

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
NOTICE OF PERMIT

In the matter of an
Application for Permit by:

DER File No. AC 35-196459
PSD-FL-176
Lake County

Mr. Earnest L. Mize, Vice President
Lake Cogen Limited
220 E. Madison Street, Suite 526
P. O. Box 2562
Tampa, Florida 33601

Enclosed is Permit Number AC 35-196459 to construct and operate a cogeneration unit rated at 108 MW at the Golden Gem Citrus Processing facility, Umatilla, Lake County, Florida, issued pursuant to Section(s) 403, Florida Statutes.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.11C, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Executed in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

B. Dexter Lewis
For C. H. Fancy, P.E., Chief
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400
904-488-1344

CERTIFICATE OF SERVICE

The undersigned duly designated deputy agency clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of business on 11-20-91 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED,
on this date, pursuant to
§120.52(11), Florida Statutes,
with the designated Department
Clerk, receipt of which is hereby
acknowledged.

Kyle J. Ober
(Clerk)

11-20-91
(Date)

Copies furnished to:
Alan Zahm, Central Dist.
Jewell Harper, EPA
Kenneth Kosky, P.E.
Wilbur N. Ladd, Jr., Fish & Wildlife

Final Determination

Lake Cogen Limited
Lake County, Florida

108 MW Combined Cycle Gas Turbine Cogeneration Facility

Permit Number: AC 35-196459
PSD-FL-176

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

November 15, 1991

Final Determination

The Technical Evaluation and Preliminary Determination for the permit for Lake Cogen Limited to construct and operate a 108 MW cogeneration facility at the existing Golden Gem Citrus Processing facility on State Road 19 in Umatilla, Lake County, Florida, was distributed on September 9, 1991. The Notice of Intent to Issue was published in the Orlando Sentinel on September 19, 1991. Copies of the evaluation were available for public inspection at the Department's Tallahassee and Orlando offices. The project will consist of two combustion turbines (CTs), two heat recovery steam generators (HRSG) with duct burners, and a steam turbine. The CTs will be capable of generating approximately 84 MW while operating in simple cycle and 108 MW when in combined cycles.

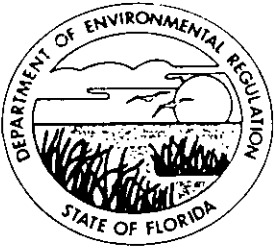
The U.S. Environmental Protection Agency (EPA) submitted a letter commenting on the Preliminary Determination October 9, 1991 stating that they had "no adverse comment."

On October 15, 1991, the U.S. Fish and Wildlife Service (FWS), Department of Interior, submitted a letter commenting on the Preliminary Determination. With regard to the Best Available Control Technology (BACT), FWS believed that selective catalytic reduction (SCR) should have been required in addition to wet injection system to control NO_x . FWS requested that future applicants "include not only the consumed SO_2 increment from this facility" but also address the "potential impact to Class I Area Air Quality Related Values (AAQRV) through cumulative air quality modeling analysis of all sources in the area"; FDER will relay these FWS requests to future applicants. FWS pointed out that the estimated emission limits for mercury, beryllium, lead, and sulfuric acid mist stated in the application were lower than the draft permit conditions and FDER has corrected this in Table 1.

Regarding the use of SCR in combination with wet injection to control NO_x , our BACT analysis indicated the incremental cost per ton of NO_x removed using SCR would exceed \$7000. This cost exceeds that which has been judged to be reasonable for NO_x control in Florida. However, FDER did require that the applicant make provisions for future installation of SCR, and an oxidation catalyst, should this equipment be justifiable in the future. The applicant provided a letter October 24, 1991 responding to FWS' comments which is included in the attachments.

The applicant provided comments on the Preliminary Determination October 9, asking that we modify the expiration date from June 1, 1993 to June 1, 1994; which FDER has done.

The final action of the Department will be to issue construction permit AC 35-196459 as proposed in the Technical Evaluation and Preliminary Determination.



Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

PERMITTEE:

Lake Cogen Limited
535 N. Ferncreek Ave.
Orlando, FL 32803

Permit Number: AC 35-196459
PSD-FL-176

Expiration Date: June 1, 1994
County: Lake

Latitude/Longitude: 28°55'02"N
81°40'37"W

Project: 108-MW Combined Cycle
Gas Turbine Cogeneration
Facility

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 17-2 and 17-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawings, plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

For the construction of a 108 combined cycle gas turbine cogeneration facility to be located adjacent to the Golden Gem Citrus Processing Plant in Lake County, Florida. The UTM coordinates are 434.0 km East and 3,198.8 km North.

The source shall be constructed in accordance with the permit application, plans, documents, amendments and drawings, except as otherwise noted in the General and Specific Conditions.

Attachments are listed below:

1. Lake Cogen Limited's application dated May 1, 1991.
2. Department's sufficiency request dated May 31, 1991.
3. Letter from KBN Engineering and Applied Science, Inc., dated June 20, 1991, to supply additional information.
4. Letter from EPA dated October 9, 1991.
5. Letter from Fish and Wildlife dated October 15, 1991.
6. Letters from KBN Engineering and Applied Science, Inc. dated October 9 and October 24, 1991.

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GENERAL CONDITIONS:

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.

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, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any 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 of 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.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgement 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.

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.

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

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facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

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 any 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.

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.

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

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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 extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

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.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.120 and 17-30.300, 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.

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

13. This permit also constitutes:

- (x) Determination of Best Available Control Technology (BACT)
- (x) Determination of Prevention of Significant Deterioration (PSD)
- (x) Compliance with New Source Performance Standards (NSPS)

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 for

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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:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurements;
- the dates analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

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.

SPECIFIC CONDITIONS:

1. The maximum allowable emissions from this facility shall not exceed the emission rates listed in Table 1.

2. Unless the Department has determined other concentrations are required to protect public health and safety, predicted acceptable ambient air concentrations (AAC) of the following pollutants shall not be exceeded:

Pollutant	Acceptable Ambient Concentrations		
	8-hrs	24-hrs	Annual
Beryllium	0.02	0.005	0.0004
Lead	1.5	0.36	0.09
Inorganic Mercury	NA	NA	0.3
Compounds, all forms of vapor, as Hg			

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SPECIFIC CONDITIONS:

3. Visible emissions shall not exceed 10% opacity.

Operating Rates

4. This source is allowed to operate continuously (8,760 hours per year).

5. This source is allowed to use natural gas as the primary fuel and distillate oil as the emergency backup fuel (limited as shown in Specific Condition 6 below).

6. The permitted materials and utilization rates for the combined cycle gas turbine shall not exceed the values as follows:

- Maximum distillate fuel oil consumption shall not exceed either of the following limitations: 2,921 gals/hr/CT; 701,050 gals/yr/CT.
- Maximum annual firing using fuel oil shall not exceed an equivalent of 10 days per year at full load.
- Maximum sulfur (S) content in the oil shall not exceed 0.1 percent by weight.
- Maximum heat input shall not exceed 384 MMBtu/hr/CT (gas) or 387 MMBtu/hr/CT (oil) at ISO conditions.
- Duct firing shall be limited to natural gas firing only with a maximum heat input of 225 MMBtu/hr.
- Duct firing shall be limited to 525,000 MMBtu/year/HRSG-duct burner, which is an equivalent to 3,500 hours at 150 MMBtu/hour.

7. Any change in the method of operation, equipment or operating hours shall be submitted to the DER's Bureau of Air Regulation and Central Florida District offices.

8. Any other operating parameters established during compliance testing and/or inspection that will ensure the proper operation of this facility shall be included in the operating permit.

