AUBURNDALE POWER PARTNERS, L.P.

12500 Fair Lakes Circle • Suite 420 • Fairfax, Virginia 22033
Phone (703) 222-0445 • Fax (703) 222-0516

June 17, 1992

RECEIVED
JUN 18 1992
Bureau of Air Regulation

Mr. C. H. Fancy, P.E., Chief
Bureau of Air Quality Management
Florida Department of Environmental Regulation
Twin Towers Office Bldg.
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

SUBJECT: AUBURNDALE COGENERATION PROJECT - PSD-FL-185, AC 53-208321

Dear Mr. Fancy:

In follow-up to our meeting on Friday, June 5 with Mr. Preston Lewis and Ms. Theresa Heron, enclosed is the requested additional information as follows:

(1) Comments on vendor SCR costs obtained by FDER (Attachment I)

(2) A proposal for lower NOx emission rates based on the staged development of Westinghouse's low Nox combustion turbine burner technology. A compliance proposal for fuel oil use is also provided. (Attachment II)

Vendor information on SCR costs provided by FDER consisted of a letter from Norton Chemical Process Corporation and a paper by Ellison Consultants prepared for the Manufacturers of Emission Controls Association. In general, SCR cost estimates previously provided by Auburndale Power Partners in the February 1992 permit application are in agreement with estimates contained in the Norton letter with the exception of catalyst replacement costs. SCR cost estimation procedures contained in the Ellison paper conflict with the Norton data with respect to installation costs and catalyst replacement frequency and will result in SCR costs which we feel significantly underestimate actual costs. Detailed comments on these two documents are provided in Attachment I.

With regards to the NOx emission proposal, our turbine vendor, Westinghouse has indicated that the expected date a new combustor would be available that could achieve the 15 ppm NOx on gas and 42 ppm NOx on oil with steam injection on a sustainable basis would be

(continued)

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JUN 18 1992

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1 [redacted] Date 6/17/92

From (Your Name) Please Print: Patricia Hallach

Your Phone Number (Very Important): (703) 222-0445

Department/Floor No.

Company: MISSION ENERGY COM Division of Air Resources Management

Street Address: 12500 FAIR LAKES CIRCLE

City: FAIRFAX State: VA ZIP Required: 22033

2 To (Recipient's Name) Please Print: Mr. C. H. Fancy, Chief

Recipient's Phone Number (Very Important): (904) 488-1344

Department/Floor No.

Company: Bureau of Air Quality, Florida Department of Environmental

Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes): Twin Towers Office Building, 2600 Blair Stone Road

City: Tallahassee State: FL ZIP Required: 32399

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PART #137204 NCREC 10/91
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in five years. As promised, enclosed is test data supplied by Westinghouse for their Bellingham Cogeneration Plant which documents emission rates currently achievable on a sustained basis with their combustor technology.

We are requesting from FDER five years with NOx emissions of 25 ppm on natural gas and 42 ppm on distillate oil, with the understanding that Auburndale Power Partners (APP) will retrofit with the new combustor as soon as it is available to achieve the 15 ppm on natural gas and 42 ppm on oil. If the 15/42 emission rates cannot be met within five years, SCR will be installed.

Reiterating some of the points made in our meeting we feel should support FDER concurrence with this proposal:

(1) APP has voluntarily proposed use of a low sulfur fuel oil that exceeds current FDER BACT requirements.

(2) We are contractually obligated to a turbine vendor who cannot now achieve emissions consistently below 25 ppm and 42 ppm on natural gas and fuel oil with their steam injection technology.

(3) Contrasting our facility from the Orlando Cogen facility, it is much more difficult to obtain 15 ppm on natural gas for a dual fuel fired combustor, where 42 ppm is required for compliance when burning fuel oil.

(4) We have demonstrated that SCR is not cost effective for our project, and that many adverse environmental impacts would result from it's use.

Mr. Fancy, I appreciate you and your staff's time and consideration of our proposal and look forward to discussing it with you, either by phone or in another meeting, in the near future. If you or your staff have any questions on the materials provided, please contact either me at (703) 222-0445 or Tom Davis at ECT (904) 336-0444.

Sincerely,

Patricia A. Haslach

Patricia A. Haslach
Environmental Manager

Attachments
cc:w/attach: Tom Davis, ECT
Jeff Meling, ECT
George Schott, Westinghouse
Don Fields, Mission
J. Bryan
C. Holladay
B. Thomas
J. Harper, EPA
C. Shaver, NPS

Bellingham Cogeneration Plant
Emission Test Summary

Date: 08/30/91 Fuel: Natural Gas Turbine No. 1

PARAMETER	Emission Limit	Run 1	Run 2	Run 3	Test Average
Operating Parameters					
Volumetric Air Flow (ACFM)		961,111	990,923	979,606	977,213
(DSCFM)		617,755	652,040	641,507	637,101
Oxygen (%) dry basis		14.93	14.91	14.86	14.90
Carbon Dioxide (%) dry basis		3.20	3.23	3.27	3.23
Moisture (%) Flue Gas		14.10	12.40	13.40	13.30
Dry Bulb/Wet Bulb (°F)		88.0/74.0	88.0/74.0	84.0/75.8	86.67/74.60
Total Suspended Particulates (TSP)*					
(lbs/hour)	6	5.21	5.21	3.13	4.52
(lbs/MMBtu, HHV)	0.0047	0.0046	0.0049	0.0029	0.0041
Sulfur Dioxide**					
(lbs/hour)	2	0.0	0.0	0.0	0.0
(lbs/MMBtu, HHV)	0.0016	0.0	0.0	0.0	0.0
Nitrogen Oxides					
(lbs/hour)	110	99.53	99.50	98.30	99.11
(lbs/MMBtu, HHV)	0.0859	0.0809	0.0773	0.0770	0.0784
(ppmvd @ 15% O_2)	---	22.23	20.98	20.89	21.37
(ppmvd @ 15% O_2) ISO	25	24.72	23.30	24.52	24.18
Carbon Monoxide					
(lbs/hour)	66	2.33	2.16	2.01	2.17
(lbs/MMBtu, HHV)	0.0516	0.0018	0.0017	0.0016	0.0017
(ppmvd @ 15% O_2)	25	0.81	0.71	0.70	0.74
Total Hydrocarbons (as carbon)					
(lbs/hour)	5.5	1.20	0.71	0.88	0.93
(lbs/MMBtu, HHV)	0.0043	0.0010	0.0005	0.0007	0.0007
(ppmvd @ 15% O_2)	---	1.03	0.57	0.71	0.77
Opacity (%)	10	0.0	0.0	0.0	0.0

*** These tests completed September 21, 1991 - see plant operating data for this date.**
**** Calculated from fuel analysis**

Bellingham Cogeneration Plant
Emission Test Summary

Date: 08/29/91 | Fuel: Natural Gas | Turbine No. 2 BASE LOAD TESTS

PARAMETER	Emission Limit	Run 1	Run 2	Run 3*	Test Average
Operating Parameters					
Volumetric Air Flow (ACFM)		873,531	949,959	979,990	934,493
(DSCFM)		600,798	623,052	653,839	625,896
Oxygen (%) dry basis		14.71	14.72	14.77	14.73
Carbon Dioxide (%) dry basis		3.37	3.37	3.38	3.37
Moisture (%) Flue Gas		9.40	13.30	12.30	11.60
Dry Bulb/Wet Bulb (°F)		87.0/71.5	85.0/71.0	85.0/73.0	85.7/71.8
Total Suspended Particulates (TSP)					
(lbs/hour)	6	1.42	1.47	7.12	3.34
(lbs/MMBtu, HHV)	0.0047	0.0012	0.0012	0.0054	0.0026
Sulfur Dioxide**					
(lbs/hour)	2	0.0	0.0	0.0	0.0
(lbs/MMBtu, HHV)	0.0016	0.0	0.0	0.0	0.0
Nitrogen Oxides					
(lbs/hour)	110	92.10	91.85	93.68	92.54
(lbs/MMBtu, HHV)	0.0859	0.0750	0.0724	0.0709	0.0728
(ppmvd @ 15% O_2)	---	20.40	19.65	19.25	19.77
(ppmvd @ 15% O_2) ISO	25	21.85	21.18	21.40	21.48
Carbon Monoxide					
(lbs/hour)	66	1.16	0.84	1.35	1.12
(lbs/MMBtu, HHV)	0.0516	0.0010	0.0007	0.0010	0.0009
(ppmvd @ 15% O_2)	25	0.42	0.29	0.46	0.39
Total Hydrocarbons (as carbon)					
(lbs/hour)	5.5	0.955	1.072	1.687	1.238
(lbs/MMBtu, HHV)	0.0043	0.0008	0.0008	0.0013	0.0010
(ppmvd @ 15% O_2)	---	0.81	0.88	1.33	1.01
Opacity (%)	10	0.0	0.0	0.0	0.0

* Particulate Run No. 3 completed 08/29/91 Runs 1 and 2 completed 09/22/91
** Calculated from fuel analysis
See plant operating data from this date.

Attachment I
Review of SCR Costs

Comments on the documents provided by FDER regarding SCR costs are provided as follows:

A. Norton Chemical Process Products Corporation letter to FDER dated May 20, 1992.

<u>Capital Costs</u>

SCR purchased equipment cost (PEC) is estimated by Norton to be "on the order of" $2,000,000 for a Westinghouse W501D combustion turbine. This estimate is in close agreement with the $2,275,000 value provided in the February 1992 permit application. Installation cost is estimated by Norton to be 50% of the PEC. Data provided in the February 1992 permit application estimated installation costs to be 30% of PEC (excluding site preparation) using recommended EPA OAQPS factors. The original estimate is therefore conservative (i.e., under-estimates installation costs) in comparison to the Norton data. Total capital costs, using the Norton data, is calculated to be $3,000,000.

It is noted that Norton did not consider indirect costs (engineering, construction & field expenses, contractor fees, start-up, performance tests, and contingencies) or interest during construction in their discussion of capital costs. These costs, which were estimated in the permit application using EPA OAQPS recommended factors, will increase direct capital costs by approximately 50% for a total of $4,500,000. The Norton capital cost data, when adjusted for indirect costs and interest during construction, is consistent with the February 1992 application estimate of $4,717,075.

<u>Annual Operating Costs</u>

Norton indicates a catalyst replacement frequency for SCR systems installed on gas-fired combustion turbines to be from 2 to 5 years. The SCR catalyst replacement frequency of 3 years premised in the Auburndale project permit application is therefore consistent with the Norton data. Catalyst replacement cost is estimated by Norton to be "on the order of" $600,000 which is lower than the $1,170,000 value provided by Westinghouse. It is believed that Norton has significantly under-estimated catalyst replacement costs; use of a correlation obtained from the Ellison paper yielded an estimated catalyst cost of $1,758,006 for the Westinghouse W501D turbine which exceeds the estimate of $1,170,000 contained in the February 1992 permit application. It is noted that SCR catalyst varies in quality and price which may explain the different cost estimates. In addition, the Norton estimate does not appear to include labor costs associated with catalyst replacement.

Norton did not consider a number of other costs associated with the operation of a SCR system, including labor and material, catalyst inventory and disposal, utilities (electricity and ammonia), energy penalties, and indirect costs (overhead, administration, property taxes, insurance, capital recovery). These additional costs would significantly increase total annual operating expenses.

B. Paper by Ellison Consultants prepared for the Manufacturers of Emission Controls Association dated July, 1991.

General

The Ellison paper suggests that SCR costs can be estimated using empirical correlations. The correlations (least squares curve fits) were developed based on questionnaires completed by U.S. SCR vendors. It is noted that foreign SCR vendors (Hitachi, Mitsubishi, Kawasaki, etc.) dominate the U.S. SCR market. *Exclusion of these vendors from the Ellison survey is felt to be a major deficiency.*

Without having access to the underlying data, it is not possible to confirm the accuracy of the correlations or to assess the "scatter" of the data; i.e., the paper did not include any discussion of the variability of the data, correlation coefficients, etc.

The Ellison correlations are stated to be applicable to exhaust flow rates of 100 to 700 pounds per second (lb/sec). The exhaust flow rate for the Westinghouse W501D turbine planned for the Auburndale project is 875 lb/sec, which is outside of the applicable range of the Ellison correlations.

Attachment I
Review of SCR Costs
(continued)

Capital Costs

Excluding installation cost and site preparation, purchased equipment costs for a SCR system using the Ellison paper correlation for natural gas firing and 80% control efficiency yields a result which is in close agreement with the estimate provided in the February 1992 permit application:

Ellison Correlation ($)	February 1992 Application ($)
2,170,687	2,275,000

The Ellison paper installation cost correlation yields an estimate which is only 8.4% of the PEC. This is believed to be a significant under-estimation and is in conflict both with EPA OAQPS factors (30% of PEC) and the Norton vendor estimate (50% of PEC).

The Ellison paper discussion of capital costs omits a number of significant cost items which should be considered; i.e., site preparation, indirect costs (engineering, construction & field expenses, contractor fees, start-up, performance tests, and contingency), and interest during construction. Inclusion of these costs will increase the direct capital cost estimate by approximately 50%.

Annual Operating Costs

There are several premises stated in the Ellison paper which have a major impact on annual operating costs. These premises include: (1) frequency of catalyst replacement of 8 and 5 years for gas and oil firing, respectively, (2) calculation of cost effectiveness ($/ton) based on reducing NO_x from 42/65 ppmvd to 8.4/13 ppmvd for gas and oil firing, respectively, and (3) a capital recovery factor (CRF) of 11%.

