 - FO	10	Conventional SCR if converted to combined cycle, unless 9 ppm is attained by ULN or Hot SCR as described above. Clean fuels, good combustion

21. Nitrogen Oxides (NO_X) Emissions:

- When NO_X monitoring data is not available, substitution for missing data shall be handled as required by Title IV (40 CFR 75) to calculate any specified average time.
- During the first 36 months after start-up (commercial operation), the concentration of NO_X in the exhaust gas shall not exceed 25 ppmvd at 15% O_2 when firing natural gas and 42 ppmvd at 15% O_2 when firing fuel oil on the basis of a 24-hr average except during periods of startup, shutdown, malfunction or fuel switching, as measured by the continuous emission monitoring system (CEMS). NOx emissions calculated as NO_2 (at ISO conditions) shall not exceed 237 lb/hr (gas) and 413 lb/hr (oil) to be demonstrated by stack test. [Rule 62-212.400, F.A.C.]
- Beginning 36 months after start-up, achievable short-term NO_X concentrations in the exhaust gas shall be demonstrated at baseload during an annual compliance test not to exceed 9 ppmvd at 15% O_2 when firing natural gas. NO_X emissions shall not exceed 12 ppmvd at 15% O_2 when firing natural gas and 42 ppmvd at 15% O_2 when firing fuel oil on the basis of a 30-day rolling average (except during periods of startup, shutdown, malfunction or fuel switching), as measured by the CEMS. NO_X emissions calculated as NO_2 (at ISO conditions) shall not exceed 85 lb/hr (gas) and 413 lb/hr (oil) to be demonstrated by stack test. [Rule 62-212.400, F.A.C.]
- If Hot SCR is installed, achievable short-term NO_X concentrations in the exhaust gas shall be demonstrated at baseload during the first compliance test following installation not to exceed 9 ppmvd at 15% O_2 when firing natural gas. NO_X emissions shall not exceed 9 ppmvd at 15% O_2 when firing natural gas and 15 ppmvd at 15% O_2 when firing fuel oil on the basis of a 30-day rolling average (except during periods of startup, shutdown, malfunction or fuel switching), as measured by the CEMS. NO_X emissions calculated as NO_2 (at ISO conditions) shall not exceed 85 lb/hr (gas) and 148 lb/hr (oil) to be demonstrated by stack test. [Rule 62-212.400, F.A.C.]
- If conventional SCR is installed in conjunction with conversion to combined cycle operation, achievable short-term NO_X concentrations in the exhaust gas shall be demonstrated at baseload during the first compliance test following installation not to exceed 7.5 ppmvd at 15% O_2 when firing natural gas. If conventional SCR catalyst is installed, NO_X emissions shall not exceed 7.5 ppmvd at 15% O_2 when firing natural gas and 15 ppmvd at 15% O_2 when firing fuel oil on the basis of a 30-day rolling average (except during periods of startup, shutdown, malfunction or fuel switching), as measured by the CEMS. NOx emissions calculated as NO2 (at ISO conditions) shall not exceed 71.1 lb/hr (gas) and 148 lb/hr (oil) to be demonstrated by stack test. [Rule 62-212.400, F.A.C.]

22. Carbon Monoxide (CO) emissions: The concentration of CO in the exhaust gas when firing natural gas shall not exceed 25 ppmvd when firing natural gas and 90 ppmvd when firing fuel oil as measured by EPA Reference Method 10 test. CO emissions (at ISO conditions) shall not exceed 106 lb/hr (gas) and 386 lb/hr (oil). [Rule 62-212.400, F.A.C.]

23. Sulfur Dioxide (SO_2) emissions: SO_2 emissions (at ISO conditions) shall not exceed 7.2 pounds per hour when firing pipeline natural gas and 127 pounds per hour when firing maximum 0.05 percent sulfur distillate fuel oil No. 2 as measured by applicable compliance methods described below. Emissions of SO_2 shall not exceed 38.4 tons per year. [Rules 62-4.070 and 62-212.400, F.A.C. to avoid PSD Review]

24. Visible emissions (VE): VE emissions shall not exceed 10 percent opacity when firing natural gas or No. 2 fuel oil.

25. Volatile Organic Compounds (VOCs) Emissions: The concentration of VOCs in the exhaust gas when firing natural gas shall not exceed 4 ppmvd when firing natural gas and 10 ppmvd when firing fuel oil as asured by EPA Methods 18, and/or 25 A. VOCs emissions (at ISO conditions) shall not exceed 10 lb/hr (gas) and 25 lb/hr (oil). -[Rule 62-212.400, F.A.C.]

EXCESS EMISSIONS

26. Excess emissions resulting from startup, shutdown, malfunction or fuel switching shall be permitted provided that best operational practices are adhered to and the duration of excess emissions shall be minimized. Excess emissions occurrences shall in no case exceed four hours in any 24-hour period for cold startup or two hours in any 24-hour period for other reasons unless specifically authorized by DEP for longer duration.

27. Excess emissions entirely or in part by poor maintenance, poor operation, or any other equipment or process failure that may reasonably be prevented during startup, shutdown or malfunction, shall be prohibited pursuant to Rule 62-210.700, F.A.C.

28. Excess Emissions Report: If excess emissions occur due to malfunction, the owner or operator shall notify DEP's Southwest District office within (1) working day of: the nature, extent, and duration of the excess emissions; the cause of the excess emissions; and the actions taken to correct the problem. In addition, the Department may request a written summary report of the incident. Pursuant to the New Source Performance Standards, excess emissions shall also be reported in accordance with 40 CFR 60.7, Subpart A. [Rules 62-4.130 and 62-210.700(6), F.A.C.]

COMPLIANCE DETERMINATION

29. Compliance with the allowable emission limiting standards shall be determined within 60 days after achieving the maximum production rate, for each fuel, at which this unit will be operated, but not later than 180 days of initial operation of the unit for that fuel, and annually thereafter as indicated in this permit, by using the following reference methods as described in 40 CFR 60, Appendix A (1997 version), and adopted by reference in Chapter 62-297, F.A.C.

30. Initial (I) performance tests shall be performed on Unit 5 while firing natural gas as well as while firing fuel oil. Initial tests shall also be conducted after any modifications (and shake down period not to exceed 100 days after re-starting the CT) of air pollution control equipment, including installation of Ultra Low NOX burners, Hot SCR, or conventional SCR.

Annual (A) compliance tests shall be performed during every federal fiscal year (October 1 - September 30) pursuant to Rule 62-297.340, F.A.C., on Unit 5 as indicated. The following reference methods shall be used.. No other test methods may be used for compliance testing unless prior DEP approval is received in writing.

- EPA Reference Method 9, "Visual Determination of the Opacity of Emissions from Stationary Sources" (I, A).
- EPA Reference Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources" (I, A).
- EPA Reference Method 20, "Determination of Oxides of Nitrogen Oxide, Sulfur Dioxide and Diluent Emissions from Stationary Gas Turbines." Initial test only for compliance with 40CFR60 Subpart GG and (I,A) short-term NO_X BACT limits (Method 7E or RATA test data may be used to demonstrate compliance for annual test requirement)
- EPA Reference Method 18, and/or 25A, "Determination of Volatile Organic Concentrations." Initial test only.

31. Continuous compliance with the NO_X emission limits: Except as noted in Specific Condition No. 21, continuous compliance with the NO_X emission limits shall be demonstrated with the CEMS system based on a 30 day rolling average. Based on CEMS data, a separate compliance test is conducted at the end of each operating day and a new 30 day average emission rate is calculated from the arithmetic average of all valid hourly emission rates during the previous 30 operating days. [Rule 62-4.070, F.A.C., 40CFR75]

32. Compliance with the SO_2 and PM/PM_{10} emission limits: Not withstanding the requirements of Rule 62-297.340, F.A.C., the use of pipeline natural gas and the use of no more than 250 hours per year of maximum 0.05 percent sulfur (by weight) distillate No. 2 fuel oil, is the method for determining compliance for SO_2 and PM_{10}. For the purposes of demonstrating compliance with the 40 CFR 60.333 SO_2 standard and the 0.05% S limit, fuel oil analysis using ASTM D2880-71 or D4294 (or equivalent) for the sulfur content of liquid fuels and D1072-80, D3031-81, D4084-82 or D3246-81 (or equivalent) for sulfur content of gaseous fuel shall be utilized in accordance with the EPA-approved custom fuel monitoring schedule. The applicant is responsible for ensuring that the procedures above are used for determination of fuel sulfur content. Analysis may be performed by the owner or operator, a service contractor retained by the owner or operator, the fuel vendor, or any other qualified agency pursuant to 40 CFR 60.335(e) (1997 version).

33. Compliance with CO emission limit: An initial test for CO, concurrent with the initial NO_X test, is required. The initial NO_X and CO test results shall be the average of three valid one-hour runs. Annual compliance testing may be conducted concurrent with the annual RATA testing required pursuant to 40 CFR 75 (required for gas only).

34. Compliance with the VOC emission limit: An initial test is required to demonstrate compliance with the BACT VOC emission limit. Thereafter, CO emission limit will be employed as surrogate.

