AUBURNDALE POWER PARTNERS

LIMITED PARTNERSHIP

12500 Fair Lakes Circle • Suite 300
Fairfax, Virginia 22033-3804
Phone (703) 222-0445 • Fax (703) 222-5524

1501 Derby Avenue
Auburndale, Florida 33823
Phone (813) 967-0300 • Fax (813) 967-8847

May 19, 1994
APP.423

Mr. Preston Lewis
Florida Department of
Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RECEIVED
MAY 23 1994
Bureau of
Air Regulation

RE: Auburndale Power Partners Limited Partnership
FDEP AC53-208321
PSD-FL-185

Dear Mr. Lewis:

The purpose of this letter is to request revisions to the allowable emission rates for the Auburndale Power Partners cogeneration project. As discussed with Ms. Theresa Heron, a review of the above referenced permit indicated discrepancies between requested and permitted emission rates for three trace metal contaminants. Emission estimates for mercury (Hg), arsenic (As), and lead (Pb) were provided to the Florida Department of Environmental Protection in correspondence dated April 27, 1992, which is attached. A comparison between these requested emission rates and the current permitted rates contained in Table 1 of FDEP permit AC53-208321 is provided as follows:

Pollutant	Fuel	Units	Requested Emissions	Permitted Emissions
Mercury	Gas	lb/hr	0.014	0.001
Arsenic	Oil	ton/yr	0.88	0.05
Lead	Oil	ton/yr	0.57	0.51

The requested emission rates are consistent with the permitted rates specified in terms of pounds per million British thermal units (lb/MMBtu). Auburndale Power Partners would therefore appreciate having FDEP permit AC53-208321 revised to reflect the requested emission rates shown above for Hg, As and Pb.

With respect to testing procedures, Specific Condition No. 10 of FDEP permit AC53-208321 states that ASTM D4292 can be used to determine the sulfur content of liquid fuels. Inasmuch as NSPS Subpart GG requires the use of ASTM D2880-71 for this analysis, it is requested that method ASTM D2280-71 also be allowed for the analysis of liquid fuel sulfur content. Specific Condition No. 12 requires the monitoring of mercury stack emissions or fuel sampling "using methods acceptable to the Department". As indicated in the Emission Testing Protocol recently approved by FDEP, EPA method 7471, Cold Vapor Atomic Absorption Spectrophometry, will be used to analyze the mercury content of liquid fuels. Because natural gas has a negligible mercury content, it is requested that Specific Condition 12 be revised to apply only to liquid fuels.

If you have any questions regarding this letter, please do not hesitate to call Neal Pospisil or me at (703) 222-0445.

Sincerely,

Edward P. Hopkins
Project Manager

EPH/pdk
cc: Don Fields
Patricia Haslach
Neal Pospisil
Bob Riley
Gene Bergfield (Mission O&M)

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.

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

5200 Newberry Road
Suite E-1
Gainesville, FL
32607

(904)
336-0444

FAX (904)
335-0373

(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.

GENERAL

(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 1.8×10^6 barrels, or 80×10^6 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, P.E.
Senior Engineer

TWD/tsw

Enclosures

cc: P. Haslach, Mission Energy

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			Economic Impacts			Energy Impacts	Environmental Impacts	
	Emission Rates (lb/hr)	(tpy)	Emission Reduction (tpy)	Installed Capital Cost ($)	Total Annualized Cost ($/yr)	Cost Effectiveness Over Baseline ($/ton)	Increase Over Baseline (MMBtu/yr)	Toxic Impact (Y/N)	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

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

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

$$NO_x = \frac{(42.823 \text{ MM ft}^3\text{/hr}) * (43 \text{ ft}^3 \text{ NO}_x\text{/MM ft}_3) * (46 \text{ lb NO}_x\text{/lb-mole})}{(378.54 \text{ ft}^3 \text{ NO}_x\text{/lb-mole})}$$

NO_x = 224 lb/hr

NO_x = 230 lb/hr	(with margin for testing variability)

Natural Gas

$$NO_x = \frac{(40.978 \text{ MM ft}^3\text{/hr}) * (26 \text{ ft}^3 \text{ NO}_x\text{/MM ft}_3) * (46 \text{ lb NO}_x\text{/lb-mole})}{(378.54 \text{ ft}^3 \text{ NO}_x\text{/lb-mole})}$$

NO_x = 129 lb/hr

NO_x = 131 lb/hr	(with margin for testing variability)

Auburndale Cogeneration Project

Attachment III
NO_x Emission Rates
(continued)

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:

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

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			NOx			CO			VOC		
			(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(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			NOx			CO			VOC		
			(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(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.)