Cost associated with catalyst replacement is a significant component of SCR operating expenses. The frequencies cited in the Ellison paper are felt to be extremely optimistic and are in conflict with the Norton letter data. A catalyst replacement frequency of every 3 years for gas firing is considered to be typical.

Use of a 42/65 ppmvd baseline instead of a 25/42 level will result in significant differences in cost effectiveness in terms of dollars per ton of NO_x removed. The Auburndale permit application provided an estimate of incremental cost effectiveness using a 25/42 ppmvd baseline and SCR controlled rates of 9/13 for gas and oil firing, respectively consistent with previous BACT analyses reviewed and approved by the FDER.

The CRF is a function of interest rate and project life and will vary from project to project. As stated in the February 1992 permit application, an interest rate of 13.5% and control system life of 15 years was premised for the Auburndale project which results in a CRF of 15.9%. The 11% CRF used in the Ellison paper is felt to be too low, adding to their under-estimation of annual costs.

The Ellison correlation for annual operating costs also omits consideration of energy penalties, downtime for catalyst replacement, and indirect costs including overhead, administrative charges, property taxes, insurance, and contingencies.

Due to the differences in catalyst replacement frequency, baseline emissions, CRF, and omission of indirect and other operating costs, estimates of annual operating costs would be expected to be much lower using the Ellison correlations. As stated previously, the catalyst replacement frequencies cited in the Ellison paper are unreasonably optimistic and inconsistent with other vendor data.

C. Conclusions

In conclusion, the SCR costs previously submitted to the FDER for the Auburndale project are felt to be reasonable estimates of actual costs. The cost estimates provided in the application are generally consistent with the Norton letter estimates and prior BACT analyses submitted to FDER. The Ellison study is felt to be flawed due to the omission of foreign SCR vendors from their survey, use of unreasonable premises with respect to installation costs and catalyst replacement frequency, use of different baseline emission levels, and omission of significant energy penalty and indirect costs.

ATTACHMEMT II

AUBURNDALE POWER PARTNERS
NOx AND FUEL OIL BACT COMPLIANCE PROPOSAL

SPECIFIC CONDITIONS:

Emission Limits

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

2. Initial NOx emission rates for natural gas firing shall not exceed 25 ppm at 15% oxygen on a dry basis. The permittee shall achieve NOx emissions of 15 ppm at 15% oxygen at the earliest achievable date based on steam injection technology, but no later than five years from permit issuance date.

Operating Rates

3. This source is allowed to operate continuously (8760 hours per year).

4. This source is allowed to use natural gas as the primary fuel and low sulfur No. 2 distillate oil as the secondary fuel (with the conditions specified in Specific Condition 5 below).

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

- Maximum low sulfur No. 2 fuel oil consumption for the facility shall be allowed for the equivalent of 18 months (13,140 hours) of the initial facility operation, or until the FGT Phase III expansion is complete and natural gas is available; whichever occurs first.

- Once the FGT Phase III expansion is complete and natural gas is available to the facility, low sulfur No. 2 fuel oil firing shall be limited to 400 hours annually.

- Maximum sulfur content in the low sulfur No. 2 fuel oil shall not exceed 0.05 percent by weight.

Compliance Determination

6. Steam injection shall be utilized for NOx control. The water to fuel ratio at which compliance is achieved shall be incorporated into the permit and shall be continuously monitored. In addition, the Permittee shall install a duct module suitable for future installation of SCR equipment.

TABLE 1
ALLOWABLE EMISSION LIMITS
COMBINED CYCLE COMBUSTION TURBINE

Pollutant	Standards: Gas Firing	Standards: No. 2 Oil Firing	Gas Turbine and HRSG Tons/Year: Gas	Gas Turbine and HRSG Tons/Year: Oil	Basis
NOx (1994 – 1997)*	25 ppm at 15% oxygen on a dry basis	42 ppmv at 15% oxygen on a dry basis			BACT
NOx (1997 onward)*	15 ppm at 15% on a dry basis	42 ppmv at 15% oxygen on a dry basis			BACT
SO2	Natural gas as fuel	0.05 percent S by weight			exceeds BACT requirements

* 15 ppm must be met at the earliest possible date, given the state of development of the turbine vendors combustor; but no later than 5 years after facility startup. Permittee shall install SCR after 5 years if 15/42 ppm requirements cannot be met.

ECT
Environmental Consulting & Technology, Inc.

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JUL 08 1992
Division of Air
Resources Management

July 7, 1992
ECT No. 91077-0400-1100

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Resources Management

Mr. C. H. Fancy, P.E.
Chief
Bureau of Air Quality Management
Florida Department of
Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Re: Auburndale Cogeneration Project
PSD-FL-185, AC 53-208321

Dear Mr. Fancy:

A summary of allowable emission rates for the Auburndale Cogeneration Project is attached as requested by Ms. Theresa Heron. These rates reflect the use of low sulfur distillate fuel oil (maximum of 0.05 weight percent sulfur) and reduced NO_x emissions (15 ppmvd at 15% O_2 and ISO conditions) to be achieved within five years (PHASE II Emission Rates).

Combustion turbine (CT) heat input rates at ISO conditions were also requested by Ms. Heron. Maximum CT heat input at ISO conditions are 1,214 MMBtu/hr and 1,170 MMBtu/hr for natural gas and distillate fuel oil firing, respectively.

Please contact me at (904) 336-0444 or Patricia Haslach at (703) 222-0445 if there are any questions concerning the attached emission rates.

Sincerely,

ENVIRONMENTAL TECHNOLOGY & CONSULTING, INC.

Thomas W. Davis

Thomas W. Davis, P.E.
Senior Engineer

P.O. Box 8188
Gainesville, FL
32605-8188

5200 Newberry Road
Suite E-1
Gainesville, FL
32607

(904)
336-0444

FAX (904)
335-0373

TWD/tw
Attachment

cc: Ms. Patricia Haslach, Mission Energy
Mr. Don Fields, Mission Energy
Mr. George Schott, Westinghouse
T. Heron
C. Halladay
B. Thomas, SW Dist.
J. Harper, EPA
C. Shaver, NPS
P. Lewis

Auburndale Cogeneration Project
Table 1 - Allowable Emission Rates

A. PHASE I (Start-up through 9/30/97)

Pollutant	Source	Fuel Type	Allowable Emission Standard/Limitation
NO_x	CT[1]	NG[2]	25 ppmvd @ 15% O_2 & ISO[3] (131.0 lbs/hr; 573.8 TPY)
		DFO[4]	42 ppmvd @ 15% O_2 & ISO (230.0 lbs/hr; 1,007.4 TPY)[5]
CO	CT	NG	15 ppmvd (43.5 lbs/hr; 190.5 TPY)
		DFO	25 ppmvd (73.0 lbs/hr; 319.7 TPY)
VOC	CT	NG	6.0 lbs/hr; 26.3 TPY
		DFO	10.0 lbs/hr; 43.8 TPY
PM_{10}	CT	NG	0.0134 lb/MMBtu (10.5 lbs/hr; 46.0 TPY)
		DFO	0.0472 lb/MMBtu (36.8 lbs/hr; 161.2 TPY)
SO_2	CT	NG	40.0 lbs/hr; 175.2 TPY
		DFO	70.0 lbs/hr; 306.6 TPY
H_2SO_4	CT	NG	5.1 lbs/hr; 22.3 TPY
		DFO	8.9 lbs/hr; 39.0 TPY
Opacity[6]	CT	NG	≤ 10% opacity
		DFO	≤ 10% opacity
Opacity[7]	CT	NG	≤ 20% opacity
		DFO	≤ 20% opacity

B. PHASE II (Effective 10/31/97)

Pollutant	Source	Fuel Type	Allowable Emission Standard/Limitation
NO_x	CT	NG	15 ppmvd @ 15% O_2 & ISO (78.6 lbs/hr; 344.3 TPY)
		DFO	42 ppmvd @ 15% O_2 & ISO (230.0 lbs/hr; 1,007.4 TPY)[5]
CO	CT	NG	21 ppmvd (43.5 lbs/hr; 190.5 TPY)
		DFO	25 ppmvd (73.0 lbs/hr; 319.7 TPY)
VOC	CT	NG	6.0 lbs/hr; 26.3 TPY
		DFO	10.0 lbs/hr; 43.8 TPY
PM_{10}	CT	NG	0.0134 lb/MMBtu (10.5 lbs/hr; 46.0 TPY)
		DFO	0.0472 lb/MMBtu (36.8 lbs/hr; 161.2 TPY)
SO_2	CT	NG	40.0 lbs/hr; 175.2 TPY
		DFO	70.0 lbs/hr; 306.6 TPY
H_2SO_4	CT	NG	5.1 lbs/hr; 22.3 TPY
		DFO	8.9 lbs/hr; 39.0 TPY
Opacity[6]	CT	NG	≤ 10% opacity
		DFO	≤ 10% opacity
Opacity[7]	CT	NG	≤ 20% opacity
		DFO	≤ 20% opacity

Auburndale Cogeneration Project
Table 1 - Allowable Emission Rates
(continued)

Notes:

1. CT: combustion turbine
2. NG: natural gas
3. ISO: International Standards Organization
4. DFO: distillate fuel oil
5. Distillate fuel oil limits are based on a fuel bound nitrogen (FBN) content less than or equal to 0.015 weight percent. For FBN levels greater than 0.015 weight percent, emission limits are adjusted in accordance with the FBN allowance contained in 40 CFR Part 60, Subpart GG.
6. Opacity limits exclude start-up, shutdown, and transfer periods. Start-up is defined as that period of time from the initiation of the combustion turbine until the unit reaches a minimum of 50 percent load. This period shall not exceed 60 minutes for a hot start-up and 120 minutes for a cold start-up. A hot start-up is defined as any start of the combustion turbine within three hours of shutdown. All other starts are cold starts. Shutdown is defined as that period of time from initial lowering of combustion turbine below 50 percent of the base load to the cessation of the combustion turbine. This period shall not exceed 120 minutes. Transfer period is the amount of time from the initiation of the transfer process in the combustion turbine between liquid and gaseous fuels, including temporary change in steam injection levels, to the completion of this process, not to exceed 30 minutes.
7. Opacity limits applicable during start-up, shutdown, and transfer periods. Start-up, shutdown, and transfer periods are as defined in Note 6.

In the folder labeled as follows there are documents, listed below, which were not reproduced in this electronic file. Those documents can be found in the supplementary documents file drawer. Folders in that drawer are arranged alphabetically, then by permit number.

Folder Name: Auburndale Power Partners, Polk County
Permit(s) numbered: AC 53-208321

Period During Which DOCUMENT WAS SUBMITTED (APPLICATION, PD & TE, FINAL DETERMINATION, POST PERMIT)	Detailed Description
Application 05/19/92	1. WESTINGHOUSE W501D COMBUSTION TURBINE GUIDE TO SYSTEMS AND APPLICATIONS

File Copy

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
75 Spring Street, S.W.
Atlanta, Georgia
30303

June 26, 1992

RECEIVED
JUL 01 1992
Division of Air Resources Management

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

Dear Mr. Fancy:

As you requested, we have reviewed the Auburndale Power Partners' (Auburndale) permit application and related information regarding a proposed cogeneration facility in Polk County, Florida, for completeness. The Auburndale facility would be located approximately 105 km west of the Chassahowitzka Wilderness Area (WA), a Class I air quality area administered by the Fish and Wildlife Service. In general, we consider the Auburndale permit application complete with respect to the Class I air quality dispersion modeling analysis. However, we have the following comments regarding the best available control technology (BACT) and air quality related values (AQRVs) analyses contained in the permit application and supplemental information.

Best Available Control Technology Analysis

The proposed project would be a significant emitter of particulate matter (PM), lead (Pb), beryllium (Be), carbon monoxide (CO), volatile organic compounds (VOC), sulfur dioxide (SO_2), sulfuric acid mist (H_2SO_4), and nitrogen oxides (NO_x). Auburndale proposes to minimize these emissions by using proper combustion controls, burning low sulfur fuel (initially oil with a maximum sulfur content of 0.05 percent, and then gas when it becomes available), and use of water injection and advanced burner design. We agree that proper combustion controls and burning a low sulfur fuel are BACT for PM, Pb, Be, CO, VOC, SO_2, and H_2SO_4. We are pleased that Auburndale has agreed to lower the maximum sulfur content of the fuel from the originally proposed 0.20 percent to 0.05 percent. This change will result in a significant reduction in SO_2 and H_2SO_4 emissions when Auburndale fires the turbine with oil. For NO_x, we believe that either water injection in combination with Selective Catalytic Reduction (SCR), or dry low-NO_x combustors is the BACT for new combined cycle combustion turbine projects. Dry low-NO_x combustors can reduce NO_x levels to less than 15 parts per million (ppm) when firing natural gas, while SCR can achieve flue gas NO_x concentrations as low as 6 ppm when burning gas and 9 ppm when burning oil.