35. Testing procedures: Testing of emissions shall be conducted with the combustion turbine operating at permitted capacity. Permitted capacity is defined as 95-100 percent of the maximum heat input rate allowed by the permit, corrected for the average ambient air temperature during the test (with 100 percent represented by a curve depicting heat input vs. ambient temperature). If it is impracticable to test at permitted capacity, the source may be tested at less than permitted capacity. In this case, subsequent operation is limited by adjusting the entire heat input vs. ambient temperature curve downward by an increment equal to the difference between the maximum permitted heat input (corrected for ambient temperature) and 105 percent of the value reached during the test until a new test is conducted. nce the unit is so limited, operation at higher capacities is allowed for no more than 15 consecutive days for the purposes of additional compliance testing to regain the permitted capacity. Test procedures shall meet all applicable requirements (i.e., testing time frequency, minimum compliance duration, etc.) of Chapter 62-297 F.A.C.

36. Test Notification: The DEP's Southwest District office shall be notified, in writing, at least 30 days prior to the initial performance tests and at least 15 days before annual compliance test(s).

37. Special Compliance Tests: The DEP may request a special compliance test pursuant to Rule 62-297.340(2), F.A.C., when, after investigation (such as complaints, increased visible emissions, or questionable maintenance of control equipment), there is reason to believe that any applicable emission standard is being violated.

38. Test Results: Compliance test results shall be submitted to the DEP's Southwest District office no later than 45 days after completion of the last test run.

NOTIFICATION, REPORTING, AND RECORDKEEPING

39. Records: All measurements, records, and other data required to be maintained by the City of Lakeland Department of Electric & Water Utilities shall be recorded in a permanent form and retained for at least five (5) years following the date on which such measurements, records, or data are recorded. These records shall be made available to DEP representatives upon request.

40. Emission Compliance Stack Test Reports: A test report indicating the results of the required compliance tests shall be filed with the DEP SW District Office as soon as practical, but no later than 45 days after the last sampling run is completed. [Rule 62-297.310(8), F.A.C.]. The test report shall provide sufficient detail on the tested emission unit and the procedures used to allow the Department to determine if the test was properly conducted and if the test results were properly computed. At a minimum, the test report shall provide the applicable information listed in Rule 62-297.310(8), F.A.C.

MONITORING REQUIREMENTS

41. Continuous Monitoring System: The permittee shall install, calibrate, maintain, and operate a continuous emission monitor in the stack to measure and record the nitrogen oxides emissions from Unit 5. Periods when NOX emissions (ppmvd @ 15% oxygen) are above the BACT-standards listed in Subsection C. Specific Condition C.1. shall be reported to the DEP Southwest District Office pursuant to Rule 62-4.160(8), F.A.C. Periods of startup, shutdown, malfunction, and fuel switching shall be monitored, recorded, and reported as excess emissions when emission levels exceed the BACT standards following the format of 40 CFR 60.7 (1997 version).

42. CEMS in lieu of Water to Fuel Ratio: Subject to EPA approval, the NO_X CEMS shall be used in lieu of the water/fuel monitoring system for reporting excess emissions in accordance with 40 CFR 60.334(c)(1), Subpart GG (1997 version). Subject to EPA approval, the calibration of the water/fuel monitoring device required in 40 CFR 60.335 (c)(2) (1997 version) will be replaced by the 40 CFR 75 certification tests of the NO_X CEMS. Upon request from DEP, the CEMS emission rates for NOX on Unit 5 shall be corrected to ISO conditions to demonstrate compliance with the NOX standard established in 40 CFR 60.332.

43. Continuous Monitoring System Reports: The monitoring devices shall comply with the certification and quality assurance, and any other applicable requirements of Rule 62-297.520, F.A.C., 40 CFR 60.13, and 40 CFR 60.75 including certification of each device in accordance with 40 CFR 60, Appendix B, Performance Specifications and 40 CFR 60.7(a)(5). Quality assurance procedures must conform to all applicable sections of 40 CFR 60, Appendix F or 40 CFR75. Data on CEM equipment specifications, manufacturer, type, calibration and maintenance needs, and its proposed location shall be provided to the Department's Southwest District Office (DEPSWD) for review at least 90 days prior to installation.

44. Fuel Oil Monitoring Schedule: The following monitoring schedule for No. 2 fuel oil shall be followed: For all bulk shipments of No. 2 fuel oil received at the C.D. McIntosh , Jr. Power Plant, an analysis which reports the sulfur content and nitrogen content of the fuel shall be provided by the fuel vendor. The analysis shall also specify the methods by which the analyses were conducted and shall comply with the requirements of 40 CFR 60.335(d).

45. Natural Gas Monitoring Schedule: The following custom monitoring schedule for natural gas is approved (pending EPA concurrence) in lieu of the daily sampling requirements of 40 CFR 60.334 (b)(2):

    - Monitoring of natural gas nitrogen content shall not be required.
    - Analysis of the sulfur content of natural gas shall be conducted using one of the EPA-approved ASTM reference methods in Specific Condition No. 32 for the measurement of sulfur in gaseous fuels, or an approved alternative method. Once Unit 5 becomes operational, monitoring of the sulfur content of the natural gas shall be conducted twice monthly for six months. If this monitoring shows little variability in the fuel sulfur

content, and indicates consistent compliance with 40 CFR 60.333, then fuel sulfur monitoring shall be conducted once per quarter for six quarters and after that, semiannually.

- Should any sulfur analysis indicate noncompliance with 40 CFR 60.333, the City shall notify DEP of such excess emissions and the customized fuel monitoring schedule shall be reexamined. The sulfur content of the natural gas will be monitored weekly during the interim period while the monitoring schedule is reexamined.
- The City shall notify DEP of any change in natural gas supply for reexamination of this monitoring schedule. A substantial change in natural gas quality (i.e., sulfur content variation of greater than 1 grain per 100 cubic foot of natural gas) shall be considered as a change in the natural gas supply. Sulfur content of the natural gas will be monitored weekly by the natural gas supplier during the interim period when this monitoring schedule is being reexamined.
- Records of sampling analysis and natural gas supply pertinent to this monitoring schedule shall be retained by the City for a period of five years, and shall be made available for inspection by the appropriate regulatory personnel.
- The City may obtain the sulfur content of the natural gas from the fuel supplier (Florida Gas Transmission) provided the test methods listed in Specific Condition E.4 are used.

46. Determination of Process Variables:

- The permittee shall operate and maintain equipment and/or instruments necessary to determine process variables, such as process weight input or heat input, when such data is needed in conjunction with emissions data to determine the compliance of the emissions unit with applicable emission limiting standards.
- Equipment and/or instruments used to directly or indirectly determine such process variables, including devices such as belt scales, weigh hoppers, flow meters, and tank scales, shall be calibrated and adjusted to indicate the true value of the parameter being measured with sufficient accuracy to allow the applicable

APPENDIX BD
BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)

C. D. McIntosh, Jr. Power Plant
City of Lakeland Electric & Water Utilities
PSD-FL-245 and 11050004-004AC
Lakeland, Polk County, Florida

BACKGROUND

The applicant, The City of Lakeland (City), proposes to install a nominal 250 megawatt (MW) (net) new simple cycle combustion turbine at the existing C.D. McIntosh, Jr. Power Plant located at 3030 East Lake Parker Drive in Lakeland, Polk County. The proposed project will result in "significant increases" with respect to Table 62-212.400-2, Florida Administrative Code (F.A.C.) of emissions of particulate matter (PM and PM_{10}), carbon monoxide (CO), volatile organic compounds (VOC), and nitrogen oxides (NO_X). The project is therefore subject to review for the Prevention of Significant Deterioration (PSD) and a determination of Best Available Control Technology (BACT) in accordance with Rules 62-212.400 and 410, F.A.C.

The unit to be installed is a 230 MW Westinghouse 501 G combustion turbine and includes a once through steam generator (OTSG) which provides steam for steam cooling of critical components and injection for further cooling and power augmentation to 250 MW. Descriptions of the process, project, air quality effects, and rule applicability are given in the Technical Evaluation and Preliminary Determination issued with the Department's Intent to Issue.

DATE OF RECEIPT OF A BACT APPLICATION:

The application was received on December 8, 1997 and included a proposed BACT determination prepared by the applicant's consultant, Golder Associates Inc.

REVIEW GROUP MEMBERS:

A. A. Linero, P.E., and Teresa Heron, Review Engineer

BACT DETERMINATION REQUESTED BY THE APPLICANT:

POLLUTANT	CONTROL TECHNOLOGY	PROPOSED BACT LIMIT
Particulate Matter	Pipeline Natural Gas No. 2 Distillate Oil Use (250 hr/yr) Combustion Controls	9.1 lb/hr (Gas) 140 lb/hr, 0.05% sulfur (Oil)
Volatile Organic Compounds	As Above	4 ppm (Gas) 10 ppm (Oil)
Visibility	As Above	20 percent
Carbon Monoxide	As Above	50 ppm (Gas, baseload) 90 ppm (Oil, baseload)
Nitrogen Oxides	Advanced Dry Low NO_X Burners (Gas) Water Injection (Oil)	25 ppm @ 15% O_2 (Gas, baseload) 42 ppm @ 15% O_2 (Oil, baseload)

The plant, with the proposed controls and limits, will emit approximately 852-863 tons per year (TPY) of NO_X, 761-1,264 TPY of CO, 37-94 TPY of VOC, and 41 TPY of PM/PM_{10}. The basis is 7,008 hours of operation including 250 hours of oil firing and 1050 hours at 50% load.