Compliance Determination

9. Initial (I) compliance tests shall be performed on each CT using both fuels. The stack test for each turbine shall be performed within 10 percent of the maximum heat rate input for the tested operating temperature. Annual (A) compliance tests shall be performed on each CT with the fuel(s) used for more than 400 hours

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SPECIFIC CONDITIONS:

in the preceding 12-month period. Tests shall be conducted using EPA reference methods in accordance with the November 2, 1989, version of 40 CFR 60 Appendix A:

- a. 5 or 17 for PM (I, A, for oil only)
- b. 10 for CO (I)
- c. 9 for VE (I, A)
- d. 20 for NOx (I, A)
- e. Trace elements of beryllium (Be) shall be tested (I, for oil only) using EMTIC Interim Test Method. As an alternative, Method 104 may be used; or Be may be determined from fuel sample analysis using either Method 7090 or 7091, and sample extraction using Method 3040 as described in the EPA solid waste regulations SW 846.
- f. Mercury (Hg) shall be tested using EPA Method 101 (40 CFR 61, Appendix B) (I, for oil only) or fuel sampling analysis using methods acceptable to the Department.

Other DER approved methods may be used for compliance testing after prior Departmental approval.

10. Method 5 or 17 must be used to determine the initial compliance status of this unit. Thereafter, the opacity emissions test may be used unless 10% opacity is exceeded.

11. Compliance with the SO2 emission limit can also be determined by calculations based on fuel analysis using ASTM D2880-71 for the sulfur content of liquid fuels.

12. Compliance with the total volatile organic compound emission limits will be assumed, provided the CO allowable emission rate is achieved; specific VOC compliance testing is not required.

13. ~~During performance tests,~~ ^{INITIAL} To determine compliance ^{with the NSPS standard for NOx} ~~with the proposed NOx standard,~~ measured NOx emission at 15 percent oxygen will be adjusted to ISO ambient atmospheric conditions by the following correction factor:

$$NO_x = (NO_x \text{ obs}) \left(\frac{P_{\text{ref}}}{P_{\text{obs}}} \right)^{0.5} e^{19} (H_{\text{obs}} - 0.00633) \left(\frac{288^\circ K}{T_{\text{AMB}}} \right)^{1.53}$$

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where:

NO_x = Emissions of NO_x at 15 percent oxygen and ISO standard ambient conditions.

NO_x obs = Measured NO_x emission at 15 percent oxygen, ppmv.

P_{ref} = Reference combustor inlet absolute pressure at 101.3 kilopascals (1 atmosphere) ambient pressure.

P_{obs} = Measured combustor inlet absolute pressure at test ambient pressure.

H_{obs} = Specific humidity of ambient air at test.

e = Transcendental constant (2.718).

T_{AMB} = Temperature of ambient air at test.

→ * 14. Test results will be the average of 3 valid runs. The Central District office shall be notified at least 30 days in advance of the compliance test. The source shall operate between 90% and 100% of permitted capacity as adjusted for ambient temperature during the compliance test. Compliance test results shall be submitted to the Central District office no later than 45 days after completion.

15. Water injection shall be utilized for NO_x control. The water to fuel ratio at which compliance is achieved shall be incorporated into the operation permit and shall be continuously monitored. In addition, the permittee shall leave a space suitable for future installation of SCR equipment. Alternative combustion controls (i.e., dry low NO_x burners) can be installed with prior Department-Bureau of Air Regulation approval provided NO_x emission levels are met.

16. Combustion control shall be utilized for CO control. Due to the lack of operational experience with the LM6000 and the uncertainty of actual CO emissions, the permittee shall leave a space suitable for future installation of an oxidation catalyst. Once performance testing has been completed, the decision to require an oxidation catalyst will be based on a cost/benefit analysis of using such control.

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17. To determine compliance with the capacity factor condition for oil firing, the Permittee shall maintain daily records of fuel usage. All records shall be maintained for a minimum of three years after the date of each record and shall be made available to representatives of the Department upon request.

18. Sulfur, nitrogen content and lower heating value of the fuel being fired in the gas turbine shall also be recorded per fuel oil shipment. These records shall also be kept by the company for at least three years and made available for regulatory agency's inspection.

Rule Requirements

19. This source shall comply with all applicable provisions of Chapter 403, Florida Statutes and Chapters 17-2 and 17-4, Florida Administrative Code.