It is evident that the BACT process is driving emissions from combustion turbines downward, and that applicants are looking for ways to inherently lower emissions, rather than opting for add-on flue gas cleaning technologies. The advantages of this approach are obvious. For example, with dry low-NO_x combustors, the potential problems often cited with SCR (i.e., ammonia slip, disposal of spent catalyst, accidental release of stored ammonia, etc.) would not be a factor. Assuming this process continues, and inherently lower emitting systems are developed, such an approach may be preferred from a total environmental standpoint. Therefore, although lower NO_x levels can be currently achieved with SCR compared to dry low-NO_x combustors, we believe that for areas that are not currently experiencing adverse effects related to NO_x emissions, either system represents BACT for new combined cycle turbines. In areas where NO_x-related adverse impacts have been documented, to minimize NO_x emissions as much as possible, we believe that there is overwhelming support for SCR. Therefore, for the proposed Auburndale project, we recommend that, as a minimum, you specify dry low-NO_x combustors as BACT for NO_x emissions and that you lower the NO_x emission rate from the proposed 25 ppm to 15 ppm when burning gas. We note that such a determination would be consistent with your recent review of the Orlando Cogen application, in which you specified dry low-NO_x combustors and a NO_x limit of 15 ppm as BACT.

Air Quality Related Values Analysis

Auburndale performed the visibility analysis using the EPA VISCREEN model. We have reviewed this analysis and have determined it to be complete. The results indicate that the proposed emissions should not cause any plume-related impacts at the Chassahowitzka WA. We are generally satisfied with Auburndale's analysis of potential effects on vegetation and soils. However, a few items are missing from this part of the AQRV analysis. First, the analysis cited old references in the vegetation section. There are numerous recent references that could be included. Second, Auburndale failed to include the references on which they based pollution threshold concentrations, and also failed to include the duration of exposure on which these threshold values were based. We suggest that they include this information to make the AQRV analysis more meaningful.

Auburndale failed to address potential effects on wildlife resulting from acid deposition (i.e., loss of invertebrate food base, death of fish and amphibian eggs and larvae). Freshwater creeks flowing into the WA provide important feeding areas for the Federally endangered peregrine falcon and bald eagle, and their integrity is essential to support these species in the WA. Therefore, Auburndale should assess the effects of increased acid deposition on the invertebrates, fish, and amphibians that inhabit these freshwater creeks, in addition to addressing any indirect effects on other wildlife species.

We appreciate the opportunity to be involved in the completeness review of the Auburndale application, and we hope that you find the above comments useful. We also reserve the right to submit additional comments during the official public comment period for this project. If you have any questions regarding these comments, please contact Mr. John Notar of our Air Quality Branch in Denver at telephone number 303/969-2071.

Sincerely yours,

John R. Eadie

John R. Eadie
Acting Regional Director

cc:
Ms. Jewell Harper, Chief
Air Enforcement Branch
Air, Pesticides and Toxic Management Division
U.S. EPA, Region 4
345 Courtland Street, NE
Atlanta, Georgia 30365

CHF/PL
Teresa Heron
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Linda Novak, PL
7-1-93

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

RE: Auburndale Power Partners,
Auburndale Cogeneration Project (PSD-FL-185)

Dear Mr. Fancy:

This is to acknowledge receipt of the Prevention of Significant Deterioration (PSD) permit application and additional information packages for the above referenced facility. The proposed facility will produce approximately 150 megawatts (MW) of electricity and will also provide steam to several nearby manufacturing plants. The project consists of one Westinghouse 501D5 combustion turbine, an unfired heat recovery steam generator, and a steam turbine generator.

Your determination proposes to limit NO_x emissions through steam injection and advanced burner technology, to limit SO_2 and H_2SO_4 Mist emissions through limiting the sulfur content of the No. 2 distillate fuel oil, to limit CO and VOC emissions through good combustion techniques, to limit PM/PM_{10} emissions by combustion controls and the use of clean fuels, and to limit Pb, Be, and As emissions through the use of clean fuels.

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

Sincerely yours,

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

cc: J. Reynolds
C. Holladay
B. Thomas, SW Dist.
C. Shaver, NPS
J. Meling, PE, ECT
CHF/PL

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ECT
Environmental Consulting & Technology, Inc.

May 15, 1992
ECT No. 91077-0400

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Bureau of
Air Regulation

Mr. C.H. Fancy, P.E., Chief
Bureau of Air Regulation
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Re: Auburndale Cogeneration Project, PSD-FL-185, AC 53-208321

Dear Mr. Fancy:

This letter is in follow-up to Environmental Consulting & Technology, Inc.'s (ECT's) letter to you dated April 27, 1992. This letter provides the response to issue (13), which was contained in your correspondence dated March 10, 1992.

AIR QUALITY ANALYSIS

(13) Please evaluate the impact of this project on the Class I Chassahowitzka National Wilderness Area. This evaluation should include an SO_2 and NO_x PSD Class I increment analysis and an air quality related values analysis (AQRV). The AQRV analysis should at least include the impacts of all PSD significant pollutants that are to be emitted by the project. Additionally, the National Park Service has informed the Department verbally that the AQRV analysis should include not only PSD significant impacts, but also the impacts of all pollutants, including toxics, that are to be emitted by the project. The AQRV analysis includes impacts to visibility, soils, vegetation, and wildlife.

a. As a preface to the response to this request, Auburndale Power Partners has made a decision to voluntarily reduce the sulfur content of No. 2 fuel oil used by this facility from a maximum of 0.2 percent to a maximum of 0.05 percent. This good-faith decision will have the very positive effect of reducing overall emissions of sulfur-bearing compounds from the facility. Specifically, the maximum hourly sulfur dioxide (SO_2) emission rate will be reduced from 275.1 pounds per hour (lb/hr) (see Table 2-4 on page 2-9 of the original application) to 68.8 lb/hr. The maximum hourly sulfuric acid mist (H_2SO_4) emission rate will be reduced from 35.6 lb/hr (see Table 2-6 on page 2-11 of the original application) to 8.9 lb/hr. Annual

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2 To (Recipient's Name) Please Print: Mr. C.H. Fancy, P.E. Chief
Recipient's Phone Number (Very Important): ( )
Company: FDER
Department/Floor No.
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emissions, in tons per year (tpy), will also be reduced substantially, as shown herein (see Table 3-5 on page 3-13 of the original application):

	Oil		Gas/Oil	
	Original	Revised	Original	Revised
SO_2	1,205	301	222	181
H_2SO_4	156	39	31	23

b. Based on the reduction in fuel oil sulfur content, revised SO_2 emissions were modeled to determine impacts at the boundaries of the Chassahowitzka National Wilderness Area. This modeling was performed with the latest version of the Industrial Source Complex Short-Term (ISCST) model (Version 92062) and 5 years of Tampa meteorological data. All other inputs were the same as used in the refined modeling submitted with the original application.

The results of these modeling runs are summarized in Tables 1, 2, and 3, attached. These results show that the maximum annual and 3-hour SO_2 impacts predicted to be below the very restrictive significance levels proposed by the National Park Service (NPS). However, in 1983 and 1986, several 24-hour impacts due to the proposed facility were predicted to be slightly above the NPS significance level. Therefore, an additional analysis was conducted. This analysis consisted of modeling the inventory of all PSD increment consuming and expanding sources on the selected days and at the specific receptors where the proposed facility's impacts were significant. The inventory consisted of sources identified by the Florida Department of Environmental Regulation (FDER) in an ISCST input file dated March 31, 1992. This listing was supplemented through a file review conducted by ECT staff on May 6, 1992, at the FDER offices in Tallahassee.

Tables 4, 5, and 6 summarize the results of this additional analysis. These tables show that on the days and at the locations of significant impacts due to the proposed facility, total 24-hour SO_2 impacts at Chassahowitzka were predicted to be less than the allowable PSD Class I increment of 5 micrograms per cubic meter ($\mu g/m^3$). Therefore, emissions from the proposed facility will not cause or contribute to an exceedance of SO_2 increments.

By scaling with respect to emission rates, the SO_2 modeling results for the proposed facility were used to calculate maximum nitrogen oxides (NO_x) impacts. These results are summarized in Tables 7, 8, and 9. These results demonstrate that NO_x impacts from the Auburndale facility do not exceed the NPS significance levels at any time at Chassahowitzka.

c. Finally, as requested, an analysis of AQRVs was conducted. The initial step was to examine potential visibility impacts. This was done by conducting Level 1 screening analyses using the VISCREEN model. Two analyses were conducted, one with inputs consistent with only fuel oil usage, the other with inputs consistent with the long-term gas/oil fuel usage mix.

The results are summarized in Tables 10 and 11. As these tables show, the very conservative Level 1 predictions were that visibility impacts due to the proposed facility will be negligible.

Potential impacts on vegetation, soils, and wildlife were also examined. Both primary (direct diffusion of gases on leaf surfaces through the atmosphere) and secondary (indirect absorption through soil deposition via the root system) pathways of pollutant exposure to plants were evaluated. The effects of airborne exposure to soils and wildlife were also assessed, as presented in the following paragraphs. Literature cited is identified in an attachment.

Impacts on Vegetation

Chassahowitzka is a complex ecosystem of vegetation assemblages that depend on the subtle interplay of slight changes in elevation, salinity, hydroperiod, and edaphic factors for distribution, extent, and species composition. The mosaic of plant communities at Chassahowitzka is represented by pine woods and hammock forests within areas of higher ground, various freshwater forested and non-forested wetlands situated within lowland depressions that are inundated/saturated with fresh water for at least part of the year (mixed swamp, marsh, etc.) and brackish to saltwater wetlands such as salt marsh and mangrove swamp distributed at lower elevations upon land that is normally inundated by tidal action and freshwater pulses from upland surface water runoff. The predominant flora associated with these associations is typically common to the central Florida region and characterized by a high diversity of terrestrial, wetland,

and aquatic species. Common vascular taxa within Chassahowitzka would include slash pine, laurel oak, live oak, cabbage palm, sweet gum, red maple, saw palmetto, and gallberry in the inland areas and needlerush, red mangrove, cordgrass, and saltgrass in the brackish to marine reaches.

Non-vascular plants such as lichens and bryophytes are also represented at the preserve.

Vegetation reacts with air pollution over a wide range of pollutant concentrations and environmental conditions. The most direct type of exposure that results in visible injury to plants is airborne. SO_2 is the most detrimental to plants in terms of potential injury and damage caused by high levels of emission from power plants. Other potential airborne pollutants include nitrogen dioxide (NO_2), particulate matter (PM), carbon monoxide (CO), fluorine, H_2SO_4, ozone (O_3), and synergistic combinations (SO_2-NO_2 and SO_2-O_3, for example). Sulfur is an important plant nutrient. Plants usually absorb sulfur from the soil in the form of sulfate ions or through leaves in the form of SO_2 or sulfur trioxide (SO_3) from the air. Assimilation of sulfur beyond a critical threshold level [429 micrograms per cubic meter ($\mu g/m^3$) of SO_2 or 0.15 parts per million (ppm)] adversely affects photosynthesis, respiration, and other plant processes. Prolonged exposure of plants to SO_2 beyond the critical level could cause irreversible injury and ultimately death. Depending on the concentration and duration of exposure, plant responses to SO_2 can be classified into both acute and chronic injury levels.

Acute injury is caused by the rapid absorption of SO_2 in toxic concentrations over 1.0 ppm for short durations, while chronic injury results from prolonged exposure of plants to concentrations less than 0.2 ppm of SO_2 or between 0.2 and 1.0 ppm for several days or weeks. Acute SO_2 injury can be characterized by leaf surfaces appearing dull or water-soaked, later changing to a whitish yellow color due to bleaching and drying (Varshnev and Garg, 1979). Chronic SO_2 injury can be identified by the yellowing of green leaves (chlorosis), other color changes to the leaves from green to brown or brownish red, premature leaf drop, reduction in growth, and bleaching. Because of relative low chlorophyll content and the absence of a protective covering of the cuticle common in the leaves of higher plants, non-vascular plants such as lichens and bryophytes are relatively more sensitive to SO_2. Visible symptoms of SO_2 injury have been documented on these primitive plants at levels as low as 88 $\mu g/m^3$ [U.S. Department of Health, Education, and Welfare (USDHEW), 1971].

Researchers have conducted numerous studies to determine the effects of SO_2 exposure to a wide variety of selected plant species. A review of the literature demonstrates that the most sensitive plants (e.g., white ash, sumacs, yellow poplar, goldenrods, legumes, blackberry, southern pine, red oak, black oak, ragweeds) exhibit visible injury to short-term exposure to SO_2 concentrations ranging from 790 to 1,570 $\mu g/m^3$ (Jones *et al.*, 1974).

A Florida investigation of the effects of exposure of SO_2 concentrations of 1,300 $\mu g/m^3$ for 8 hours on cypress, slash pine, live oak, and mangrove determined that these tree species exhibited no visible injury (Woltz and Howe, 1981).

As presented previously (see part b. of this response), the very conservatively estimated maximum SO_2 impacts predicted from the proposed cogeneration facility, based on the use of fuel oil, are well below any of the threshold values cited in the preceding paragraphs. Therefore, it can be concluded that SO_2 emissions from the facility will not affect AQRVs at Chassahowitzka. Furthermore, the use of natural gas as the facility's primary fuel will reduce (or eliminate) any predicted SO_2 impacts with an additional margin of safety.

NO_2 is the other largest potential emission from the proposed cogeneration plant. Symptoms of plant tissue injury from high concentrations of NO_2 usually appear as irregular white to brown collapsed lesions on intercostal tissue and near leaf margins (4,700 $\mu g/m^3$ for 4 hours). By evaluation of published toxicity values for NO_2 exposure, 1,800 to 4,324 $\mu g/m^3$ is the estimated threshold range for a 24-hour averaging period. Potential impacts of the proposed facility's NO_x emissions would be insignificant when compared to these thresholds.