APPENDIX BD
BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)

BACT DETERMINATION PROCEDURE:

In accordance with Chapter 62-212, F.A.C., this BACT determination is based on the maximum degree of reduction of each pollutant emitted which the Department of Environmental Protection (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:

- Any Environmental Protection Agency determination of BACT 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.
- All scientific, engineering, and technical material and other information available to the Department.
- The emission limiting standards or BACT determination of any other state.
- 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 unit in question, the most stringent control available for a similar or identical emission unit or emission unit category. If it is shown that this level of control is technically or economically unfeasible for the emission unit in question, then 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.

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES:

The minimum basis for a BACT determination is 40 CFR 60, Subpart GG, Standards of Performance for Stationary Gas Turbines (NSPS). Subpart GG was adopted by the Department by reference in Rule 62-204.800, F.A.C. The key emission limits required by Subpart GG are 75 ppm NO_X @ 15% O_2. (assuming 25 percent efficiency) and 150 ppm SO_2 @ 15% O_2.(or <0.8% sulfur in fuel). The BACT proposed by the City is consistent with the NSPS which allows NO_X emissions over 110 ppm for the higher efficiency unit purchased by the City of Lakeland. No National Emission Standard for Hazardous Air Pollutants exists for stationary gas turbines.

DETERMINATIONS BY EPA AND STATES:

Most recent stationary gas turbine BACT determinations made to-date by EPA and the states, including the State of Florida, have been much more stringent than the requirements of the NSPS. The following table is a sample of information on recent BACT and a few Lowest Achievable Emission Rate (LAER) determinations made by EPA and the States for stationary gas turbine projects as large or larger than the one under review. LAER is required in areas where the ambient air (unlike that Florida) does not attain the National Ambient Air Quality Standards (NAAQS).

APPENDIX BD
BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)

Project Location	Power Output and Duty	NOx Limit ppm @ 15% O_2 and Fuel	Technology	Comments
Cataula, GA	1200 MW SC PKR	25 - NG 42 - No. 2 FO	DLN WI	4x300 MW **WH 501G** CTs CTs rated 230 MW @ ISO, NG
CCC, VA	398 MW SC PKR	42/65 - No. 2 FO	WI	3x132.5 MW CTs 2000 (500 @ Peak) hr/yr/CT
PREPA, PR	248 MW SC CON	10 - No. 2 FO	WI & Hot SCR	3x83 MW CTs
Tiger Bay, FL	270 MW CC CON	15/10 - NG 42 - No. 2 FO	DLN &/or SCR WI	184 MW GE MS7001FA CT DLN/15 ppm or SCR/10 ppm
Hines Polk, FL	485 MW CC CON	12 - NG 42 - No. 2 FO	DLN WI	2x165 MW WH 501FC CTs Canceled GE CTs
Tallahassee, FL	260 MW CC CON	12 - NG 42 - No. 2 FO	DLN WI	160 MW GE MS 7231FA CT DLN Guarantee is 9 ppm
Eco-Electrica, PR	461 MW CC CON	7 - NG 9 - LPG, No. 2 FO	DLN & SCR	2x160 MW WH 501F CTs
Sithe/IPP, NY	1012 MW CC CON	4.5 - NG	DLN & SCR	4 x160 MW GE 7FA CTs
Hermiston, OR	474 MW CC CON	4.5 - NG	SCR	2x160 MW GE 7FA CTs
Brooklyn, NY	240 MW CC CON	3.5 - NG (LAER) 10 - No. 2 FO	SCR	2x106 MW Siemens V84.2 CTs
Berkshire, MA	272 MW CC CON	3.5 - NG (LAER) 9.0 - No. 2 FO	DLN & SCR WI & SCR	178 MW ABB GT24 CT

SC = Simple Cycle
CC = Combined Cycle
NG = Natural Gas
CT = Combustion Turbine
CON = Continuous
PKR = Peaking Unit
FO = Fuel Oil
ISO = 59°F
DLN = Dry Low NO_x Combustion
SCR = Selective Catalytic Reduction
LPG = Liquefied Propane Gas
WI = Water or Steam Injection
GE = General Electric
WH = Westinghouse
ABB = Asea Brown Bovari
ppm = parts per million

Factors in Common with City of Lakeland Project are bolded. All determinations are BACT unless denoted as LAER.

Project Location	CO - ppm (or lb/mmBtu)	VOC - ppm (or lb/mmBtu)	PM - lb/mmBtu (or gr/dscf)	Technology and Comments
Cataula, GA	25 - NG @15% O_2 75 - FO@ 15% O_2	0.01 lb/mmBtu	0.005 - NG 0.03 - FO	Clean Fuels Good Combustion
CCC, VA	Not PSD	Not PSD	0.0216 - FO	Clean Fuels Good Combustion
PREPA, PR	9 - FO @15% O_2	11 - FO @15% O_2	0.0171 gr/dscf	Clean Fuels Good Combustion
Tiger Bay, FL	0.045 lb/mmBtu-NG 0.053 lb/mmBtu-FO		0.053 - NG 0.009 - FO	Clean Fuels Good Combustion
Hines Polk, FL	25 - NG 30 - FO	7 - NG 7 - FO	0.006 - NG 0.01 - FO	Clean Fuels Good Combustion
Tallahassee, FL	25 - NG 90 - FO			Clean Fuels Good Combustion
Eco-Electrica, PR	33 - NG/LPG @15% O_2 33 - FO @15% O_2	1.5/2.5 - NG/LPG 6 - FO	0.0053 - NG/LPG 0.0390 - FO	Clean Fuels Good Combustion
Sithe/IPP, NY	13 - NG			Clean Fuels Good Combustion
Hermiston, OR	15 - NG			Clean Fuels Good Combustion
Brooklyn, NY	4 - NG (Avoid LAER) 5 - FO (Avoid LAER)	3.5 - NG 10 - FO		Clean Fuels CO Catalyst
Berkshire, MA	4 - NG (LAER) 5 - FO (LAER)	4 - NG 16 - FO	0.0105 - NG 0.0468 - FO	Clean Fuels CO Catalyst

OTHER INFORMATION AVAILABLE TO THE DEPARTMENT:

Besides the information submitted by the applicant and that mentioned above, other information available to the Department consists of:

- Comments from the National Park Service dated January 6 and 12, April 2 and 15, 1998
- Letters from EPA Region IV dated February 10 and March 6, 1998
- Decisions by the Environmental Appeals Board
- Papers and letters written by Westinghouse on the development of the 501 G combustion turbine and nitrogen oxides control technologies
- DOE website information on Advanced Turbine Systems Project
- Mitsubishi website
- City of Lakeland Website, City Commission Meeting Minutes
- Alternative Control Techniques Document - NO_X Emissions from Stationary Gas Turbines
- General Electric 39th Turbine State-of-the-Art Technology Seminar Proceedings

REVIEW OF NITROGEN OXIDES CONTROL TECHNOLOGIES:

Much of the discussion in this section is based on a 1993 EPA document on Alternative Control Techniques for NO_X Emissions from Stationary Gas Turbines. Project-specific information is included where applicable.

Nitrogen Oxides Formation

Nitrogen oxides form in the gas turbine combustion process as a result of the dissociation of molecular nitrogen and oxygen to their atomic forms and subsequent recombination into seven different oxides of nitrogen. Thermal NO_X forms in the high temperature area of the gas turbine combustor. Thermal NO_X increases exponentially with increases in flame temperature and linearly with increases in residence time. Flame temperature is dependent upon the ratio of fuel burned in a flame to the amount of fuel that consumes all of the available oxygen.

By maintaining a low fuel ratio (lean combustion), the flame temperature will be lower, thus reducing the potential for NO_X formation. Prompt NO_X is formed in the proximity of the flame front as intermediate combustion products. The contribution of Prompt to overall NO_X is relatively small in lean, near-stoichiometric combustors and increases for leaner fuel mixtures. This provides a practical limit for NO_X control by lean combustion.

Fuel NO_X is formed when fuels containing bound nitrogen are burned. This phenomenon is not important when combusting natural gas. It is not important for the Lakeland project because natural gas will be the primary fuel and low sulfur fuel oil will be used only for 250 hours per year.

Uncontrolled emissions range from about 100 to over 600 parts per million by volume, dry, corrected to 15 percent oxygen (ppm @15% O_2). For large modern turbines, the Department estimates uncontrolled emissions at approximately 200 ppm @15% O_2.