20. This source shall comply with all requirements of 40 CFR 60, Subparts GG and Db and F.A.C. Rule 17-2.660(2)(a), Standards of Performance for Stationary Gas Turbines and Standards of Performance for Industrial, Commercial, and Institutional Steam Generating Units.

21. Issuance of this permit does not relieve the facility owner or operator from compliance with any applicable federal, state, or local permitting requirements and regulations (F.A.C. Rule 17-2.210(1)).

22. This source shall comply with F.A.C. Rule 17-2.700, Stationary Point Source Emission Test Procedures.

23. Pursuant to F.A.C. Rule 17-2.210(2), Air Operating Permits, the permittee is required to submit annual reports on the actual operating rates and emissions from this facility. These reports shall include, but are not limited to the following: sulfur, nitrogen content and lower heating value of the fuel being fired, fuel usage, hours of operation, air emissions limits, etc. Annual reports shall be sent to the Department's Central District office.

24. 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 (F.A.C. Rule 17-4.090).

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SPECIFIC CONDITIONS:

25. An application for an operation permit must be submitted to the Central Florida District office at least 90 days prior to the expiration date of this construction permit or within 45 days after completion of compliance testing, whichever occurs first. To properly apply for an operation permit, the applicant shall submit the appropriate application form, fee, certification that construction was completed noting any deviations from the conditions in the construction permit, and compliance test reports as required by this permit (F.A.C. Rule 17-4.220).

Issued this 20th day
of November, 1991

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION



Carol M. Browner, Secretary

Table 1. Allowable Emission Limits Combined Cycle Combustion Turbine Cogeneration Facility

Pollutant	Source ^a	Fuel ^b	Basis of Limit	Allowable Emission Limits	
				lbs/hr	tons/year
NOx	CT	NG	BACT: 25 ppmvd at 15% O ₂	78.8	404.7
	CT	DFO	BACT: 42 ppmvd at 15% O ₂	137.0	
	DB	NG	BACT: 0.1 lb/MMBtu	45.0	
CO	CT	NG	BACT: 42 ppmvd	80.6*	466.5*
	CT	DFO	BACT: 78 ppmvd	151.0*	
	DB	NG	BACT: 0.2 lb/MMBtu	90.0*	
PM/PM10	CT	NG	BACT: 0.0065 lb/MMBtu	5.0	27.0
	CT	DFO	BACT: 0.026 lb/MMBtu	20.0	
	DB	NG	BACT: 0.006 lb/MMBtu	2.6	
SO ₂	CT	DFO	Established by Applicant 0.1% S	80.0	21.0
VOC	CT	NG	Established by Applicant	3.3	30.8
	CT	DFO	Established by Applicant	8.3	
	DB	NG	Established by Applicant	13.5	
Mercury (Hg)	CT	DFO	Established by Applicant	--	0.0003
Lead (Pb)	CT	DFO	Established by Applicant	--	0.0008
Beryllium (Be)	CT	DFO	Established by Applicant	--	0.0002
Sulfuric Acid Mist	CT	DFO	Established by Applicant	--	0.8

^a CT = combustion turbine

DB = duct burner

^b NG = natural gas

DFO = distillate fuel oil

* Emission limit for CO subject to change should additional control (oxidation catalyst) be required.

Best Available Control Technology (BACT) Determination
Lake Cogen Limited
Lake County

The applicant proposes to install a combustion turbine generator at their facility in Lake County. The facility will consist of two nominal 42 megawatt (MW) combustion turbines (CT), with exhaust through heat recovery steam generators (HRSG) which will be used to power a nominal 244 MW steam turbine.