It has been demonstrated that a simultaneous exposure to SO_2 and NO_2 results in synergistic plant injury. However, there is insufficient evidence in the literature to either support or refute the possibility that synergistic effects may occur as a result of the predicted annual ambient concentrations of SO_2 and NO_2. However, the predicted concentrations (annual average) would be much less than those resulting in a synergistic response over longer exposure periods.

O_3 injury symptoms on plants are exhibited by flecking, stippling, bleached spotting, pigmentation, necrosis, and browning. An injury threshold of 59 $\mu g/m^3$ for 4 hours has been reported in the literature.

O_3 will not be a direct by-product from the combustion of fuel at the proposed plant, but instead results from complex photochemical reactions involving NO_x and hydrocarbons. O_3 formation is not a well understood phenomenon. The state-of-the-art is such that it is difficult to predict what effect the proposed plant emissions will have on ambient O_3 concentrations from either a local or regional scale. However, it can be stated that emissions of NO_x and hydrocarbons from the facility will be insignificant when compared to emissions from existing sources in the area--both stationary and mobile. Therefore, the proposed facility would not be expected to add to the potential for O_3-related damage to vegetation at Chassahowitzka.

Information regarding the effects of PM on plants is scarce in the literature. However, concentrations of PM lower than 163 $\mu g/m^3$ did not appear to be injurious to the plants evaluated. The maximum PM concentrations due to the proposed facility would be much lower than the threshold values that cause injury to plant foliage.

Although data on the effects of CO on plants is also rather scarce in the literature, a concentration of 5.7 $\mu g/m^3$ can be used as the threshold value. The maximum 1-hour CO concentration would be far lower than this threshold. In addition, it must be understood that the physiological changes (reduction in photosynthesis) to plants associated with CO are reversible.

Fluoride is a reactive halide that often becomes volatile in the form of hydrofluoric acid (HF), which has been demonstrated to cause visible injury to citrus (top and margin burn, leaf abscission, bleaching between veins) in the vicinity of power plants at concentrations of 750 $\mu g/m^3$ for 2 hours. Symptoms of damage can consist of leaf margin necrosis and interveinal chlorosis. Even assuming that all emitted fluoride would be transformed into HF, it is apparent that the concentrations due to the proposed facility would be much lower than the threshold value.

Emissions of trace elements due to the operation of the proposed facility will be limited by the facility's size and its use of very clean fuels over its lifetime (especially natural gas). Therefore, no impacts due to these emissions would be expected.

Impacts on Soils

The U.S. Department of Agriculture (USDA) (1991a and 1991b) lists the primary soil type in Chassahowitzka as Weekiwachee-Durbin muck. This soil type is characterized by high levels of sulfur and organic content. Sulfur levels may approach 4 percent in the upper soil layer. Daily flooding by high tides cause the pH to vary between 6.1 and 7.8.

Typically, SO_2 represents the greatest threat to soil since this pollutant causes increased sulfur content and decreased pH. However, for this project, given the extremely low levels of SO_2 emitted, the distance from the source, the naturally high sulfur content of the Class I area soils, and the pH variability caused by tidal influences, no impacts to soils are expected.

Impacts on Wildlife

Wildlife resources in the 30,500-acre Chassahowitzka NWR are fairly typical of central Florida's Gulf Coast. The eastern portions of the site are fringed by hardwood swamp habitats, but the primary habitats are the estuarine and brackish marshes along with the saltwater bays containing many mangrove-covered islands. These habitats support large numbers of resident and migratory waterfowl, water birds, and shorebirds. Wading birds are also quite common. Deer, raccoons, black bears, otters, and bobcats are the notable mammals. Alligators are numerous. Bald eagles and the West Indian manatee are the primary endangered/threatened species utilizing the area.

Air impacts to wildlife can occur two ways. Direct impacts are those where exposure to a pollutant may cause physiological or behavioral changes. Indirect impacts are those where pollutants affect the habitat required by an animal. Direct impacts to animals are typically associated with high pollutant levels over prolonged exposures. The extremely low levels of pollutants generated by this project and the distance from the Class I area will not directly impact wildlife resources in the area. Since pollutant values are also so low as to not affect vegetation or soils in the Class I area, indirect impacts to wildlife are also not expected.

Conclusions

Based on this evaluation of air quality-related values of the effects on vegetation, soils, wildlife, and visibility from the proposed Auburndale cogeneration project, no effects will occur to the Chassahowitzka Class I area in terms of ecological function and value, or in terms of quality of visitor enjoyment of the area.

This letter completes our response to your March 10, 1992, correspondence. Please advise if further issues remain to be discussed.

Sincerely,

ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.

Jeff Meling

Jeffrey L. Meling, P.E.
Senior Engineer

JLM/dlm

Attachments
cc: J. Heron
C. Holladay
B. Thomas, SW Dist.
J. Harper, EPA
J. Notar, NPS

LITERATURE CITED

Jones, H.C., Weber, D., and Balsillie, D. 1974. Acceptable Limits for Air Pollution Dosages and Vegetation Effects: Sulfur Dioxide. Paper No. 74-225, 67th Annual Meeting of the Air Pollution Control Association, Denver, CO.

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Table 1. Summary of ISCST Results for Class I Area Impacts: SO_2, Fuel Oil, 100 Percent Load, 92°F Emission Parameters

Concentration ($\mu g/m^3$)	1982	1983	1984	1985	1986	NPS Significance Level
Annual average						
Highest	0.0063	0.0048	0.0040	0.0047	0.0064	0.025
24-Hour average						
Highest	0.068	0.087	0.056	0.065	0.076	0.07
Highest second highest	0.065	0.071	0.053	0.062	0.065	0.07
3-Hour average						
Highest	0.397	0.337	0.370	0.439	0.389	0.48
Highest second highest	0.364	0.264	0.313	0.341	0.322	0.48

Source: ECT, 1992.

Table 2. Summary of ISCST Results for Class I Area Impacts: SO_2, Fuel Oil, 80 Percent Load, 47°F Emission Parameters

Concentration ($\mu g/m^3$)	1982	1983	1984	1985	1986	NPS Significance Level
Annual average						
Highest	0.0062	0.0047	0.0040	0.0046	0.0063	0.025
24-Hour average						
Highest	0.068	0.085	0.054	0.061	0.075	0.07
Highest second highest	0.057	0.069	0.052	0.059	0.064	0.07
3-Hour average						
Highest	0.393	0.332	0.367	0.428	0.384	0.48
Highest second highest	0.358	0.260	0.307	0.337	0.315	0.48

Source: ECT, 1992.

Table 3. Summary of ISCST Results for Class I Area Impacts: SO_2, Fuel Oil, 65 Percent Load, 29°F Emission Parameters

Concentration ($\mu g/m^3$)	1982	1983	1984	1985	1986	NPS Significance Level
Annual average						
Highest	0.0057	0.0044	0.0036	0.0044	0.0059	0.025
24-Hour average						
Highest	0.065	0.079	0.051	0.057	0.070	0.07
Highest second highest	0.053	0.064	0.049	0.054	0.060	0.07
3-Hour average						
Highest	0.372	0.313	0.348	0.402	0.363	0.48
Highest second highest	0.339	0.245	0.289	0.319	0.296	0.48

Source: ECT, 1992.

Table 4. Additional Analysis of Total Class I Area Impacts: SO_2, Fuel Oil, 100 Percent Load, 92°F Emission Parameters

NPS Significant Impacts					Total Impact (All PSD Sources) ($\mu g/m^3$)	Allowable Class I Increment ($\mu g/m^3$)
Year	Month/ Day	Concentration ($\mu g/m^3$)	Receptor Location (UTM) E	Receptor Location (UTM) N		
1983	10/13	0.087	340700.00	3171900.00	-2.39	5.0
	09/03	0.077	342000.00	3174000.00	4.64	5.0
	05/02	0.073	340300.00	3165700.00	2.99	5.0
	03/05	0.072	340300.00	3167700.00	3.67	5.0
	09/03	0.071	334000.00	3183400.00	3.76	5.0
	10/13	0.071	342000.00	3174000.00	-2.60	5.0
	10/13	0.071	340300.00	3169800.00	-0.36	5.0
	03/05	0.071	340300.00	3169800.00	2.71	5.0
	09/03	0.070	331500.00	3183400.00	3.31	5.0
1986	12/10	0.076	342400.00	3180600.00	3.12	5.0
	03/12	0.075	340300.00	3169800.00	0.23	5.0
	12/10	0.075	341100.00	3183400.00	3.39	5.0
	12/10	0.071	339000.00	3183400.00	2.06	5.0
	12/10	0.070	343700.00	3178300.00	2.85	5.0
	03/12	0.070	340700.00	3171900.00	0.24	5.0

Source: ECT, 1992.

Table 5. Additional Analysis of Total Class I Area Impacts: SO_2, Fuel Oil, 80 Percent Load, 47°F Emission Parameters

NPS Significant Impacts					Total Impact (All PSD Sources) ($\mu g/m^3$)	Allowable Class I Increment ($\mu g/m^3$)
Year	Month/ Day	Concentration ($\mu g/m^3$)	Receptor Location (UTM) E	N		
1983	10/13	0.085	340700.00	3171900.00	-2.39	5.0
	09/03	0.076	342000.00	3174000.00	4.64	5.0
	05/02	0.072	340300.00	3165700.00	2.99	5.0
	09/03	0.070	334000.00	3183400.00	3.76	5.0
1986	12/10	0.075	342400.00	3180600.00	3.12	5.0
	03/12	0.074	340300.00	3169800.00	0.23	5.0
	12/10	0.073	341100.00	3183400.00	3.39	5.0

Source: ECT, 1992.

Table 6. Additional Analysis of Total Class I Area Impacts: SO_2, Fuel Oil, 65 Percent Load, 29°F Emission Parameters

NPS Significant Impacts					Total Impact (All PSD Sources) ($\mu g/m^3$)	Allowable Class I Increment ($\mu g/m^3$)
			Receptor Location (UTM)			
Year	Month/ Day	Concentration ($\mu g/m^3$)	E	N		
1983	10/13	0.080	340700.00	3171900.00	-2.40	5.0
	09/03	0.071	342000.00	3174000.00	4.63	5.0
1986	12/10	0.070	342400.00	3180600.00	3.11	5.0

Source: ECT, 1992.

Table 7. Summary of ISCST Results for Class I Area Impacts: NO_x, Fuel Oil, 100 Percent Load, 92°F Emission Parameters

Concentration	1982	1983	1984	1985	1986	NPS Significance Level
Annual average						
Highest ($\mu g/m^3$)	0.015	0.011	0.010	0.011	0.015	0.025

Source: ECT, 1992.

Table 8. Summary of ISCST Results for Class I Area Impacts: NO_x, Fuel Oil, 80 Percent Load, 47°F Emission Parameters

Concentration	1982	1983	1984	1985	1986	NPS Significance Level
Annual average Highest ($\mu g/m^3$)	0.020	0.015	0.012	0.015	0.021	0.025

Source: ECT, 1992.

Table 9. Summary of ISCST Results for Class I Area Impacts: NO_x, Fuel Oil, 65 Percent Load, 29°F Emission Parameters

Concentration	1982	1983	1984	1985	1986	NPS Significance Level
Annual average						
Highest ($\mu g/m^3$)	0.019	0.015	0.012	0.015	0.020	0.025

Source: ECT, 1992.

Table 10. Level 1 Visibility Screening Results at Chassahowitzka Wilderness Area: Fuel Oil Only

		Delta E†		Contrast**	
Background	Theta*	Threshold	Plume	Threshold	Plume
Sky	10	2.00	0.064	0.05	0.000
Sky	140	2.00	0.014	0.05	-0.001
Terrain	10	2.00	0.009	0.05	0.000
Terrain	140	2.00	0.002	0.05	0.000

* Theta is the scattering angle between direct solar radiation and the line of sight. Theta equal to 10 degrees (°) is the worst-case sun angle for forward scattering, and theta equal to 140° is the worst-case for backward scattering.

† Delta E, the color difference parameter, indicates the perceived magnitude of color and brightness changes; it is the basis for determining plume perceptibility. The threshold value of 2.00 is used to determine if there is the potential for visibility impairment from the plume. If the absolute value of the plume contrast is greater than the threshold value, the potential is present for visibility impairment.

** Contrast is a measure of the difference in light intensity between the plume and the background. The threshold value of 0.05 is used to determine if there is the potential for visibility impairment from the plume. If the absolute value of the plume contrast is greater than the threshold value, the potential is present for visibility impairment.

Source: ECT, 1992.

Table 11. Level 1 Visibility Screening Results at Chassahowitzka Wilderness Area: Gas/Oil Mix

Background	Theta*	Delta E† Threshold	Delta E† Plume	Contrast** Threshold	Contrast** Plume
Sky	10	2.00	0.022	0.05	0.000
Sky	140	2.00	0.007	0.05	-0.000
Terrain	10	2.00	0.003	0.05	0.000
Terrain	140	2.00	0.001	0.05	0.000

* Theta is the scattering angle between direct solar radiation and the line of sight. Theta equal to 10° is the worst-case sun angle for forward scattering, and theta equal to 140° is the worst-case for backward scattering.