NO_X Control Techniques

Wet Injection

Injection of either water or steam directly into the combustor lowers the flame temperature and thereby reduces thermal NO_X formation. Typical emissions achieved by wet injection are about 25 ppm when firing gas and 42 ppm when firing fuel oil in large combustion turbines. These values often form the basis for further reduction to BACT limits by other techniques. Carbon monoxide (CO) and hydrocarbon (HC) emissions are relatively low for most gas turbines. However steam and (more so) water injection increase emissions of both of these pollutants.

Combustion Controls

The excess air in lean combustion, cools the flame and reduces the rate of thermal NO_X formation. Lean premixing of fuel and air prior to combustion can further reduce NO_X emissions. This is accomplished by minimizing localized fuel-rich pockets (and high temperatures) that can occur when trying to achieve lean mixing within the combustion zones.

The above principle is depicted in Figure 1 for a can-annular combustor operating on gas. For ignition, warm-up, and acceleration to approximately 20 percent load, the first stage serves as the complete combustor. Flame is present only in the first stage, which is operated as lean stable combustion will permit. With increasing load, fuel is introduced into the secondary stage, and combustion takes place in both stages. When the load reaches approximately 40 percent, fuel is cut off to the first stage and the flame in this stage is extinguished. The venturi ensures the flame in the second stage cannot propagate upstream to the first stage. When the fuel in the first-stage flame is extinguished (as verified by internal flame detectors), fuel is again introduced into the first stage, which becomes a premixing zone to deliver a lean, unburned, uniform mixture to the second stage. The second stage acts as the complete combustor in this configuration.

Combustors used in Westinghouse products are shown in Figure 2. These operate according to the same principles as described above. However they have different characteristics and do not reach the so-called fully pre-mixed operation until the load is over 50 percent.

In all but the most recent gas turbine combustor designs, the high temperature combustion gases are cooled to an acceptable temperature with dilution air prior to entering the turbine (expansion) section. The sooner this cooling occurs, the lower the thermal NO_X formation. Cooling is also required to protect the first stage nozzle. When this is accomplished by air cooling, the air is injected into the component and is ejected into the combustion gas stream, causing a further drop in combustion gas temperature. This, in turn, results in a lower achievable thermal efficiency for the unit.

By using steam in a closed loop system, the fluid is circulated through the internal portion of the nozzle component or around the transition piece between the combustor the nozzle and does not enter the exhaust stream. Instead it is normally sent back to the steam generator. The difference between flame temperature and firing temperature into the first stage is minimized and higher thermal efficiency is achieved.

Another important result of steam cooling is that a higher firing temperature can be attained with no increase in flame temperature. Flame temperatures and NO_X emissions can therefore be maintained at comparatively low levels even at high firing temperatures. At the same time, thermal efficiency should be greater when employing steam cooling. A similar analysis applies to steam cooling around the transition piece between the combustor and first stage nozzle.

The relationship between flame temperature, firing temperature, unit efficiency, and NO_X formation can be appreciated from Figure 3 which is from a General Electric discussion on these principles. In addition to employing pre-mixing and steam cooling, further reductions are accomplished through design optimization of the burners, testing, further evaluation, etc.

At the present time, emissions achieved by combustion controls are low as 9 ppm (and even lower) from gas turbines smaller than about 200 MW (simple cycle). Initial guarantees of 25 ppm by combustion controls are proposed for turbines larger than larger than 200 MW. The guaranteed values are expected to be reduced for the reasons given above. As in the case of wet injection, higher CO and hydrocarbon emissions can occur as a result of employing combustion controls to minimize NO_X.

Selective Catalytic Combustion

Selective catalytic reduction (SCR) is an add-on NO_X control technique that is placed in the exhaust stream following the gas turbine. SCR reduces NO_X emissions by injecting ammonia into the flue gas. As of early 1992, over 100 gas turbine installations already used SCR in the United States. No combustion turbines in Florida employ SCR. Virtually all SCR units are used in combination with wet injection or combustion controls.

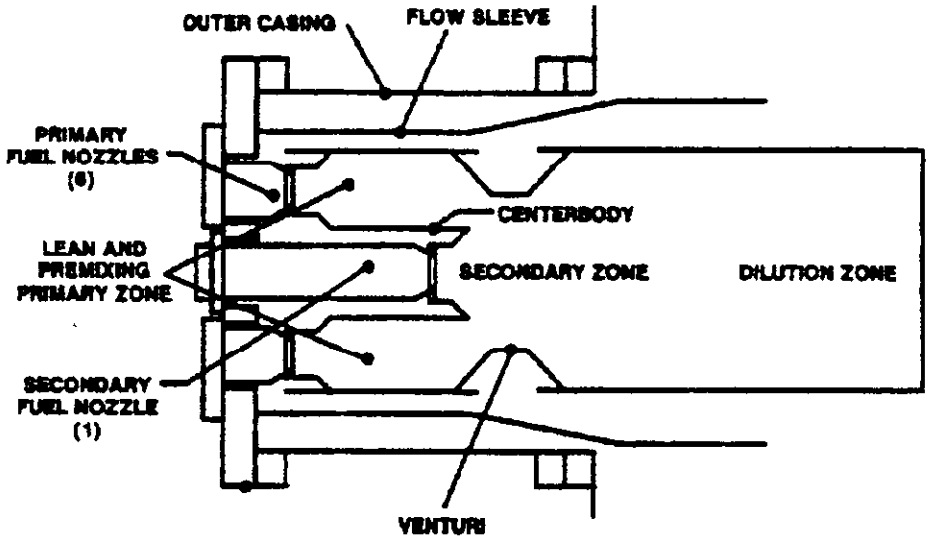
Ammonia reacts with NO_X in the presence of a catalyst and excess oxygen yielding molecular nitrogen and water. The catalyst used in combined cycle, low temperature applications (conventional SCR), is usually vanadium or titanium oxide and accounts for almost all installations. For high temperature applications (Hot SCR up to 1100 ^{o}F), such as simple cycle turbines, zeolite catalysts are available but used in few applications to-date.

In the past, sulfur was found to poison the catalyst material. Sulfur-resistant catalyst materials are now available, however, and catalyst formulation improvements have proven effective in resisting performance degradation with fuel oil in Europe and Japan, where conventional SCR catalyst life in excess of 4 to 6 years has been achieved, versus 8 to 10 years with natural gas.

In a manner analogous to balancing control of NO_X from the combustor with emissions of CO and hydrocarbon, similar balancing is required when controlling NO_X by SCR. Excessive ammonia use tends to increase emissions of CO, ammonia (slip), and particulate matter (when sulfur bearing fuels are used). Permit limits as low as 3.5 ppm NO_X have been specified for certain conventional SCR applications in ozone non-attainment areas.

REVIEW OF PARTICULATE MATTER (PM/PM_{10}) CONTROL TECHNOLOGIES:

Particulate matter is generated by various physical and chemical processes during combustion and will be affected by the design and operation of the NO_X controls. The particulate matter emitted from this unit will mainly be less than 10 microns in diameter (PM_{10}).



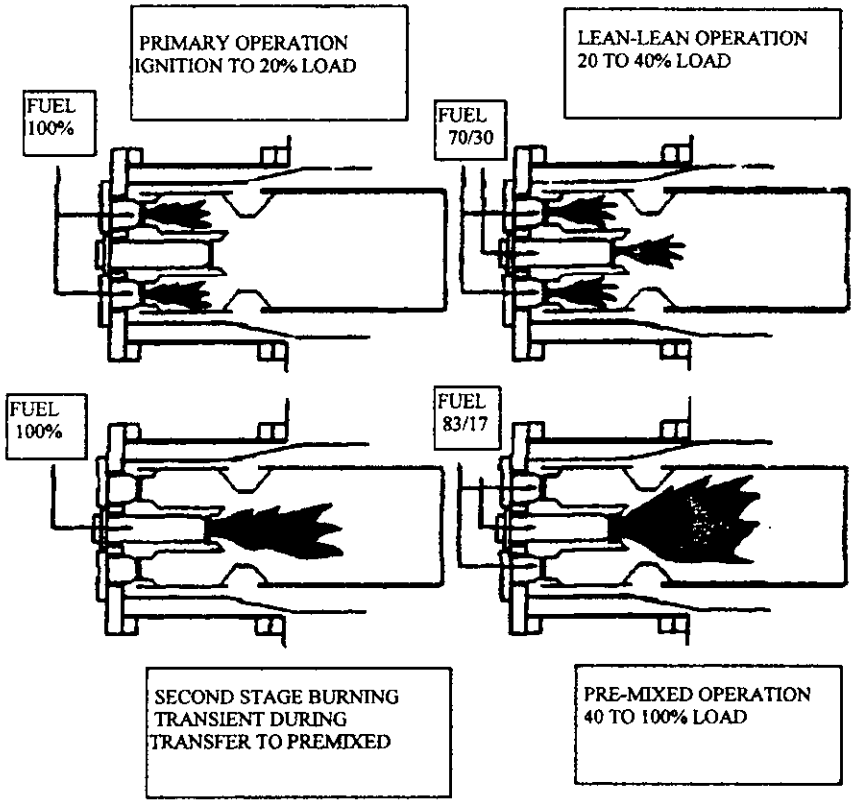
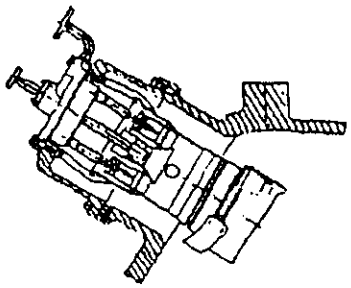