The combustion turbine will be capable of only combined cycle operation. The applicant requested that the combustion turbine use either natural gas or distillate oil. The applicant has indicated the maximum annual tonnage of regulated air pollutants emitted from the facility based on 100 percent capacity and type of fuel fired at ISO conditions to be as follows:

Pollutant	Combustion Fuel Oil ^a (tons/yr)	Turbine Gas ^b (tons/yr)	Duct Burner Gas ^c (tons/yr)	Total ^d (tons/yr)	PSD Signi. Emission Rate (tons/yr)
NOx	16.4	344.8	52.3	404.7	40
SO2	9.6	10.1	1.58	21.0	40
PM	2.4	22.0	3.16	27.0	25
PM10	2.4	22.0	3.16	27.0	15
CO	18.2	353.2	105.0	466.5	100
VOC	1.0	14.4	15.8	30.8	40
H2SO4	0.8	NEG	NEG	0.8	7
Be	0.0002	NEG	NEG	0.0002	0.0004
Hg	0.0003	NEG	NEG	0.0003	0.1
Pb	0.0008	NEG	NEG	0.0008	0.6

- ^a Performance based on NOx emissions of 42 ppmvd (corrected to 15 percent O₂); SO₂ emissions based on an average sulfur content of 0.1 percent sulfur; annual emission data based on 240 hr/yr (10 days/year).
- ^b Performance based on NOx emissions of 25 ppmvd (corrected to 15 percent O₂); annual emissions data based on 8,760 hours/year (365 days/yr operation).
- ^c Performance based on 150 x 10⁶ Btu/hr heat input per HRSG and 3,500 hours per year operation.
- ^d Annual emissions data based on fuel oil gas turbine 240 hr/yr, natural gas combustion turbine 8,520 hr/yr, and natural gas duct burner 3,500 hr/yr operation.

Florida Administrative Code Rule 17-2.500(2) (f) (3) requires a BACT review for all regulated pollutants emitted in an amount equal to or greater than the significant emission rates listed in the previous table.

Date of Receipt of a BACT Application:

May 3, 1991

BACT Determination Requested by the Applicant:

<u>Pollutant</u>	<u>Determination</u>
NOx	25 ppmvd @ 15% O ₂ (natural gas burning)--CT 42 ppmvd @ 15% O ₂ (distillate oil firing)--CT 0.1 lb/10 ⁶ Btu--duct burner
CO	42 ppmvd @ 15% O ₂ (natural gas burning)--CT 78 ppmvd @ 15% O ₂ (distillate firing)--CT 0.2 lb/10 ⁶ Btu-Duct Burner
PM and PM10	0.0065 lb/10 ⁶ Btu (natural gas burning)--CT 0.0258 lb/10 ⁶ (distillate oil firing)--CT 0.006 lb/10 ⁶ Btu-duct burner

BACT Determination Procedure:

In accordance with Florida Administrative Code Chapter 17-2, Air Pollution, this BACT determination is based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques. In addition, the regulations state that in making the BACT determination the Department shall give consideration to:

- (a) Any Environmental Protection Agency determination of Best Available Control Technology pursuant to Section 169, and any emission limitation contained in 40 CFR Part 60 (Standards of Performance for New Stationary Sources) or 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants).
- (b) All scientific, engineering, and technical material and other information available to the Department.
- (c) The emission limiting standards or BACT determinations of any other state.
- (d) The social and economic impact of the application of such technology.

The EPA currently stresses that BACT should be determined using the "top-down" approach. The first step in this approach is to determine for the emission source in question the most stringent control available for a similar or identical source or source category. If it is shown that this level of control is technically or economically infeasible for the source in question, 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.

The air pollutant emissions from combined cycle power plants can be grouped into categories based upon what control equipment and techniques are available to control emissions from these facilities.

Using this approach, the emissions can be classified as follows:

- o Combustion Products (e.g., Particulates). Controlled generally by good combustion of clean fuels.
- o Products of Incomplete Combustion (e.g., CO). Controlled generally by proper combustion techniques.
- o Acid Gases (e.g., NOx). Controlled generally by gaseous control devices.