† Delta E, the color difference parameter, indicates the perceived magnitude of color and brightness changes; it is the basis for determining plume perceptibility. The threshold value of 2.00 is used to determine if there is the potential for visibility impairment from the plume. If the absolute value of the plume contrast is greater than the threshold value, the potential is present for visibility impairment.

** Contrast is a measure of the difference in light intensity between the plume and the background. The threshold value of 0.05 is used to determine if there is the potential for visibility impairment from the plume. If the absolute value of the plume contrast is greater than the threshold value, the potential is present for visibility impairment.

Source: ECT, 1992.

"Westinghouse W501D Combustion Turbine
Guide to Systems and Applications
is available in the permit file hardcopy"

APPENDIX F--SCREENING MODELING WORKSHEETS

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 100% Load, 31 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 9.9 ug/m3

Highest Short-Term Impacts:

SO2

3-Hour Impact	9.9 x (5.04/10) x 0.9 4.5 ug/m3
24-Hour Impact	9.9 x (5.04/10) x 0.4 2.0 ug/m3

PM

24-Hour Impact	9.9 x (1.32/10) x 0.4 0.5 ug/m3

CO

1-Hour Impact	9.9 x (5.48/10) 5.4 ug/m3
8-Hour Impact	9.9 x (5.48/10) x 0.7 3.8 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 100% Load, 47 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 10.0 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	10 x (4.81/10) x 0.9
	4.3 ug/m3
24-Hour Impact	10 x (4.81/10) x 0.4
	1.9 ug/m3

PM

24-Hour Impact	10 x (1.26/10) x 0.4
	0.5 ug/m3

CO

1-Hour Impact	10 x (5.29/10)
	5.3 ug/m3
8-Hour Impact	10 x (5.29/10) x 0.7
	3.7 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 100% Load, 72 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 10.3 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	10.3	x (4.57/10) x 0.9
	4.2	ug/m3
24-Hour Impact	10.3	x (4.57/10) x 0.4
	1.9	ug/m3

PM

24-Hour Impact	10.3	x (1.21/10) x 0.4
	0.5	ug/m3

CO

1-Hour Impact	10.3	x (4.91/10)
	5.1	ug/m3
8-Hour Impact	10.3	x (4.91/10) x 0.7
	3.5	ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 100% Load, 92 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 10.5 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	10.5	x (4.34/10) x 0.9
	4.1	ug/m3
24-Hour Impact	10.5	x (4.34/10) x 0.4
	1.8	ug/m3

PM

24-Hour Impact	10.5	x (1.15/10) x 0.4
	0.5	ug/m3

CO

1-Hour Impact	10.5	x (4.72/10)
	5.0	ug/m3
8-Hour Impact	10.5	x (4.72/10) x 0.7
	3.5	ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 80% Load, 31 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 10.2 ug/m3

Highest Short-Term Impacts:

SO2

3-Hour Impact	10.2	x (4.22/10) x 0.9
	3.9	ug/m3
24-Hour Impact	10.2	x (4.22/10) x 0.4
	1.7	ug/m3

PM

24-Hour Impact	10.2	x (1.08/10) x 0.4
	0.4	ug/m3

CO

1-Hour Impact	10.2	x (4.35/10)
	4.4	ug/m3
8-Hour Impact	10.2	x (4.35/10) x 0.7
	3.1	ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 80% Load, 47 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 10.3 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	10.3 x (4.06/10) x 0.9
	3.8 ug/m3
24-Hour Impact	10.3 x (4.06/10) x 0.4
	1.7 ug/m3

PM

24-Hour Impact	10.3 x (1.04/10) x 0.4
	0.4 ug/m3

CO

1-Hour Impact	10.3 x (4.16/10)
	4.3 ug/m3
8-Hour Impact	10.3 x (4.16/10) x 0.7
	3.0 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 80% Load, 72 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 11.1 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	11.1	x (3.88/10) x 0.9
	3.9	ug/m3
24-Hour Impact	11.1	x (3.88/10) x 0.4
	1.7	ug/m3

PM

24-Hour Impact	11.1	x (1.00/10) x 0.4
	0.4	ug/m3

CO

1-Hour Impact	11.1	x (3.97/10)
	4.4	ug/m3
8-Hour Impact	11.1	x (3.97/10) x 0.7
	3.1	ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 80% Load, 92 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 12.6 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	12.6 x (3.72/10) x 0.9
	4.2 ug/m3
24-Hour Impact	12.6 x (3.72/10) x 0.4
	1.9 ug/m3

PM

24-Hour Impact	12.6 x (0.97/10) x 0.4
	0.5 ug/m3

CO

1-Hour Impact	12.6 x (3.78/10)
	4.8 ug/m3
8-Hour Impact	12.6 x (3.78/10) x 0.7
	3.3 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 65% Load, 31 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 37.2 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	37.2 x (3.67/10) x 0.9
	12.3 ug/m3
24-Hour Impact	37.2 x (3.67/10) x 0.4
	5.5 ug/m3

PM

24-Hour Impact	37.2 x (0.94/10) x 0.4
	1.4 ug/m3

CO

1-Hour Impact	37.2 x (3.78/10)
	14.1 ug/m3
8-Hour Impact	37.2 x (3.78/10) x 0.7
	9.8 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 65% Load, 47 deg F

Highest 1–Hour Concentration
from SCREEN (@ 10 g/sec) = 38.7 ug/m3

Highest Short–Term Impacts:

SO_2

3–Hour Impact	38.7 x (3.52/10) x 0.9
	12.3 ug/m3
24–Hour Impact	38.7 x (3.52/10) x 0.4
	5.4 ug/m3

PM

24–Hour Impact	38.7 x (0.91/10) x 0.4
	1.4 ug/m3

CO

1–Hour Impact	38.7 x (3.78/10)
	14.6 ug/m3
8–Hour Impact	38.7 x (3.78/10) x 0.7
	10.2 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 65% Load, 72 deg F

Highest 1–Hour Concentration
from SCREEN (@ 10 g/sec) = 41.1 ug/m3

Highest Short–Term Impacts:

SO2

3–Hour Impact	41.1 x (3.31/10) x 0.9
	12.2 ug/m3
24–Hour Impact	41.1 x (3.31/10) x 0.4
	5.4 ug/m3

PM

24–Hour Impact	41.1 x (0.87/10) x 0.4
	1.4 ug/m3

CO

1–Hour Impact	41.1 x (3.59/10)
	14.8 ug/m3
8–Hour Impact	41.1 x (3.59/10) x 0.7
	10.3 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Gas, 65% Load, 92 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 43.1 ug/m3

Highest Short-Term Impacts:

SO2

3-Hour Impact	43.1	x (3.14/10) x 0.9
	12.2	ug/m3
24-Hour Impact	43.1	x (3.14/10) x 0.4
	5.4	ug/m3

PM

24-Hour Impact	43.1	x (0.83/10) x 0.4
	1.4	ug/m3

CO

1-Hour Impact	43.1	x (3.40/10)
	14.7	ug/m3
8-Hour Impact	43.1	x (3.40/10) x 0.7
	10.3	ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 100% Load, 29 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 7.2 ug/m3

Highest Short-Term Impacts:

SO2

3-Hour Impact	7.2 x (34.7/10) x 0.9
	22.5 ug/m3
24-Hour Impact	7.2 x (34.7/10) x 0.4
	10.0 ug/m3

PM

24-Hour Impact	7.2 x (8.00/10) x 0.4
	2.3 ug/m3

CO

1-Hour Impact	7.2 x (9.20/10)
	6.6 ug/m3
8-Hour Impact	7.2 x (9.20/10) x 0.7
	4.6 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 100% Load, 47 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 8.0 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	8	x (33.2/10) x 0.9
	23.9	ug/m3
24-Hour Impact	8	x (33.2/10) x 0.4
	10.6	ug/m3

PM

24-Hour Impact	8	x (7.66/10) x 0.4
	2.5	ug/m3

CO

1-Hour Impact	8	x (8.82/10)
	7.1	ug/m3
8-Hour Impact	8	x (8.82/10) x 0.7
	4.9	ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 100% Load, 72 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 9.1 ug/m3

Highest Short-Term Impacts:

SO2

3-Hour Impact	9.1	x (31.5/10) x 0.9
	25.8	ug/m3
24-Hour Impact	9.1	x (31.5/10) x 0.4
	11.5	ug/m3

PM

24-Hour Impact	9.1	x (7.30/10) x 0.4
	2.7	ug/m3

CO

1-Hour Impact	9.1	x (8.32/10)
	7.6	ug/m3
8-Hour Impact	9.1	x (8.32/10) x 0.7
	5.3	ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 100% Load, 92 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 9.9 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	9.9 x (29.9/10) x 0.9
	26.6 ug/m3
24-Hour Impact	9.9 x (29.9/10) x 0.4
	11.8 ug/m3

PM

24-Hour Impact	9.9 x (6.94/10) x 0.4
	2.7 ug/m3

CO

1-Hour Impact	9.9 x (7.81/10)
	7.7 ug/m3
8-Hour Impact	9.9 x (7.81/10) x 0.7
	5.4 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 80% Load, 29 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 8.8 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	8.8	x (29.1/10) x 0.9
	23.0	ug/m3
24-Hour Impact	8.8	x (29.1/10) x 0.4
	10.2	ug/m3

PM

24-Hour Impact	8.8	x (6.63/10) x 0.4
	2.3	ug/m3

CO

1-Hour Impact	8.8	x (7.31/10)
	6.4	ug/m3
8-Hour Impact	8.8	x (7.31/10) x 0.7
	4.5	ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 80% Load, 47 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 9.6 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	9.6 x (27.9/10) x 0.9
	24.1 ug/m3
24-Hour Impact	9.6 x (27.9/10) x 0.4
	10.7 ug/m3

PM

24-Hour Impact	9.6 x (6.39/10) x 0.4
	2.5 ug/m3

CO

1-Hour Impact	9.6 x (7.06/10)
	6.8 ug/m3
8-Hour Impact	9.6 x (7.06/10) x 0.7
	4.7 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 80% Load, 72 deg F

Highest 1–Hour Concentration
from SCREEN (@ 10 g/sec) = 9.9 ug/m3

Highest Short–Term Impacts:

SO_2

3–Hour Impact	9.9 x (26.8/10) x 0.9
	23.9 ug/m3
24–Hour Impact	9.9 x (26.8/10) x 0.4
	10.6 ug/m3

PM

24–Hour Impact	9.9 x (6.14/10) x 0.4
	2.4 ug/m3

CO

1–Hour Impact	9.9 x (6.80/10)
	6.7 ug/m3
8–Hour Impact	9.9 x (6.80/10) x 0.7
	4.7 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 80% Load, 92 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 10.1 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	10.1	x (25.6/10) x 0.9
	23.3	ug/m3
24-Hour Impact	10.1	x (25.6/10) x 0.4
	10.3	ug/m3

PM

24-Hour Impact	10.1	x (5.90/10) x 0.4
	2.4	ug/m3

CO

1-Hour Impact	10.1	x (6.55/10)
	6.6	ug/m3
8-Hour Impact	10.1	x (6.55/10) x 0.7
	4.6	ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 65% Load, 29 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 9.8 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	9.8 x (25.4/10) x 0.9
	22.4 ug/m3
24-Hour Impact	9.8 x (25.4/10) x 0.4
	10.0 ug/m3

PM

24-Hour Impact	9.8 x (5.79/10) x 0.4
	2.3 ug/m3

CO

1-Hour Impact	9.8 x (6.43/10)
	5.3 ug/m3
8-Hour Impact	9.8 x (6.43/10) x 0.7
	4.4 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 65% Load, 47 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 9.9 ug/m3

Highest Short-Term Impacts:

SO_2

3-Hour Impact	9.9 x (24.1/10) x 0.9
	21.5 ug/m3
24-Hour Impact	9.9 x (24.1/10) x 0.4
	9.5 ug/m3

PM

24-Hour Impact	9.9 x (5.54/10) x 0.4
	2.2 ug/m3

CO

1-Hour Impact	9.9 x (6.30/10)
	6.2 ug/m3
8-Hour Impact	9.9 x (6.30/10) x 0.7
	4.4 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 65% Load, 72 deg F

Highest 1–Hour Concentration
from SCREEN (@ 10 g/sec) = 10.1 ug/m3

Highest Short–Term Impacts:

SO2

3–Hour Impact	10.1 x (22.8/10) x 0.9
	20.7 ug/m3
24–Hour Impact	10.1 x (22.8/10) x 0.4
	9.2 ug/m3

PM

24–Hour Impact	10.1 x (5.28/10) x 0.4
	2.1 ug/m3

CO

1–Hour Impact	10.1 x (6.05/10)
	6.1 ug/m3
8–Hour Impact	10.1 x (6.05/10) x 0.7
	4.3 ug/m3

Auburndale Cogen Project

Screening Worksheet

Case: Oil, 65% Load, 92 deg F

Highest 1-Hour Concentration
from SCREEN (@ 10 g/sec) = 10.2 ug/m3

Highest Short-Term Impacts:

SO2

3-Hour Impact	10.2	x (21.6/10) x 0.9
	19.8	ug/m3
24-Hour Impact	10.2	x (21.6/10) x 0.4
	8.8	ug/m3

PM

24-Hour Impact	10.2	x (5.05/10) x 0.4
	2.1	ug/m3

CO

1-Hour Impact	10.2	x (5.80/10)
	5.9	ug/m3
8-Hour Impact	10.2	x (5.80/10) x 0.7
	4.1	ug/m3