Figure 1 - Cross Sections of a Lean Premixed Can-annular Combustor



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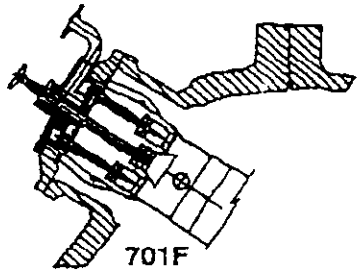

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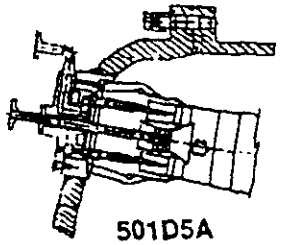

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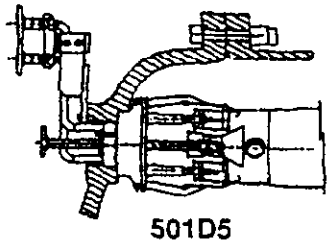

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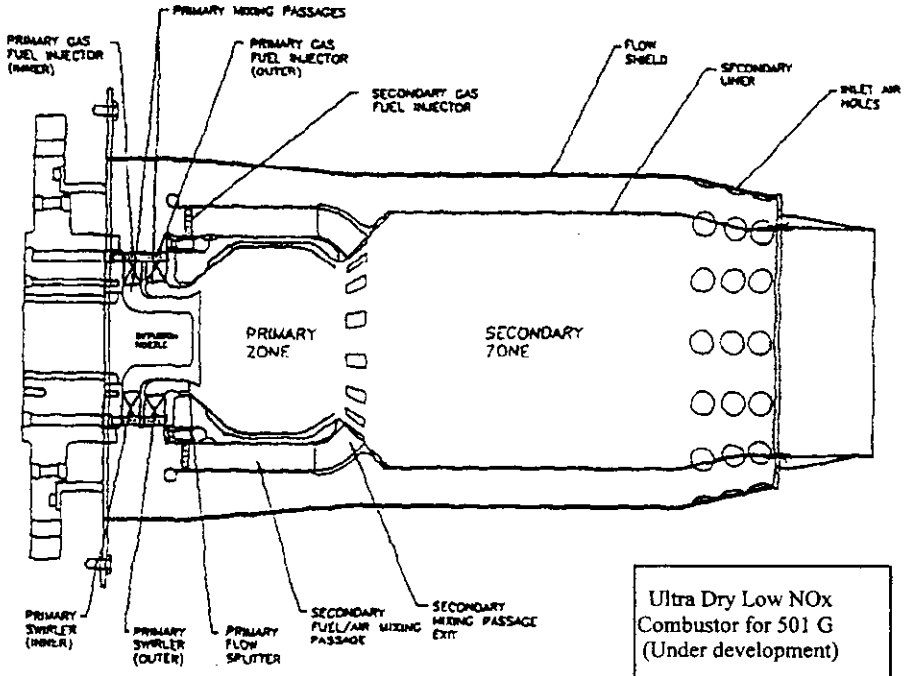

Ultra Dry Low NOx Combustor for 501 G (Under development)

Figure 2 - Westinghouse Dry Low NOx Combustors

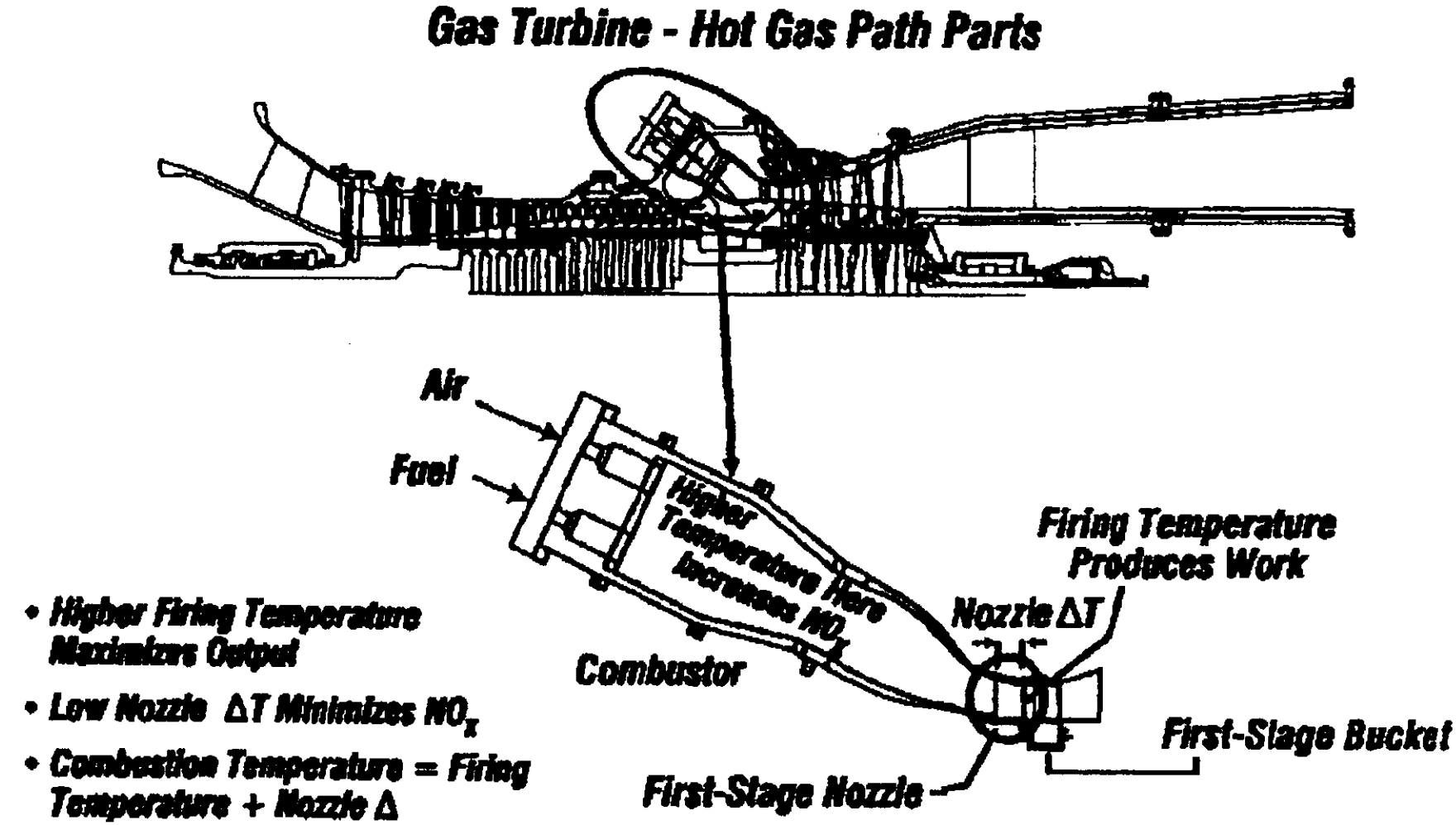

Figure 3. Relationship — combustion temperature to firing temperature

Natural gas and 0.05 percent sulfur No 2. fuel oil will be the only fuels fired and are efficiently combusted in gas turbines. Such fuels are necessary to avoid damaging turbine blades and other components already exposed to very high temperature and pressure. Natural gas is an inherently clean fuel and contains no ash. The fuel oil to be combusted contains a minimal amount of ash and will be used for only 250 hours per year making any conceivable add-on control technique for PM/PM_{10} either unnecessary or impractical.

A technology review indicated that the top control option for PM_{10} is a combination of good combustion practices, fuel quality, and filtration of inlet air. The City indicated that the PM_{10} emissions will not exceed 0.01 gr/scf when firing natural gas and pointed out that such a value is equal to a typical specification for baghouse design. Annual emissions of PM_{10} are expected to be approximately 30 tons for natural gas and less than 15 tons for fuel oil.

REVIEW OF CARBON MONOXIDE(CO) CONTROL TECHNOLOGIES

CO is emitted from combustion turbines due to incomplete fuel combustion. Combustion design and catalytic oxidation are the control alternatives that are viable for the project. The most stringent control technology for CO emissions is the use of an oxidation catalyst.

Most installation using catalytic oxidation are located in the Northeast. Besides the Berkshire and Brooklyn installation listed above, CO oxidation catalyst has been installed at the 240 MW Masspower facility, the 165 MW Pittsfield Generating Plant in Massachusetts, and the 345 MW Selkirk Generating Plant in New York. Catalytic oxidation was recently installed at a cogeneration plant at Reedy Creek (Walt Disney World), Florida to avoid PSD review which would have been required due to increased operation at low load.