Grouping the pollutants in this manner facilitates the BACT analysis because it enables the equipment available to control the type or group of pollutants emitted and the corresponding energy, economic, and environmental impacts to be examined on a common basis. Although all of the pollutants addressed in the BACT analysis may be subject to a specific emission limiting standard as a result of PSD review, the control of "nonregulated" air pollutants is considered in imposing a more stringent BACT limit on a "regulated" pollutant (i.e., particulates, sulfur dioxide, fluorides, sulfuric acid mist, etc.), if a reduction in "nonregulated" air pollutants can be directly attributed to the control device selected as BACT for the abatement of the "regulated" pollutants.

Combustion Products:

The projected emissions of particulate matter and PM10 from the Lake Cogen Limited facility surpass the significant emission rates given in Florida Administrative Code Rule 17-2.500, Table 500-2.

A PM/PM10 emissions limitations of 0.0065 lb/MMBtu from the CT when firing natural gas and 0.0258 lb/MMBtu for No. 2 fuel oil firing is reasonable as BACT for the Lake Cogen facility. The duct burner PM/PM10 emission rate of 0.006 lb/MMBtu is reasonable or BACT.

Products of Incomplete Combustion:

The emissions of carbon monoxide exceed the PSD significant emission rate of 100 tpy. The emissions of CO are affected by the amount of wet injection used for the control of NOx. The applicant has indicated that the carbon monoxide emissions from the proposed turbines are based on exhaust concentrations of 42 ppmvd for natural gas and 78 ppmvd for No. 2 fuel oil.

A review of the BACT/LAER clearinghouse indicates that several of the combustion turbines using wet injection to control NOx to 25 ppmvd (corrected to 15 percent O2) have been permitted with CO limitations that are similar to those proposed by the applicant. The proposed CO emissions are, however, higher than other similar-sized CTs. The applicant has stated that the CT is a new design, and CO margins must be higher. The applicant expects the CO emissions to be half that guaranteed by the manufacturer. Although the majority of BACT emissions limitations have been based on combustion controls for carbon monoxide and volatile organic compounds minimization, additional control is achievable through the use of catalytic oxidation.

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

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

Given the applicant's proposed BACT level for carbon monoxide stated above, an evaluation can be made of the cost and associated benefit of using catalytic oxidation as follows:

The estimated annualized cost of a CO oxidation catalyst is \$968,120 with a cost effectiveness of about \$2,800/ton of CO removed. The cost effectiveness is based on 75 percent efficiency. No costs are associated with combustion techniques since they are inherent to design. However, at a catalyst back pressure of about 2 inches, an energy penalty of about 1,925,000 kwh/yr would result at 100 percent load.

It should be noted that the proposed basis for the CO emissions may be high based on the applicant's statements. A review of previous projects indicates that some equipment being evaluated has proposed CO emission rates as low as 10 ppmvd for natural gas firing and as low as 26 ppmvd for oil firing. As this is the case, the applicant's proposal for CO emissions may exceed that calculated above. Should the compliance testing indicate these low levels of CO emissions, the cost of using an oxidation catalyst would be

prohibitive. However, at the proposed level, \$2,800/ton is justifiable based on other permitting decisions. As this is the case, the decision to require an oxidation catalyst should be based on a cost/benefit analysis once compliance testing has been completed. If the actual emission rates were equivalent to that of these other facilities, the cost of using catalytic oxidation would likely be greater.

For these reasons, it appears that the limit proposed by the applicant is reasonable pending actual testing. If lower limits are obtained during testing, the operation permit should reflect a lower limit.

Emission of volatile organic compounds are each below the significant level and therefore do not require a BACT analysis.

Acid Gases

The emissions of nitrogen oxides represent a significant proportion of the total emissions and need to be controlled if deemed appropriate.

The applicant has stated that BACT for nitrogen oxides will be met by using wet (water) injection necessary to limit emissions to 42 ppmvd or 25 ppmvd at 15% oxygen when burning No. 2 fuel oil or natural gas, respectively.

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

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

A review of the combined cycle facilities in which SCR has been established as a BACT requirement indicates that the majority of these facilities are also intended to operate at high capacity factors. As this is the case, the proposed project is similar to other facilities in which SCR has been established as BACT.