APPENDIX G--RAW ISCST MODEL RESULTS SUMMARIES

Table G-1. Raw ISCST Results: Fuel Oil, 100 Percent Load, 92°F Emission Parameters at 10.0 g/sec

Concentration	1982	1983	1984	1985	1986
Annual average					
Highest ($\mu g/m^3$)	0.0474	0.0442	0.0533	0.0469	0.0442
Location					
Distance (meters)	5,000	4,000	4,000	4,000	4,000
Radial (°)	240	240	240	250	240
1-Hour average					
Highest ($\mu g/m^3$)	5.88	8.72	6.99	8.32	6.62
Location					
Distance (meters)	1,250	1,000	1,250	1,000	1,250
Radial (°)	210	280	150	90	40
Second highest ($\mu g/m^3$)	5.24	5.43	5.31	5.39	5.37
Location					
Distance (meters)	1,000	1,250	1,000	1,000	1,000
Radial (°)	10	160	120	100	160
3-Hour average					
Highest ($\mu g/m^3$)	2.94	2.96	3.34	3.16	3.63
Location					
Distance (meters)	1,500	2,000	1,250	2,500	1,000
Radial (°)	260	350	160	60	340
Second highest ($\mu g/m^3$)	2.34	2.55	2.85	2.55	2.64
Location					
Distance (meters)	3,000	2,500	2,000	1,000	1,000
Radial (°)	220	240	340	300	20
8-Hour average					
Highest ($\mu g/m^3$)	2.10	1.93	1.99	1.91	1.80
Location					
Distance (meters)	2,000	2,000	2,500	2,500	3,000
Radial (°)	260	350	260	270	110
Second highest ($\mu g/m^3$)	1.57	1.62	1.48	1.71	1.46
Location					
Distance (meters)	3,000	3,000	3,000	3,000	2,500
Radial (°)	360	300	270	260	120

Table G-1. Raw ISCST Results: Fuel Oil, 100 Percent Load, 92°F Emission Parameters at 10.0 g/sec (Continued, Page 2 of 2)

Concentration	1982	1983	1984	1985	1986
24-Hour average					
Highest ($\mu g/m^3$)	0.70	0.66	0.76	0.74	0.68
Location					
Distance (meters)	2,000	2,500	2,500	3,000	2,500
Radial (°)	260	310	260	270	300
Second highest ($\mu g/m^3$)	0.61	0.54	0.60	0.62	0.55
Location					
Distance (meters)	4,000	3,000	4,000	3,000	2,500
Radial (°)	360	300	260	260	300

Source: ECT, 1992.

Table G-2. Raw ISCST Results: Fuel Oil, 80 Percent Load, 47°F Emission Parameters at 10.0 g/sec

Concentration	1982	1983	1984	1985	1986
Annual average					
Highest (μg/m³)	0.0611	0.0572	0.0696	0.0607	0.0550
Location					
Distance (meters)	4,000	3,000	4,000	4,000	3,000
Radial (°)	240	240	240	250	240
1-Hour average					
Highest (μg/m³)	6.61	9.05	7.33	8.62	8.75
Location					
Distance (meters)	3,000	1,000	1,250	1,000	1,250
Radial (°)	130	280	150	90	250
Second highest (μg/m³)	6.16	6.27	6.22	6.29	6.28
Location					
Distance (meters)	1,000	1,000	1,000	1,000	1,000
Radial (°)	10	120	120	100	160
3-Hour average					
Highest (μg/m³)	3.78	3.70	3.81	3.96	4.52
Location					
Distance (meters)	1,500	2,000	1,000	2,000	1,000
Radial (°)	260	350	150	60	340
Second highest (μg/m³)	3.07	3.18	3.53	3.01	3.21
Location					
Distance (meters)	3,000	2,000	2,000	1,000	1,000
Radial (°)	220	240	340	300	20
8-Hour average					
Highest (μg/m³)	2.59	2.40	2.42	2.44	2.29
Location					
Distance (meters)	1,500	2,000	2,000	3,000	2,500
Radial (°)	260	350	260	260	110
Second highest (μg/m³)	1.99	2.07	1.88	2.11	1.83
Location					
Distance (meters)	2,500	2,500	2,500	2,500	2,500
Radial (°)	360	300	270	260	120

Table G-2. Raw ISCST Results: Fuel Oil, 80 Percent Load, 47°F Emission Parameters at 10.0 g/sec (Continued, Page 2 of 2)

Concentration	1982	1983	1984	1985	1986
24-Hour average					
Highest ($\mu g/m^3$)	0.86	0.85	0.92	0.97	0.86
Location					
Distance (meters)	1,500	2,000	2,000	5,000	2,500
Radial (°)	260	350	260	90	300
Second highest ($\mu g/m^3$)	0.76	0.69	0.75	0.80	0.69
Location					
Distance (meters)	3,000	2,500	3,000	3,000	2,500
Radial (°)	360	300	260	260	300

Source: ECT, 1992.

Table G-3. Raw ISCST Results: Fuel Oil, 65 Percent Load, 29°F Emission Parameters at 10.0 g/sec

Concentration	1982	1983	1984	1985	1986
Annual average					
Highest ($\mu g/m^3$)	0.0674	0.0630	0.0760	0.0667	0.0608
Location					
Distance (meters)	4,000	3,000	4,000	3,000	3,000
Radial (°)	240	240	240	260	240
1-Hour average					
Highest ($\mu g/m^3$)	6.71	9.22	7.49	8.79	8.93
Location					
Distance (meters)	1,000	1,000	1,250	1,000	1,250
Radial (°)	270	280	150	90	250
Second highest ($\mu g/m^3$)	6.49	6.60	6.55	6.62	6.61
Location					
Distance (meters)	1,000	1,000	1,000	1,000	1,000
Radial (°)	10	120	120	100	160
3-Hour average					
Highest ($\mu g/m^3$)	4.12	4.00	4.11	4.37	4.89
Location					
Distance (meters)	1,500	2,000	2,500	2,000	1,000
Radial (°)	260	350	300	60	340
Second highest ($\mu g/m^3$)	3.32	3.46	3.82	3.18	3.40
Location					
Distance (meters)	3,000	2,000	1,500	1,000	1,000
Radial (°)	220	240	340	300	20
8-Hour average					
Highest ($\mu g/m^3$)	2.83	2.59	2.66	2.68	2.53
Location					
Distance (meters)	1,500	2,000	2,000	3,000	2,500
Radial (°)	260	350	260	260	110
Second highest ($\mu g/m^3$)	2.18	2.27	2.06	2.28	1.98
Location					
Distance (meters)	2,500	2,500	2,500	2,500	2,500
Radial (°)	360	300	270	260	120

Table G-3. Raw ISCST Results: Fuel Oil, 65 Percent Load, 29°F Emission Parameters at 10.0 g/sec (Continued, Page 2 of 2)

Concentration	1982	1983	1984	1985	1986
24-Hour average					
Highest ($\mu g/m^3$)	0.94	0.92	1.05	1.10	0.95
Location					
Distance (meters)	1,500	2,000	2,000	4,000	2,000
Radial (°)	260	350	260	90	300
Second highest ($\mu g/m^3$)	0.83	0.76	0.83	0.87	0.75
Location					
Distance (meters)	3,000	2,500	3,000	2,500	2,500
Radial (°)	360	300	260	260	300

Source: ECT, 1992.

ECT
Environmental Consulting & Technology, Inc.

April 27, 1992
91077-0400

Mr. C. H. Fancy, P.E., Chief
Bureau of Air Regulation
Florida Department of
Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Re: Auburndale Cogeneration Project
PSD-FL-185, AC 53-208321

Dear Mr. Fancy:

Receipt is acknowledged of your correspondence dated March 10, 1992, regarding the above referenced project. Responses to the issues raised in your letter are provided as follows:

BACT ANALYSIS

(1) *Section 4.5.2.2: What is the net energy penalty in millions cu. ft. of natural gas per year for the proposed steam injection and advanced combustor technology? Show the basis of this calculation.*

Net energy penalty associated with steam injection and advanced combustor technology is calculated to be equivalent to the use of 718.89 MM ft^3 per year of natural gas. Details of this calculation are shown on Attachment I.

(2) *Section 4.5.2.3: What is the cost effectiveness ($/tons NO_x removed) of the proposed steam injection and advanced combustor technology?*

Cost effectiveness of steam injection and advanced combustor design is calculated to be $2,814 per ton of NO_x removed. Details of this calculation are shown on Attachment II.

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G-ELDOR.3/0427JLM.1

3320-0444.03

LTR

UPS SHIPPER NUMBER N349—X88

TRACKING NO. 0146 4831 673

SHIPMENT FROM

REFERENCE NUMBER: 91077-0400

NAME: THOMAS W. DAVIS

TELEPHONE: 904-335-0444

COMPANY: ECT

STREET ADDRESS: 5200 ...

CITY: GAINESVILLE

STATE: FL

ZIP CODE: 32607

DELIVERY TO

NAME: MR. C.H. FANCY, P.E.

TELEPHONE:

COMPANY: FL DEPT. OF ENVIRONMENTAL REGULATION

STREET ADDRESS: 2600 BLAIR STONE ROAD

DEPT./FLOOR:

CITY: TALLAHASSEE

STATE: FL

ZIP CODE: 3[illegible]

UPS NEXT DAY AIR

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(3) *Section 4.5.2.3: What is the efficiency of this turbine? Calculate Y (refer to the NSPS, Subpart GG).*

The efficiency of the combustion turbine, obtained from vendor data, is 10,020 Btu/kwh (LHV) at 72 °F ambient temperature, base load, and natural gas firing. Using a conversion factor of 1.055056 kilojoule/Btu, the "Y" term in Subpart GG is calculated to be 10.57 kilojoules per watt hour.

(4) *Section 4.5.2.3: What is the low heating value of the fuel? Calculate NO_x emissions based on the LHV of the fuel. Attach the basis of this calculation (ppmv, lb/MMBtu, lb/hr, tpy).*

The lower heating values (LHV) of natural gas and distillate oil fuels are 19,920 and 18,200 Btu/lb, respectively. NO_x emission rate estimates, and the basis for the estimates, using the fuel LHV are shown on Attachment III.

<u>GENERAL</u>

(5) *Submit a flow diagram of the proposed cogeneration system. Include the stacks associated with this system.*

The process flow diagram CCD-HD-1126 for the cogeneration facility is attached separately.

(6) *Submit a manufacturer's specification manual for the proposed Westinghouse 501D5 combustion turbine, if available.*

Please refer to booklet "Westinghouse W501D Combustion Turbine-Guide to Systems and Applications," attached separately.

(7) *Heat Recovery Steam Generator (HRSG): Submit manufacturer's name, model number, generator name plate rating (gross MW), maximum steam production rate (lb/hr and/or horsepower).*

The heat recovery steam generator (HRSG) will be a horizontal gas flow type waste heat recovery boiler located adjacent to the combustion turbine. The HRSG will be comprised of a high pressure (HP) and a low pressure (LP) section. Each section will contain an economizer tube bundle, a natural circulation type evaporator tube bundle with steam drum, and a superheater tube bundle.

HP steam will be supplied directly to the steam turbine inlet and LP steam will be supplied directly to the steam turbine as induction steam. The maximum HP steam production rate will be 368,000 pounds per hour; the maximum LP steam production rate will be 108,700 pounds per hour.

The HRSG will be manufactured by either Nooter/Erickson Cogeneration System, Inc., or Zurn Industries.

(8) *Steam Turbine Generator: What is the nominal power (MW) output of this steam turbine?*

The nominal output of the steam turbine generator is 52 MW.

(9) *Steam Turbine Generator: What is the steam input to this turbine?*

The nominal output given in response No. 8 is based on the following steam flows, in pounds per hour:

HP inlet - 363,000
LP induction - 102,000
Extraction for NO_x control - 54,000
Extraction for process - Zero

Because of thermal cycle requirements, the nominal steam turbine generator rating does not occur at the same operating point as that for the maximum steam production rate from the HRSG.

(10) *Storage Tanks: What is the estimated annual throughput and type of air pollution control?*

There will be two identical fuel oil storage tanks. Each tank will be of the fixed roof type and will have a capacity of approximately 600,000 gallons.

During the first year of operation (when the facility will operate exclusively on distillate oil), total throughput will be approximately 1.8 x 10^6 barrels, or 80 x 10^6 gallons. After natural gas is available onsite, the facility will operate a maximum of 400 hours per year on distillate oil. The annual throughput under this circumstance will be approximately 86,000 barrels, or 3.6 x 10^6 gallons.

(11) *Storage Tanks: What are the estimated emissions?*

Estimated emissions of volatile organic compounds (VOCs) are calculated using equations contained in the U.S. Environmental Protection Agency (EPA) publication AP-42, Section 4.3. Total maximum VOC emissions are estimated to be 0.84 tons per year or less. Details of these calculations are provided in Attachment IV.

(12) *Pollutant Information: Show basis of emission rate calculations (lb/hr, TPY, lb/MMBtu) for each of the pollutants considered in this project using the low heating value of the fuel (LHV) and percentage loads.*

Hourly mass emission rates for the criteria pollutants (TSP/PM_{10}, NO_x, CO, and VOC) and H_2SO_4 were provided by the combustion turbine vendor for operating loads of 100, 80, and 65 percent for several ambient air temperatures. These hourly rates were then converted to units of tons per year based on operating hours for each fuel type and units of lb/MMBtu using the fuel LHV. Mass emission rates for SO_2 were calculated based on the fuels sulfur content and maximum consumption rates. Details of these calculations are shown on Attachment V.