Most combustion turbines incorporate good combustion to minimize emissions of CO. These installations typically achieve emissions between 10 and 30 at full load, even as they achieve relatively low NO_X emissions by SCR or dry low NO_X means. By comparison, the values of 50 and 90 ppm for gas and oil respectively at baseload proposed in the City's application appear high.

REVIEW OF VOLATILE ORGANIC COMPOUND (VOC) CONTROL TECHNOLOGIES

Volatile organic compound (VOC) emissions, like CO emissions, are formed due to incomplete combustion of fuel. There are no viable add-on control techniques as the combustion turbine itself is very efficient at destroying VOC. The limits proposed for this project are 4 and 10 ppm for gas and oil firing respectively.

BACKGROUND ON SELECTED GAS TURBINE

The City has already committed to the purchase of a 230 MW Westinghouse 501 G simple cycle gas turbine.[1] The unit was already under construction by Westinghouse and awaiting sale. The contract for the unit includes NO_X emission guarantees of 25 ppm on gas and 42 ppm on fuel oil.

The choice satisfies the City's immediate power needs and reserve capacity. If it is ultimately converted to combined cycle operation, the power generating capacity will be about 350 MW.[2] In the meantime the City is considering a Department of Energy (DOE) Pressurized Circulating Fluidized Bed Project while "re-evaluating the (electric utility) regulatory climate."[1, 3]

The 501 G was jointly developed and is manufactured by both Westinghouse and Mitsubishi Heavy Industries (MHI). The first 501 G started operation in April of 1997 in Japan at the MHI Takasago Machinery Works 330 MW Demonstrator Combined Cycle Plant. The unit has the "highest firing temperature (1500 °C, 2732 °F) ever recorded, and a combined cycle efficiency of over 58 percent."[4] The efficiency is also the highest ever demonstrated for combined cycle turbine. NO_X emissions are reportedly controlled a selective catalytic reduction (SCR) system located within the heat recovery steam generator (HRSG).

The first commercial operation (i.e. not within MHI subsidiaries) of a "1500 °C" combined cycle unit will begin trial operation at the Tohoku Electric Higashui Niigata Power Plant in October, 1998.[5] The specific unit will be the "701 G," which is a larger, 50 Hertz version of the 501 G. Commercial operation will begin in July, 1999 or soon after the time that Westinghouse and the City plan to start up the first commercial 501 G in the United States.

Westinghouse, MHI and General Electric continue to work on even larger and more efficient turbines. Westinghouse has already tested the compressor for its planned "H" Class turbine capable of achieving 60 percent efficiency while operating in combined cycle mode.[6] General Electric does not have an entry in the "G" class. However it is conducting trials in Greenville, South Carolina on the MS9001H, which is its 50 Hertz entry into the H Class. GE expects a combined cycle efficiency of 60 percent and generation of over 400 MW. GE plans to make its similar 60 Hertz MS7001H version available in 2001 or 2002.[7]

Westinghouse and General Electric are counting on further advancement and refinement of DLN technology to provide sufficient NO_X control for their turbines. In the case of the 501 G, steam cooling of the transition piece allows the unit the maintain the same NO_X formation potential as the 501 F while achieving a higher turbine inlet (firing) temperature. Examples of Westinghouse combustors are shown in Figure 2. These include their second generation of Dry Low NO_X combustors (Advanced DLN) and their fully pre-mixed Piloted Ring Combustor (Ultra LN).[8] Where required by BACT or LAER determinations of certain states, both companies incorporate SCR in combined cycle projects.[9,10]

The approach of progressively refining such technology is a proven one, even on some relatively large units. Basically this was the strategy adopted in Florida throughout the 1990's. Recently GE Frame 7 FA units (160 MW gas turbines with firing temperatures of 2400) met performance guarantees of 9 ppm with "DLN-2.6" burners at Fort St. Vrain, CO and Clark County, WA.[11] Westinghouse will conduct two phases of testing in 1998 to refine the Ultra Low NO_X technology for its "F" Class to meet a NO_X level of 9-12 ppm by about early to mid-2000.[12] The Department is working with Westinghouse and utilities to try to accelerate the testing program to achieve these values sooner so that the developments can be incorporated as applicable to the 501 G.

Both Westinghouse and General Electric are partners with the Department of Energy (DOE) in the Advanced Turbine Systems (ATS) Program.[13] The Mission/Vision Statement of ATS is to "develop base-load advanced turbine systems for commercial offering in the year 2000." Among the goals of the Program are 60 percent combined cycle efficiency while achieving NO_X emissions of 9 ppm or less.[14] The cost of producing the prototypes is estimated at $435,000,000 and $300,000,000 for the GE and Westinghouse projects respectively.[15] The goals of the ATS are reflected in the "H" Class units described above.

In simple cycle, continuous duty mode, the Westinghouse 501 G achieves an admirable efficiency of approximately 38 percent.[16] However this efficiency is much lower than what can be realized with the same unit (58 percent) when operating in combined cycle.[17] For that reason the Department believes it is or will become economically feasible for the City to convert the unit to combined cycle mode after the status of the Lakeland/DOE project and the electrical regulatory climate become clearer.

The 25 ppm initial NO_X guarantee on natural gas appears high when compared with BACT determinations for continuous-duty or combined cycle units, such as those previously listed. It is also higher than the stated goal of the ATS Program. The simple cycle mode with the flexibility of switching (or not switching) to combined cycle operation, presents constraints in evaluating the feasibility and costs of various emission reduction options otherwise available. For this reason, the Department does not constrain itself to any presumed historical cost-effectiveness criteria or cost estimating procedures such as might apply to a project with a clearly defined staging schedule and final configuration. At the same time, however, the Department has a full appreciation of the goals of the ATS Program and does not want to arbitrarily impede progress toward its goals.

Westinghouse provided a technology update of the Westinghouse family of combustion turbines. It includes a schedule for the 501 G to reach low NO_X levels of 9-12 by Ultra Low NO_X. The structure of the schedule is similar to that described for their 501 F class unit. According to Westinghouse, the experience gained from the 501 F will be employed in development of Ultra LN for the 501 G. Basic design and laboratory testing Ultra LN combustors for the 501 G is already underway. Initial field verification will be conducted beginning in mid-1999. Design modification and retesting will occur from mid-1999 through mid 2000. Additional design changes/tests will be carried out from mid-2000. Full commercial application will be implemented from 2001 through 2004.[8]

Westinghouse provided the City with a more specific schedule for the 501 G to be installed at Lakeland.[18] Westinghouse "fully anticipates having a combustion system available that meets the 9-12 NO_X requirement for the McIntosh No. 5 Unit within the next four years." That will occur in early 2002 and is within the general schedule given above. According to the same document, "since McIntosh Unit No. 5 is the demonstration project for the 501 G, there is a high probability that some field verification testing will be performed on the unit."

The proximity of Westinghouse technical staff in Orlando to the project site in Lakeland should enhance the probability of meeting Westinghouse's goal at an early date.

DEPARTMENT BACT DETERMINATION

Following are the BACT limits determined for the Lakeland project. Values for NO_X are corrected to 15% O_2.

Operational Mode	NO_X (ppm)	CO (ppm)	VOC (ppm)	PM/Visibility (% Opacity)	Technology and Comments
250 MW SC CON	25 - NG 42 - FO	25 - NG or 10 by Ox Cat 90 - FO	4 - NG 10 - FO	10	Adv. DLN on gas, WI on oil. Applies first 36 months after startup. Clean fuels, good combustion
250 MW SC CON	9 - NG 12 - (30 day) 42 - FO	25 - NG or 10 by Ox Cat 90 - FO	4 - NG 10 - FO	10	ULN on gas, WI on oil. Applies after 36 months operation. Clean fuels, good combustion
250 MW SC CON	9 - NG 15 - FO	25 - NG or 10 by Ox Cat 90 - FO	4 - NG 10 - FO	10	Hot SCR. Applies after 36 months if 9 ppm NO_X not achievable by ULN. Clean fuels, good combustion.
350 MW CC CON	7.5 - NG 15 - FO	25 - NG or 10 by Ox Cat 90 - FO	4 - NG 10 - FO	10	Conventional SCR if converted to combined cycle, unless 9 ppm is attained by ULN or Hot SCR as described above. Clean fuels, good combustion

RATIONALE FOR DEPARTMENT'S DETERMINATION

- The initial 25 and 42 ppm NO_X limits are guaranteed by Westinghouse and the Department has reasonable assurance that these can be met.
- There is a clear plan for achieving emissions of 9-12 ppm at the Lakeland location within 4 years of April, 1998. This will occur in early 2002 - about 3 years after an early-1999 startup.
- The unit will be operated in simple cycle mode while maintaining the flexibility to expand at a future date to combined cycle operation through the addition of a 100 MW heat recovery steam generator. Therefore control options which are feasible for combined cycle units are not immediately applicable at commencement of operation. At project inception, this rules out Low Temperature (conventional) SCR which achieves a 4.5 ppm NO_X BACT limit at the Hermiston and Sithe/IPP projects above.
- The turbine has a very high exhaust temperature of about 1100 °F.[16] This is at the higher limit of the present operational temperature of Hot SCR zeolite catalyst.[19] Therefore the catalyst would have to placed *after* the OTSG. The PREPA simple cycle turbines have exhaust temperatures ranging from 824 to 1024 °F and the Hot SCR catalyst (which must achieve 10 ppm NO_X) is located *between* the turbine and the OTSG.[20]
- Hot SCR is technically feasible for gas.[21] The same evaluation states that the technology has not been demonstrated for oil. However the PREPA units have since been installed.[22] These operate solely on 0.15 percent sulfur fuel oil.[23] The Lakeland unit is proposed to operate only 250 hours per year on fuel oil of 0.05 percent sulfur.