Given the applicant's proposed BACT level for nitrogen oxides control stated above, an evaluation can be made of the cost and associated benefit of using SCR as follows:

The applicant has indicated that the total levelized annual cost (operating plus amortized capital cost) to install SCR for natural gas firing at 100 percent capacity factor is \$1,955,300. Taking into consideration the total annual cost, a cost/benefit analysis of using SCR can now be developed.

Based on the information supplied by the applicant, it is estimated that the maximum annual NOx emissions with wet injection from the Lake Cogen Limited facility will be 405 tons/year. Assuming that SCR would reduce the NOx emissions to a level of 9 ppmvd when firing natural gas and 17 ppmvd when firing fuel oil, about 263 tons of NOx annually. When this reduction is taken into consideration with the total levelized annual cost of \$1,955,300, the cost per ton of controlling NOx is \$7,443. This calculated cost is higher than has previously been approved as BACT.

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

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

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

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

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

The latest information available now indicates that SCR can be used for oil firing provided that adjustments are made in the ammonia to NOx injection ratio. For natural gas firing operation NOx emissions can be controlled with up to a 90 percent efficiency using a 1 to 1 or greater injection ratio. By lowering the injection ratio for oil firing, testing has indicated that NOx can be controlled with efficiencies ranging from 60 to 75 percent. When the injection ratio is lowered there is not a problem with ammonium

bisulfate formation since essentially all of the ammonia is able to react with the nitrogen oxides present in the combustion gases.

Based on this strategy SCR has been both proposed and established as BACT for oil fired combined cycle facilities with NOx emission limits ranging from 11.7 to 25 ppmvd depending on the efficiency of control established.

Environmental Impact Analysis

The predominant environmental impacts associated with this proposal are related to the use of SCR for NOx control. The use of SCR results in emissions of ammonia, which may increase with increasing levels of NOx control. In addition, some catalysts may contain substances which are listed as hazardous waste, thereby creating an additional environmental burden. Also, air emissions result from the lost generations that must be replaced. The lost generation is due to the back pressure on the turbine covered by the catalyst. Although the use of SCR does have some environmental impacts, the disadvantages may outweigh the benefit which would be provided by reducing nitrogen oxide emissions by 80 percent or greater. The benefit of NOx control by using SCR is substantiated by the fact that nearly one half of all BACT determinations have established SCR as the control measure for nitrogen oxides over the last five years.

In addition to the criteria pollutants, the impacts of toxic pollutants associated with the combustion of natural gas and No. 2 fuel oil have been evaluated. Toxics are expected to be emitted in minimal amounts, with the total emissions combined to be less than 0.1 tons per year.

Although the emissions of the toxic pollutants could be controlled by particulate control devices such as a baghouse or scrubber, the amount of emission reductions would not warrant the added expense. As this is the case, the Department does not believe that the BACT determination would be affected by the emissions of the toxic pollutants associated with the firing of natural gas or No. 2 fuel oil.

Potentially Sensitive Concerns:

With regard to controlling NOx emissions with SCR, the applicant has identified the following technical limitations:

1. SCR would reduce output of combustion turbines by one-half percent.
2. SCR could result in the release of unreacted quantities of ammonia to the atmosphere.
3. SCR would require handling of ammonia by plant operators. Since it is a hazardous material, there is a concern about safety and productivity of operators.

4. SCR results in contaminated catalyst from flue gas trace elements which could be considered hazardous. Safety of operators and disposal of spent catalyst is a concern.

The combustion turbines proposed for the project (GE LM6000) are a new aircraft derivative machine that is highly efficient. Therefore, the amount of NO_x emitted from the proposed project can be related to emissions from other combustion turbines after adjusting for efficiency; in other words, relating the emissions to the amount of energy produced. Based on information supplied by the applicant, the relative NO_x emissions for the project compared to other CTs are: LM6000 CT = 20.6 ppmvd; advanced CT = 21.8 ppmvd, and conventional CT = 25 ppmvd (corrected to 15% O₂). This comparison shows the amount of NO_x emitted per unit of electrical energy produced will be 17.6 percent lower for the CT proposed for the project compared with a conventional CT.