Mass emission rates for non-criteria pollutants (As, Be, F, Pb, and Hg) were calculated using the emission factors shown in Table B-1 of the PSD permit application and maximum heat input rates. Details of these calculations are shown on Attachment VI.

AIR QUALITY ANALYSIS

(13) *Please evaluate the impact of this project on the Class I Chassahowitzka National Wilderness Area. This evaluation should include an SO_2 and NO_x PSD Class I increment analysis and an air quality related values analysis (AQRV). The AQRV analysis should at least include the impacts of all PSD significant pollutants that are to be emitted by the project. Additionally, the National Park Service has informed the Department verbally that the AQRV analysis should include not only PSD significant impacts, but also the impacts of all pollutants, including toxics, that are to be emitted by the project. The AQRV analysis includes impacts to visibility, soils, vegetation, and wildlife.*

The additional evaluations of impacts on the Chassahowitzka Class I area are currently being completed. This analysis will be provided for review as soon as possible.

We look forward to your review of this information, and we are available to answer any further questions that may arise.

Sincerely,

ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.

Thomas W. Davis

Thomas W. Davis, P.E.
Senior Engineer

TWD/tsw

Enclosures

cc: P. Haslach, Mission Energy
J. Heron
C. Holladay
B. Thomas, SW Dist.
J. Harper, EPA
C. Shaver, NPS

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Environmental Consulting & Technology, Inc.

Auburndale Cogeneration Project
Attachment I
Net Energy Penalty Associated with
Steam Injection and Advanced Combustion

Energy penalties associated with steam injection and use of advanced combustion are due to: (1) heat value of the injected steam and (2) reduction in turbine efficiency. An energy credit results from the increase in power due to higher mass flow through the turbine. Specific energy calculations for each of these items follows:

1. **Steam Injection Penalty**

   Energy value of steam = 1,195 Btu/lb
   Steam Injection Rate = 79,950 lb/hr
   (At 72°F, base load, natural gas fuel)

   Penalty = (1,195 Btu/lb) * (79,950 lb/hr) * (8,760 hr/yr)
   Penalty = <u>836,933 MMBtu/hr</u>

   Note: This represents a revision to the value originally provided since fuel flow, instead of steam flow, was inadvertently used in the original calculation.

2. **Reduction in Turbine Efficiency Penalty**

   Heat Rate Increase = 125 Btu/kwh (per turbine vendor)
   Power Output = 113,550 kw
   (At 72°F, base load, natural gas fuel)

   Penalty = (125 Btu/kwh) * (113,550 kw) * (8,760 hr/yr)
   Penalty = <u>124,337 MMBtu/hr</u>

3. **Power Increase Credit**

   Power Increase = 60,500,000 kwh/yr (per turbine vendor)

   Credit = (60,500,000 kwh/yr) * (0.003412141 MMBtu/kwh)
   Credit = <u>206,435 MMBtu/yr</u>

4. **Net Energy Penalty (MMBtu/yr)**

   Net Penalty = 836,933 MMBtu/yr + 124,337 MMBtu/yr
   - 206,435 MMBtu/yr
   Net Penalty = <u>754,835 MMBtu/yr</u>

5. **Net Energy Penalty Natural Gas Equivalent (MMft^3/yr)**

   Heat Content of Natural Gas = 1,050 Btu/ft^3

   Net Penalty = (754,835 MMBtu/yr) ÷ (1,050 Btu/ft^3)

Net Penalty = 718.89 MM ft^3/yr

ATTACHMENT II

Capital Costs for Steam Injection/Advanced Combustor

Direct Costs	($)	OAQPS Factor
Purchased Equipment	(114,500)	A
Installation		
Foundations & Supports	(9,160)	0.08 * A
Handling & Erection	(16,030)	0.14 * A
Electrical	(4,580)	0.04 * A
Piping	(2,290)	0.02 * A
Insulation For Ductwork	(1,145)	0.01 * A
Painting	(1,145)	0.01 * A
Total Installation Cost	(34,350)	
Site Preparation	(4,000)	
Total Direct Cost	(152,850)	TDC
Indirect Costs	**($)**	**OAQPS Factor**
Engineering	(11,450)	0.10 * A
Construction & Field Expenses	(5,725)	0.05 * A
Contractor Fees	(11,450)	0.10 * A
Start-up	(2,290)	0.02 * A
Performance Test	(1,145)	0.01 * A
Contingency	0	0.25 * A
Total Indirect Cost	(32,060)	TIC
Interest During Construction	(18,491)	
Total Capital Investment	(203,401)	TCI

ATTACHMENT II

Annual Operating Costs for Steam Injection/Advanced Combustor
1st Year 100% Oil
2nd Year 50.0% Gas, 50.0% Oil
3rd – 15th Year 95.4% Gas, 4.6% Oil

Direct Costs	($)	OAQPS Factor
Labor & Material Costs		
Operator	0	A
Supervisor	0	0.15 * A
Maintenance		
Labor	0	B
Materials	0	1.00 * B
Total Labor & Material Costs	0	C
Utilities		
Electricity	(2,100)	
Natural Gas	0	
Water	(20,000)	
Total Utilities	(22,100)	
Energy Penalties		
Turbine Efficiency Reduction	(22,381)	
Power Increase	945,000	
Steam Injection	49,085	
Total Energy Penalties	994,085	
Total Direct Cost	971,985	TDC
Contingency	0	.25 * TDC
Indirect Costs	**($)**	**OAQPS Factor**
Overhead	0	0.60 * C
Administrative Charges	(4,068)	0.02 * TCI
Property Taxes	(2,034)	0.01 * TCI
Insurance	(2,034)	0.01 * TCI
Capital Recovery	(32,291)	
Total Indirect Cost	(40,427)	
Total Annual Cost	931,558	

Summary of NO_x BACT Analysis

Control Option	Emission Impacts: Emission Rates (lb/hr)	Emission Impacts: Emission Rates (tpy)	Emission Impacts: Emission Reduction (tpy)	Economic Impacts: Installed Capital Cost ($)	Economic Impacts: Total Annualized Cost ($/yr)	Economic Impacts: Cost Effectiveness Over Baseline ($/ton)	Energy Impacts: Increase Over Baseline (MMBtu/yr)	Environmental Impacts: Toxic Impact (Y/N)	Environmental Impacts: Adverse Envir. Impact (Y/N)
Advanced Combustor & Steam Injection	116.2	508.8	331.0	(203,401)	931,558	2,814	754,835	N	N
Baseline	191.7	839.8	N/A	N/A	N/A	N/A	N/A	N	N

Notes: (1) Emission rates represent composite of gas and oil-firing at 72°F ambient temperature.
(2) Baseline is standard combustor with steam injection.

Source: ECT, 1992.
Westinghouse, 1992.

Auburndale Cogeneration Project

Attachment III
NO_x Emission Rates

NO_x emission rate estimates based on fuel LHV are provided as follows:

Basis:

Parameter	Units	Fuel Type: Distillate Oil	Fuel Type: Natural Gas
Exhaust concentration	ppmvd @ 15% O_2	43	26
Exhaust Flow Rate	lb/hr	3,173,110	3,150,540
Exhaust Water Content	Vol. %	9.92	10.98
Exhaust Molecular Weight	lb/lb-mole	28.35	28.06
Exhaust oxygen content	Vol. %, dry	14.28	14.51

Note: Combustion turbine exhaust flow rates, temperatures, water contents, molecular weights, and oxygen contents from vendor data at base load and 29 °F (oil) and 31 °F (gas) ambient temperatures.

NO_x exhaust concentrations indicated in the PSD application (42 and 25 ppmvd for oil and gas, respectively) are at 15% O_2 and ISO conditions and include humidity and combustor pressure corrections per Subpart GG of the NSPS.

Calculations:

1. Exhaust volumetric flow rate at ISO Conditions

At 59 °F, one lb-mole of gas occupies 378.54 ft^3. Using the Ideal Gas Law (PV = nRT), combustion turbine volumetric exhaust flow rates are calculated for each fuel as follows:

Distillate Oil

$$\text{Flow Rate} = \frac{(3{,}173{,}110 \text{ lb/hr}) * (378.54 \text{ ft}^3\text{/lb-mole})}{(28.35 \text{ lb/lb-mole})}$$

Flow Rate = 42.369 MM ft^3/hr @ 59 °F, wet

Flow Rate = (42.369 MM ft^3/hr) * (1 - 0.0992) * [(20.9 - 14.28)/5.9]

Flow Rate = 42.823 MM ft^3/hr @ 59 °F, dry, 15% O_2

Auburndale Cogeneration Project

Attachment III
NO_x Emission Rates
(continued)

Calculations:

1. Exhaust volumetric flow rate at ISO Conditions

Natural Gas

$$\text{Flow Rate} = \frac{(3{,}150{,}540\ lb/hr) * (378.54\ ft^3/lb\text{-}mole)}{(28.06\ lb/lb\text{-}mole)}$$

Flow Rate = 42.502 MM ft^3/hr @ 59 °F, wet

Flow Rate = (42.502 MM ft^3/hr) * (1 - 0.1098) * [(20.9 - 14.51)/5.9]

Flow Rate = 40.978 MM ft^3/hr @ 59 °F, dry, 15% O_2

2. NO_x Emission Rate; lb/hr

Distillate Oil

$$NO_x = \frac{(42.823\ MM\ ft^3/hr) * (43\ ft^3\ NO_x/MM\ ft_3) * (46\ lb\ NO_x/lb\text{-}mole)}{(378.54\ ft^3\ NO_x/lb\text{-}mole)}$$

NO_x = 224 lb/hr

NO_x = 230 lb/hr

(with margin for testing variability)

Natural Gas

$$NO_x = \frac{(40.978\ MM\ ft^3/hr) * (26\ ft^3\ NO_x/MM\ ft_3) * (46\ lb\ NO_x/lb\text{-}mole)}{(378.54\ ft^3\ NO_x/lb\text{-}mole)}$$

NO_x = 129 lb/hr

NO_x = 131 lb/hr

(with margin for testing variability)

3. NO_x Emission Rate; lb/MMBtu (LHV)

Distillate Oil

Heat Input (LHV) = 1,252 MMBtu/hr
(Per vendor data at 29°F, base load)

NO_x = (230 lb/hr) ÷ (1,252 MMBtu/hr)

NO_x = 0.184 lb/MMBtu

Natural Gas

Heat Input (LHV) = 1,253 MMBtu/hr
(Per vendor data at 31°F, base load)

NO_x = (131 lb/hr) ÷ (1,253 MMBtu/hr)

NO_x = 0.105 lb/MMBtu

4. NO_x Emission Rate; ton/yr

Distillate Oil

NO_x = (230 lb/hr) * (8,760 hr/yr) * (.0005 ton/lb)

NO_x = 1,007 ton/yr

Natural Gas/Distillate Oil

Operating Time on Natural Gas = 8,360 hr/yr
Operating Time on Distillate Oil = 400 hr/yr
(Following initial 18 month operation on distillate oil)

NO_x = [(230 lb/hr * 400 hr/yr) + (131 lb/hr * 8,360 hr/y)] * (.0005 ton/lb)]

NO_x = 594 ton/yr

Auburndale Cogeneration Project

Attachment IV
Storage Tank Emissions Calculations

1. Breathing losses from fixed roof tanks are calculated as follows:

$$L_B = 2.26 \times 10^{-2} M_V \left(\frac{P}{P_A - P}\right)^{0.68} D^{1.73} H^{0.51} \Delta T^{0.50} F_P C K_C$$

Where:

L_B = fixed roof breathing loss (lb/yr).
M_V = molecular weight of vapor in storage tank (lb/lb mole) = 130.
P_A = average atmospheric pressure at tank location (psia) = 14.76.
P = true vapor pressure at bulk liquid conditions (psia) = 0.012 at 80°F.
D = tank diameter (ft) = 45.
H = average vapor space height, including roof volume correction (ft) = 25.
ΔT = average ambient diurnal temperature change (°F) = 16.5.
F_P = paint factor (dimensionless) = 1.33 (light gray tank color).
C = adjustment factor for small diameter tanks (dimensionless) = 1.0.
K_C = product factor (dimensionless) = 1.0.

Therefore:

$$L_B = 2.26 * 10^{-2} * 130 * [0.012/(14.76 - 0.012)]^{0.68} * 45^{1.73} * 25^{0.51} * 16.5^{0.50} * 1.33 * 1.0 * 1.0 = 471 \text{ lb/yr}$$

L_B = 0.24 tons/yr

2. Working losses from fixed roof tanks are calculated as follows:

$$L_W = 2.40 * 10^{-5} M_V P V N K_N K_C$$

Where:

L_W = fixed roof working loss (lb/yr).
M_V = molecular weight of vapor in storage tank (lb/lb mole) = 130.
P = true vapor pressure at bulk liquid temperature (psai) = 0.012 at 80°F.
V = tank capacity (gal) = 600,000.
N = number of turnovers per year (dimensionless)

$$N = \frac{\text{Total throughput per year (gal)}}{\text{Tank capacity, V (gal)}} = 133 \text{ (max)}$$

K_N = turnover factor (dimensionless) = 0.4.
K_C = product factor (dimensionless) = 1.0.