- The levelized costs of NO_X removal by Hot SCR were estimated by the City as $5,236 per ton of NO_X removed. Other Hot and conventional SCR cost estimates submitted by the applicant are not considered in this evaluation because they are based on many conditional assumptions regarding possible ultimate project phasing scenarios which are not typically encountered when applying the methodology used by the applicant. Also the cost estimates do not consider a continuation of the actual downward trend in catalyst prices, progressively improving performance, and typically longer-than-expected life.
- The levelized costs derived in the application for Hot SCR at Lakeland are based on a quote from Engelhard. The vendor based the proposal on design operation on fuel oil with guaranteed NO_X reduction of 70 percent to 12.6 ppm @15% O_2.[24]
- In order to avoid allowing control on fuel oil to become the main design consideration, the Department obtained a budgetary estimate from Engelhard to guarantee reduction of NO_X emissions while operating on gas by 64 percent (from 25 to 9 ppm).[25] The replacement cost of the Hot SCR catalyst designed for gas is $1,600,000 versus the $2,800,000 estimated for the Lakeland project designed for oil. During the very few hours of operation on oil, estimated NO_X emissions from the 501 G controlled by Hot SCR will be approximately 13 ppm @15% O_2.
- The cost effectiveness for NO_X removal given for the PREPA simple cycle project is $2,200 per ton. The main reason for the relatively low levelized cost is that total costs are applied over a reduction of 40 ppm whereas the reduction in the Lakeland case is over a smaller reduction. The cost per ton of NO_X removed by Hot SCR at the PREPA project can be rescaled for the Lakeland project. This would involve a significant increase due lower removal. However there would be decreases due to the natural gas design, application on one large unit versus three smaller ones, and lower ammonia requirements. The resulting costs would be less than $4,000 per ton.
- A cost estimate for Hot SCR was given by U.S. Generating in the BACT application for the planned Cataula peaking project where identical 501 G units have been permitted but not installed. In fact, U.S. Generating, Cataula is the alternative commercial demonstration site for the specific unit that Lakeland has contracted to purchase. According to U.S. Generating, "because the turbines will operate intermittently throughout the year, the cost of add-on SCR technology per ton of NO_X removed are very high and are outside of acceptable costs. Total annual removal cost of SCR technology was estimated to be $4,114 per ton of NO_X removed." This means that continuous duty operation should yield levelized costs less than $4,000 per ton for a 501 G unit.
- The Department does not necessarily accept the comments about what is considered unacceptable costs by U.S. Generating for the Cataula 501 G project. However, the Department is aware that U.S. Generating has a great deal of experience in implementing SCR NO_X technology. Projects include the first coal-fired plants in the country with SCR and the only one in Florida. Also U.S. Generating built many of the low emitting combined cycle plants. The Department, therefore, has some confidence in the $4,114 per ton estimate for intermittent (essentially peaking) operation of a 501 G.

- Using much of the basic capital cost information developed by Lakeland, The National Park Service estimated the cost of NO_X removal by Hot SCR at $3,802 per ton (excluding the energy penalty) for the continuous duty 501 G. A further refinement of the Park Service estimate by including the energy penalty, using the revised catalyst cost data, and assuming a five year estimated life for the catalyst would yield a cost-effectiveness closer to $3,500 per ton of NO_X removed.
- The Department concludes that Hot SCR is both technically and economically feasible now. The probability of success using this technology is at least as high as it is using the Ultra LN technology under development.
- According to Westinghouse, a heat exchange surface is required between the turbine and Hot SCR catalyst to insure an operational temperature less than 1100 °F is maintained. If a future HRSG is installed, Westinghouse indicates that the OTSG (which provides the steam for cooling and power augmentation) will be removed. This would expose the Hot SCR system (if installed) to unacceptable temperatures. Westinghouse does not believe relocation of catalyst to the HRSG is feasible and thus the Hot SCR system would be written off and possibly replaced by a conventional SCR system in the HRSG.
- The Department notes that a future conversion to combined cycle operation has not actually been proposed and details of possible configurations are not available to the Department for evaluation. Therefore the Department does not concur that Hot SCR is not feasible based on conceivable future development scenarios.
- According to Westinghouse, the ultimate design of their ATS-based gas turbine has options for "recuperative cycles" working within combined cycles. These cycles ultimately lower the gas temperature entering the steam cycle and appear to provide heat exchange surface to cool the gases and protect the Hot SCR system before the HRSG.
- There are various kinds of recuperative cycles - some of which make the combined cycle less efficient and others that which make it more efficient. According to a paper heralding the arrival of the 501 G, the author writes that "what is more significant is that the 501 G has been designed to incorporate the technology advances planned in the ATS program, such as intercooling and reheat, humidification and *chemical recuperation*, as and when they are good and ready."[2]
- The Department is not aware of actual plans to incorporate recuperation cycles in Westinghouse 501 products, the likely combined cycle efficiency benefits (or penalties), or their applicability to the Lakeland project by the time of conversion to combined cycle operation. The point is that ultimate wasting of Hot SCR equipment installed at startup, is not a foregone conclusion considering that many developments can occur within the time horizon of possible future project expansion scenarios.
- It is possible, and even likely, that Hot SCR catalysts will be improved (similar to refinement of Ultra LN) and can be used to replace the initial catalyst as it degrades. By the time the OTSG is removed for combined cycle conversion (e.g. 5 years), replacement catalyst might be able to withstand the higher temperature regime.

- Hot SCR has environmental and energy impacts including increased particulate emissions, undesirable (though unregulated) ammonia emissions, and energy penalties. All factors being equal, Ultra LN is a better control strategy than Hot SCR. A three year period to refine this technology to achieve similar emissions as Hot SCR is reasonable and not unprecedented.
- The Department does not conclude at this time that achieving 9-12 ppm of NO_X in three years by Ultra LN is an overall better strategy than immediately achieving 4.5 - 7.5 ppm by conventional SCR in a combined cycle unit. However, if the 9-12 ppm value can be achieved by ULN within the three years, subsequent installation of conventional SCR during a conversion to combined cycle will probably not be cost-effective.
- Three years is equal to the longest period of time provided to any previous applicant to achieve Department BACT limits by DLN technologies. With the accumulated knowledge and experience from DLN technologies for smaller units, it should be possible to achieve the Department's BACT limit for this project within three years after startup.
- The approach promotes further progress of the DOE ATS Program and falls within the realm of BACT determinations made by the Department in recent years.
- The Hot SCR scenario has, nevertheless, been included in the Department's determination for implementation in case that the Ultra LN strategy fails to reach the objectives within a reasonable period of time. If the City converts the unit to combined cycle mode in the near future, conventional SCR (with the catalyst in a low temperature regime within a HRSG) becomes immediately feasible, particularly if progress is slow on Ultra LN. Conventional SCR now rather than Ultra LN in three years, would be BACT at this time if the City planned to operate the unit in combined cycle mode at startup.
- BACT for PM_{10} was determined to be good combustion practices consisting of: inlet air filtering; use of clean, low ash, low sulfur fuels; and operation of the unit in accordance with the manufacturer-provided manuals.
- PM_{10} emissions will be very low and difficult to measure at the high temperature exiting the stack in simple cycle operation. Additionally, the higher emission mode will involve fuel oil firing which will occur only 250 hours per year. It is not practical to require running the turbine on oil, simply to conduct tests. Therefore, the Department will set a Visible Emission standard of 10 percent opacity as BACT for both natural gas and fuel oil firing, consistent with the definition of BACT. Examples of installations with similar VE limits include the City of Tallahassee, Florida and the Berkshire, Massachusetts projects in the above table.
- CO emission estimates from the City's project are higher than for any pollutant. However the impact on ambient air quality is lower compared to other pollutants because the allowable concentrations of CO are much greater than for NO_X, SO_2, or PM_{10}.
- The City evaluated the use of an oxidation catalyst designed for 90 percent reduction and having a two year catalyst life. The oxidation catalyst control system was estimated by the City to increase the total capital cost of the project by "about $2,000,000, with an annualized cost of $980,000 per year." The City estimated levelized costs for CO catalyst control at about $800 per ton to control CO emission to 10 ppm.