BACT Determination by DER

NO_x Control

A review of the permitting activities for combined cycle proposals across the nation indicates that SCR has been required and most recently proposed for installations with a variety of operating conditions (i.e., natural gas, fuel oil, capacity factors ranging from low to high). However, the cost and other concerns expressed by the applicant are valid, and advanced NO_x combustion controls have been accepted as BACT on similar projects.

The information that the applicant presented and Department calculations indicates that the incremental cost of controlling NO_x (\$7,443/ton) is high compared to other BACT determinations which require SCR. Based on the information presented by the applicant and the studies conducted, the Department believes that the use of SCR for NO_x control is not justifiable as BACT. Therefore, the Department is willing to accept wet injection for NO_x control when firing natural gas and distillate oil. However, distillate oil firing will be limited to 240 hours per year. In addition, the permittee shall install a duct module suitable for future installation of SCR equipment.

The emissions of NO_x from the duct burners will be limited to 0.1 lb/MMBtu which has been the BACT limit established for similar facilities. Duct firing will be used for supplying steam and limited to an equivalent of 3,500 hours/year.

CO Control

A national review of permitting activities involving oxidation catalyst for CO control indicates that existing oxidation catalyst applications primarily have been limited to smaller cogeneration facilities burning natural gas. Oxidation catalysts have not been used on fuel-oil-fired CT's or combined cycle facilities. the use

of sulfur containing fuel with an oxidation catalyst system would result in an increase of SO₃ emissions and increase the corrosive effects to the stack. In addition, trace metals in the fuel could result in catalyst poisoning during prolonged periods of fuel oil use.

The information that the applicant presented and Department calculations indicate that the incremental cost of controlling CO with an oxidation catalyst is approximately \$2,800/ton. This is based on a 76 percent reduction efficiency from 42 ppmvd to 10 ppmvd. An energy penalty would result from the expected 2 inch pressure drop across the catalyst. This penalty is estimated to be 1,925,000 kwh/yr at 100 percent load. Based on the information presented by the applicant and the studies conducted by the Department, the use of oxidation catalyst for CO control is not justifiable at this time as BACT. Therefore, the Department is willing to accept combustion control for CO control when firing natural gas or distillate oil. However, distillate oil firing will be limited to 240 hours per year. Also, due to the lack of operational experience with the LM6000 and the uncertainty of actual CO emissions, the permittee shall install a duct module suitable for future installation of an oxidation catalyst.

Other Emissions Control

The emissions limitations for PM and PM₁₀ are based on previous BACT determinations for similar facilities.

The emission limits for the Lake Cogen Limited project are thereby established as follows:

<u>Pollutant</u>	<u>Emission Limit</u>		
	<u>CT (Natural Gas Firing)</u>	<u>CT (Fuel Oil Firing)*</u>	<u>Duct Burner+</u>
NO _x	25 ppmvd @ 15% O ₂	42 ppmvd @ 15% O ₂	0.1 lb/MMBtu
CO	42 ppmvd	78 ppmvd	0.2 lb/MMBtu
PM & PM ₁₀	0.0065 lb/MMBtu	0.026 lb/MMBtu	0.006 lb/MMBtu

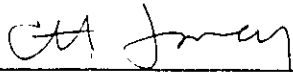
* Fuel oil usage limited to 10 days/year equivalent of the total heat input on an annual basis.

+ Natural gas will only be used for supplemental firing for no greater than 3,500 full-load equivalent hours on a total annual Btu basis.

Details of the Analysis May Be Obtained By Contacting:

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Recommended By:



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

November 12, 1991
Date

Approved By:



Carol M. Browner, Secretary
Department of Environmental
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November 20, 1991
Date

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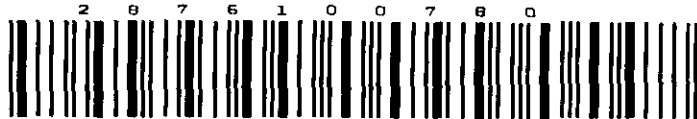
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