Auburndale Cogeneration Project

Attachment IV
Storage Tank Emissions Calculations
(continued)

Therefore:

$L_W = 2.40 * 10^{-5} * 130 * 0.012 * 600{,}000 * 133 * 0.4 * 1.0 = 1{,}195$ lb/yr.

$L_W = 0.60$ tons/yr

Thus, maximum <u>total</u> VOC emissions would be:

$$\text{Total VOC} = L_B + L_W$$
$$= 0.24 + 0.60$$
$$= 0.84 \text{ ton/yr}$$

Total VOC = 0.84 tons/yr

VOC emissions would be much less when the use of oil decreases to 400 hours per year.

Auburndale Cogeneration Project
Attachment V
Criteria Pollutant Emission Rates

A. Natural Gas

Unit Load (%)	Ambient Temperature (oF)	Heat Input (LHV) (MMBtu/hr)	PM10/TSP (lb/hr)	PM10/TSP (ton/yr)	PM10/TSP (lb/MMBtu)	NOx (lb/hr)	NOx (ton/yr)	NOx (lb/MMBtu)	CO (lb/hr)	CO (ton/yr)	CO (lb/MMBtu)	VOC (lb/hr)	VOC (ton/yr)	VOC (lb/MMBtu)
100	31	1,253	10.5	46.0	0.0084	131.0	573.8	0.1045	43.5	190.5	0.0347	6.0	26.3	0.0048
80	31	1,049	8.6	37.7	0.0082	109.0	477.4	0.1039	34.5	151.1	0.0329	4.0	17.5	0.0038
65	31	912	8.6	37.7	0.0094	109.0	477.4	0.1195	34.5	151.1	0.0378	4.0	17.5	0.0044

B. Distillate Fuel Oil

Unit Load (%)	Ambient Temperature (oF)	Heat Input (LHV) (MMBtu/hr)	PM10/TSP (lb/hr)	PM10/TSP (ton/yr)	PM10/TSP (lb/MMBtu)	NOx (lb/hr)	NOx (ton/yr)	NOx (lb/MMBtu)	CO (lb/hr)	CO (ton/yr)	CO (lb/MMBtu)	VOC (lb/hr)	VOC (ton/yr)	VOC (lb/MMBtu)
100	29	1,252	63.5	278.1	0.0507	230.0	1,007.4	0.1837	73.0	319.7	0.0583	10.0	43.8	0.0080
80	29	1,049	52.6	230.4	0.0501	192.0	841.0	0.1830	58.0	254.0	0.0553	8.0	35.0	0.0076
65	29	915	46.0	201.5	0.0504	168.0	735.8	0.1842	51.0	223.4	0.0559	7.0	30.7	0.0077

Auburndale Cogeneration Project
Attachment V
Criteria Pollutant Emission Rates

C. Sulfur Compounds - Natural Gas

Unit Load (%)	Ambient Temperature (oF)	Heat Input (LHV) (MMBtu/hr)	Sulfur Content (gr/scf)	Sulfur Content (Wt %)	Fuel Flow Rate (lb/hr)	SO2			H2SO4		
						(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)
100	31	1,253	10.0	0.0318	62,900	40.0	175.3	0.0319	5.1	22.3	0.0041
80	31	1,049	10.0	0.0318	52,650	33.5	146.7	0.0319	4.3	18.8	0.0041
65	31	912	10.0	0.0318	45,800	29.1	127.6	0.0319	3.7	16.2	0.0041

D. Sulfur Compounds - Distillate Oil

Unit Load (%)	Ambient Temperature (oF)	Heat Input (LHV) (MMBtu/hr)	Sulfur Content (Wt %)	Fuel Flow Rate (lb/hr)	SO2			H2SO4		
					(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)
100	29	1,252	0.20	68,770	275.1	1204.9	0.2197	35.6	155.9	0.0284
80	29	1,049	0.20	57,650	230.6	1010.0	0.2198	29.8	130.5	0.0284
65	29	915	0.20	50,290	201.2	881.1	0.2198	26.0	113.9	0.0284

Note: Annual rates (ton/yr) based on 8,760 hrs/yr operation.

Auburndale Cogeneration Project
Attachment VI
Non-Criteria Pollutant Emission Rates

A. Natural Gas

Turbine Conditions			Hg			
Unit Load (%)	Ambient Temperature (oF)	Heat Input (LHV) (MMBtu/hr)	Emission Factor (lb/TBtu)	Emission Rates (lb/hr)	Emission Rates (ton/yr)	Emission Rates (lb/MMBtu)
100	31	1,253	11.3	0.014	0.062	0.000011
80	31	1,049	11.3	0.012	0.052	0.000011
65	31	912	11.3	0.010	0.045	0.000011

B. Distillate Fuel Oil

Turbine Conditions			Hg				As				Be			
Unit Load (%)	Ambient Temperature (oF)	Heat Input (LHV) (MMBtu/hr)	Emission Factor (lb/TBtu)	Emission Rates (lb/hr)	Emission Rates (ton/yr)	Emission Rates (lb/MMBtu)	Emission Factor (lb/TBtu)	Emission Rates (lb/hr)	Emission Rates (ton/yr)	Emission Rates (lb/MMBtu)	Emission Factor (lb/TBtu)	Emission Rates (lb/hr)	Emission Rates (ton/yr)	Emission Rates (lb/MMBtu)
100	29	1,252	3.0	0.004	0.016	0.000003	161.0	0.202	0.883	0.000161	2.5	0.003	0.014	0.000002
80	29	1,049	3.0	0.003	0.014	0.000003	161.0	0.169	0.740	0.000161	2.5	0.003	0.011	0.000002
65	29	915	3.0	0.003	0.012	0.000003	161.0	0.147	0.645	0.000161	2.5	0.002	0.010	0.000003

Auburndale Cogeneration Project
Attachment VI
Non-Criteria Pollutant Emission Rates

B. Distillate Fuel Oil (cont.)

Turbine Conditions			F				Pb			
Unit Load (%)	Ambient Temperature (oF)	Heat Input (LHV) (MMBtu/hr)	Emission Factor (lb/TBtu)	Emission Rates (lb/hr)	Emission Rates (ton/yr)	Emission Rates (lb/MMBtu)	Emission Factor (lb/TBtu)	Emission Rates (lb/hr)	Emission Rates (ton/yr)	Emission Rates (lb/MMBtu)
100	29	1,252	32.5	0.041	0.178	0.000033	104.0	0.130	0.570	0.000104
80	29	1,049	32.5	0.034	0.149	0.000033	104.0	0.109	0.478	0.000104
65	29	915	32.5	0.030	0.130	0.000033	104.0	0.095	0.417	0.000104

Note: TBtu = teraBtu; 1.0E12 Btu

Florida Department of Environmental Regulation

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

Lawton Chiles, Governor

Carol M. Browner, Secretary

March 10, 1992

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mrs. Patricia A. Haslach, Environmental Manager
Auburndale Power Adventures Limited Partnership
12500 Fair Lakes Circle, Suite 420
Fairfax, Virginia 22033

Dear Mrs. Haslach:

Re: PSD-FL-185, AC 53-208321

The Department has received the application for a permit to construct a 150 MW cogeneration system at the Auburndale Power Adventures facility in Auburndale, Polk County, Florida. Based on our initial review of your proposal, we have determined that additional information is needed in order to process this application. Please complete the application by supplying the information requested below:

BACT ANALYSIS

Section 4.5.2.2. (1) What is the net energy penalty in millions cu. ft. of natural gas per year for the proposed steam injection and advanced combustor technology? Show the basis of this calculation.

Section 4.5.2.3. (2) What is the cost effectiveness ($/tons NO_x removed) of the proposed steam injection and advanced combustor technology? (3) What is the efficiency of this turbine? Calculate Y (refer to the NSPS, Subpart GG). (4) What is the low heating value of the fuel? Calculate NO_x emissions based on the LHV of the fuel. Attach the basis of this calculation (ppmv, lb/MMBtu, lb/hr, tpy).

GENERAL

(5) Submit a flow diagram of the proposed cogeneration system. Include the stacks associated with this system. (6) Submit a manufacturer's specifications manual for the proposed Westinghouse 501D5 combustion turbine, if available.

Heat Recovery Steam Generator (HRSG): (7) Submit manufacturer's name, model number, generator name plate rating (gross MW), maximun steam production rate (lb/hr and/or horsepower).

Steam Turbine Generator: (8) What is the nomimal power (MW) output of this steam turbine? (9) What is the steam input to this turbine?

Storage Tanks: (10) What is the estimated annual throughput and type of air pollution control? (11) What are the estimated emissions?

Pollutant Information: (12) Show basis of emission rate calculations (lb/hr, TPY, lb/MMbtu) for each one of the pollutants considered in this project using the low heating value of the fuel (LHV) and percentage loads.

AIR QUALITY ANALYSIS

(13) Please evaluate the impact of this project on the Class I Chassahowitzka National Wilderness Area. This evaluation should include an SO_2 and NO_x PSD Class I increment analysis and an air quality related values analysis (AQRV). The AQRV analysis should at least include the impacts of all PSD significant pollutants that are to be emitted by the project. Additionally, the National Park Service has informed the Department verbally that the AQRV analysis should include not only PSD significant impacts, but also the impacts of all pollutants, including toxics, that are to be emitted by the project. The AQRV analysis includes impacts to visibility, soils, vegetation, and wildlife.

Should you have any questions on this matter, please contact Teresa Heron (review engineer) or Cleve Holladay (meteorologist) at (904) 488-1344 or write to me at the above address. The processing of your application will continue once this information is received.

Sincerely,

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

CHF/TH/plm

c: Thomas W. Davis, P.E.
Bill Thomas, SWD
C. Shaver, NPS
J. Harper, EPA

SENDER:

- Complete items 1 and/or 2 for additional services.
- Complete items 3, and 4a & b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt Fee will provide you the signature of the person delivered to and the date of delivery.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Mrs. Patricia A. Haslach
Environmental Manager
~~Auburndale~~ Power Adventures
12500 Fair Lakes Cir., Suite 420
~~Fairfax~~, Virginia 22033

4a. Article Number
P 832 538 787

4b. Service Type
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery
3-16-92

5. Signature (Addressee)

8. Addressee's Address (Only if requested and fee is paid)

6. Signature (Agent)
[signature]

PS Form **3811**, November 1990 ☆U.S. GPO: 1991—287-066 **DOMESTIC RETURN RECEIPT**

P 832 538 787

Certified Mail Receipt

No Insurance Coverage Provided
Do not use for International Mail
(See Reverse)

UNITED STATES POSTAL SERVICE

Sent to: Mrs. Patricia A. Haslach ~~Auburndale Power~~ Par	
Street & No.: 12500 Fair Lakes Cir., Ste 420	
P.O., State & ZIP Code: Fairfax, VA 22033	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Address of Delivery	
TOTAL Postage & Fees	$
Postmark or Date: Mailed: 3-10-92 Permit : AC 53-208321	

PS Form **3800**, June 1990

Environmental Consulting & Technology, Inc.

P. O. Box 8188
Gainesville, FL
32605
(904) 336-0444

LETTER OF TRANSMITTAL

TO: Florida Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

PROJECT NO. 91-077-0400

DATE: February 11, 1992

ATTENTION: Ms. Patty Adams

RE: Permit Application for the Auburndale Cogeneration Project

We are sending you [XX] Attached [ ] Under Separate Cover via

Copies	Description
1	Referenced Permit Application

These are transmitted as checked below:

- [ ] For Approval
- [ ] For your information
- [XX] As requested
- [ ] For review and comment
- [ ] Review and Correct
- [ ] Review and File
- [ ] Returned for Corrections
- [ ] Prints Returned after loan to us
- [ ]

Remarks: If there is anything else I can help you with, please let me know.

Copy to: Jeffrey L. Meling

Signed: Theresa A. Barnard

Tranltr.0590

Florida Department of Environmental Regulation

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

Lawton Chiles, Governor

Carol M. Browner, Secretary

February 11, 1992

Mrs. Chris Shaver, Chief
Permit Review and Technical Support Branch
National Park Service-Air Quality Division
Post Office Box 25287
Denver, Colorado 80225

Dear Mrs. Shaver:

RE: Auburndale Power Partners
Auburndale Cogeneration Facility
Polk County, PSD-FL-185

The Department has received the above referenced PSD application. Please review this package for completeness by March 6, 1992, and forward your comments to the Bureau of Air Regulation. The Bureau's FAX number is (904)922-6979.

If you have any questions, please call Teresa Heron or Cleve Holladay at (904)488-1344 or write to me at the above address.

Sincerely,

Barry D. Andrews

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

CHF/pa

Enclosure

Florida Department of Environmental Regulation
Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400
Lawton Chiles, Governor
Carol M. Browner, Secretary

February 11, 1992

Ms. Jewell A. Harper, Chief
Air Enforcement Branch
U.S. EPA, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30308

Dear Ms. Harper:

RE: Auburndale Power Partners
Auburndale Cogeneration Facility
Polk County, PSD-FL-185

The Department has received the above referenced PSD application package. Please review this package for completeness by March 6, 1992, and forward your comments to the Department's Bureau of Air Regulation. The Bureau's FAX number is (904)922-6979.

If you have any questions, please contact Teresa Heron or Cleve Holladay at (904)488-1344 or write to me at the above address.

Sincerely,

Barry D. Andrews

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

CHF/pa

Enclosures