- The estimate of about $800 per ton for the Lakeland 501 G operating as a continuous duty unit is comparable to the $1,305 value calculated for identical 501 G units operating in intermittent (essentially peaking) mode at the Cataula, Georgia project. Cataula is a U.S. Generating project. This company operates three of the previously-mentioned facilities where CO catalyst is used. Catalytic CO control appears to be cost-effective for the Lakeland unit..
- In the 501 G Application Overview prepared by Westinghouse and included in the City's application for permit, the combustors have "initial emission levels less than the following:"[16]

Pollutant (ppm)	Natural Gas (no injection)	Distillate Oil (water injection)
Nitrogen Oxides	25	42
Carbon Monoxide	10	90
Unburned Hydrocarbons	5	20

- In an article included in the permit application, the author states "NO_X levels of less than 25 ppm on natural gas, less than 42 ppm on oil, while maintaining CO at less than 10 ppm will be specified for introductory machines."[2] The simultaneous initial CO and NO_X objectives are consistent with measured results for GE tests involving similar levels of DLN technology.[26]
- Westinghouse tables of "expected performance" in the permit application for the specific unit, however, estimate CO emissions while burning natural gas as 50, 100, and 350 ppm when operating at baseload, 75% load, and 50% load respectively. While operating on oil the estimated values are 90, 125, and 350 ppm at baseload, 75%, and 50% respectively.
- The permit application states that the high emission limits are "a result of uncertainty associated with maintaining low NO_X emissions while keeping emissions of CO as low as possible over the load range of the machine." It also mentions that the Westinghouse Application Overview estimate is 10 ppm for CO and accordingly calculates a much higher alternative cost per ton of removal based on the lower expected starting point prior for catalytic oxidation.
- The Department will set CO limits achievable by good combustion equal to those set for the City of Tallahassee project of 25 ppm on gas and 90 ppm on oil. For reference, the FPC Hines 501 F project is limited to 25 ppm on natural gas and 30 ppm on oil. The Hines project will incorporate the same ULN technology that the City of Lakeland plans to use on the 501 G.
- At the relatively high initial NO_X emission rate of 25 ppm, there should not be technical difficulties in achieving 25 ppm of CO with Advanced Dry Low NO_X technology. These values remain as appropriate objectives to meet with the Ultra Low NO_X technology under development. The oil case is relatively insignificant because of the limited firing time.
- It is up to the City to evaluate whether to meet the CO limits by combustion optimization or alternative lower limits achievable by catalytic oxidation. A plan describing how the limits will be met should be submitted prior to issuance of the final permit.
- VOC emission limits proposed by the City are at the lower end of values determined as BACT. Good Combustion is sufficient to achieve these low levels.

COMPLIANCE PROCEDURES

Pollutant	Compliance Procedure
Visible Emissions	Method 9 (initial tests only)
Volatile Organic Compounds	Method 18, 25, or 25A (initial tests only)
Carbon Monoxide	Annual Method 10 (can use RATA if at capacity)
NO_X (30 day rolling averages)	Calculate Daily from NO_X CEMS and O_2 or CO_2 diluent monitor
NO_X (short-term)	Method 20 (Initial tests only for Subpart GG and short-term BACT)

DETAILS OF THE ANALYSIS MAY BE OBTAINED BY CONTACTING:

A. A. Linero, P.E. Administrator, New Source Review Section
Teresa Heron, Review Engineer, New Source Review Section
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:

Approved By:

Howard L. Rhodes, Director
Division of Air Resources Management

Date:

REFERENCES

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[20] SBE Environmental Company. PSD Application, Puerto Rico Electric Power Authority Proposed 248 MW Combustion Turbine Facility, Cambalache, Puerto Rico. January, 1994.
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APPENDIX GC
GENERAL PERMIT CONDITIONS [F.A.C. 62-4.160]

G.1 The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

G.2 This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings or exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

G.3 As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey and vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

G.4 This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

G.5 This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

G.6 The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

G.7 The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

a) Have access to and copy and records that must be kept under the conditions of the permit;
b) Inspect the facility, equipment, practices, or operations regulated or required under this permit, and,
c) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

G.8 If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

a) A description of and cause of non-compliance; and
b) The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

G.9 In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extend it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

G.10 The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

G.11 This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 62-4.120 and 62-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

G.12 This permit or a copy thereof shall be kept at the work site of the permitted activity.

G.13 This permit also constitutes:

a) Determination of Best Available Control Technology (X)
b) Determination of Prevention of Significant Deterioration (X); and
c) Compliance with New Source Performance Standards (X).

G.14 The permittee shall comply with the following:

a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application or this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c) Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;
2. The person responsible for performing the sampling or measurements;
3. The dates analyses were performed;
4. The person responsible for performing the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

G.15 When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

Memorandum

Florida Department of Environmental Protection

TO: Clair Fancy

FROM: A. A. Linero 4/22

DATE: April 22, 1998

SUBJECT: City of Lakeland McIntosh Unit No. 5
250 MW Gas Turbine (PSD-FL-245)

Attached is the draft final permit package for construction of a 250 MW Westinghouse 501 G simple cycle gas-fired combustion turbine at the City of Lakeland's McIntosh Power Plant. The project includes a once-through steam generator to provide steam for cooling key turbine components and for power augmentation to reach the 250 MW level. A 1.05 million gallon storage tank will be constructed for the back-up distillate fuel that will be used for no more than 250 hours per year.

The unit is the largest and most efficient turbine sold commercially for 60 Hertz utilities. It operates at a relatively high flame temperature and a very high turbine inlet temperature. Initially the unit will be delivered with the Westinghouse Advanced Dry Low NO_X combustors guaranteed to achieve NO_X limits of 25 ppm on natural gas. Westinghouse has provided an aggressive schedule to design, test, and implement the Piloted Ring Combustor Ultra Low NO_X (ULN) technology so that emission limits from 9-12 ppm can be met four years from now at the Lakeland site. This is somewhat less than three years from start-up. The location of the Westinghouse combustion experts in Orlando and the installation and refinement of virtually identical ULN technology on the new Westinghouse 501 FC's at the FPC Hines Power Plant this year will maximize the chances of success at Lakeland.

If the technology fails to achieve the requirements, the City must install Hot SCR to meet a 9 ppm limit. If the unit is converted to combined cycle operation and achievement of 9 ppm by ULN or Hot SCR is not in-sight, conventional SCR to meet a 6 ppm value will be required. If the unit achieves the 9 ppm value as scheduled, they do not have to take a lower limit if and when they convert to combined cycle operation.

Although the applicant rejects Hot SCR as not cost effective, we consider it to be cost-effective. We estimate the costs at about $3,500 per ton of NO_X removed. However we consider ULN to be superior because it is simpler, less expensive, avoids handling of additional materials such as ammonia and catalyst, and will achieve comparable emission reductions within a reasonable period of time. The claimed limitations on Hot SCR can be overcome if the City must resort to it in three years. I have just as much assurance that the catalyst manufacturers will within three years respond with a less expensive system capable of operating within the City's constraints as I have that the ULN system will be available within three years.

The City wanted some rather high CO limits (50 and 90 ppm for gas and oil). At these levels CO catalyst becomes cost-effective per the City's own calculations. We are issuing the permit with lower values believing the claim in the application that emissions will actually be lower. At the lower levels the CO catalyst will probably not cost-effective. I expect some discussions with them during the comment period.

I recommend your approval of the attached Intent to Issue.

AAL/aal

Attachments

Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
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Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

P.E. Certification Statement

Permittee:

City of Lakeland
Electric and Water Utilities Department
Lakeland, Polk County

DEP File No. 1050004-004-AC (PSD-FL-245)

Project type:

Project to construct a 230 megawatt Westinghouse 501 G gas-fired, simple cycle, continuous duty combustion turbine with a once-through steam generator providing cooling and power augmentation to 250 MW at 59 degrees Fahrenheit. Project includes an 85-foot stack and a 1.05 million gallon storage tank for back-up distillate fuel oil having a sulfur content of 0.05 percent. Initial nitrogen oxides (NO_X) limits are 25 ppm for gas firing achievable by Advanced Dry Low NO_X and 42 ppm for oil firing by water injection. Best Available Control Technology (BACT) is the installation of Ultra Low NO_X piloted ring combustors or high temperature selective catalytic reduction (SCR) within 36 months of start-up to meet a NO_X emission limit of 9 ppm @15% O_2. Failure to achieve the limit within 36 months may result in a stricter limit if and when the turbine is converted to combined cycle operation. In such a case the NO_X limit will be 7.5 ppm by conventional SCR.

Other pollutants, including PM/PM_{10}, VOC, and SO_2 will be controlled by good combustion and use of clean fuels. Similar controls are required for CO, unless the City chooses to meet the required reduction by employment of an oxidation catalyst.

I HEREBY CERTIFY *that the engineering features described in the above referenced application and subject to the proposed permit conditions provide reasonable assurance of compliance with applicable provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 62-4 and 62-204 through 62-297. However, I have not evaluated and I do not certify aspects of the proposal outside of my area of expertise (including but not limited to the electrical, mechanical, structural, hydrological, and geological features).*

A A. Linero, P.E. — Date: 4/22/98
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