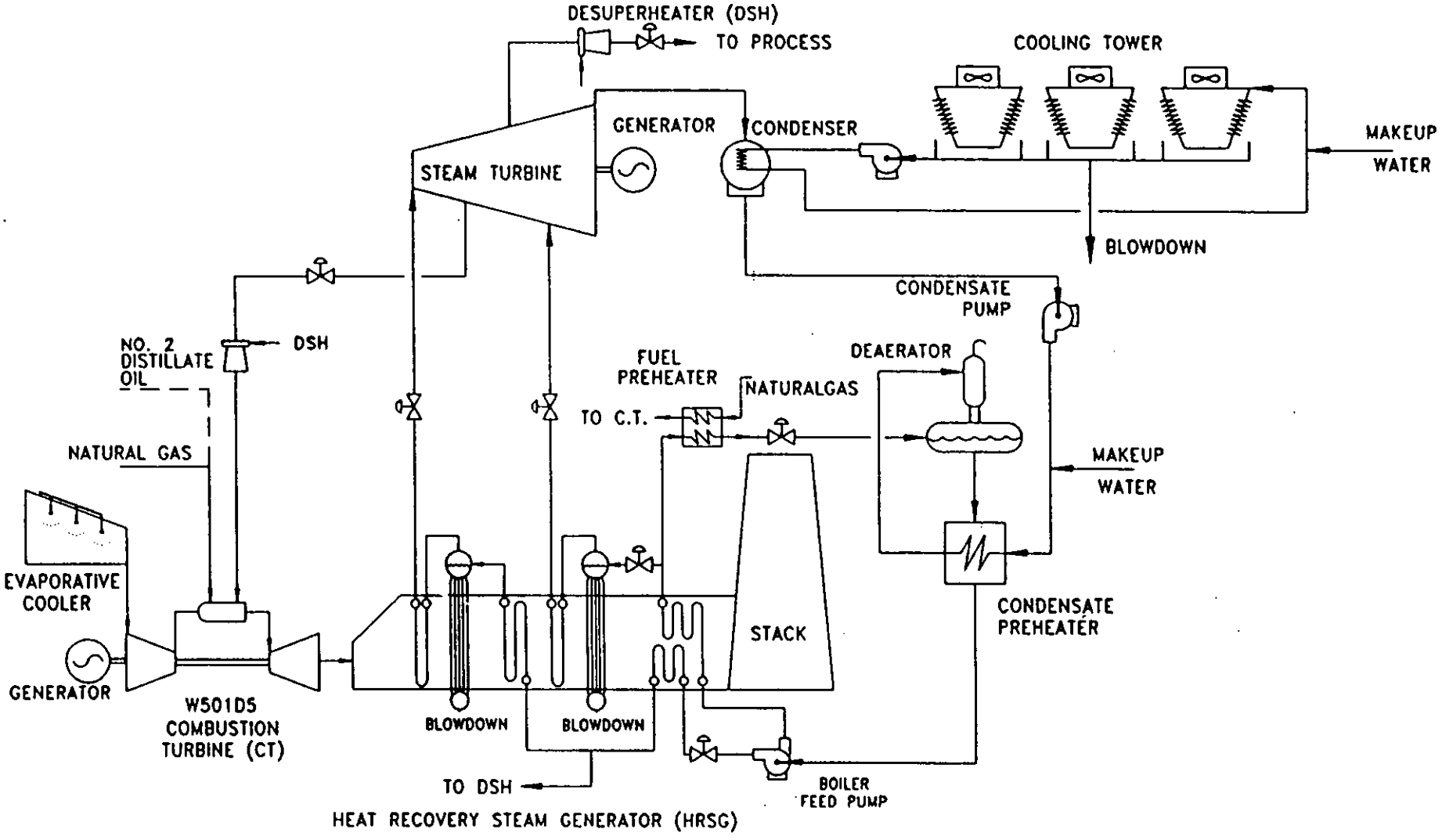
Turbine Conditions			F				Pb			
Unit Load (%)	Ambient Temperature (oF)	Heat Input (LHV) (MMBtu/hr)	Emission Factor (lb/TBtu)	Emission Rates (lb/hr)	Emission Rates (ton/yr)	Emission Rates (lb/MMBtu)	Emission Factor (lb/TBtu)	Emission Rates (lb/hr)	Emission Rates (ton/yr)	Emission Rates (lb/MMBtu)
100	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

AUBURNDALE POWER PARTNERS

COGENERATION POWER FACILITY

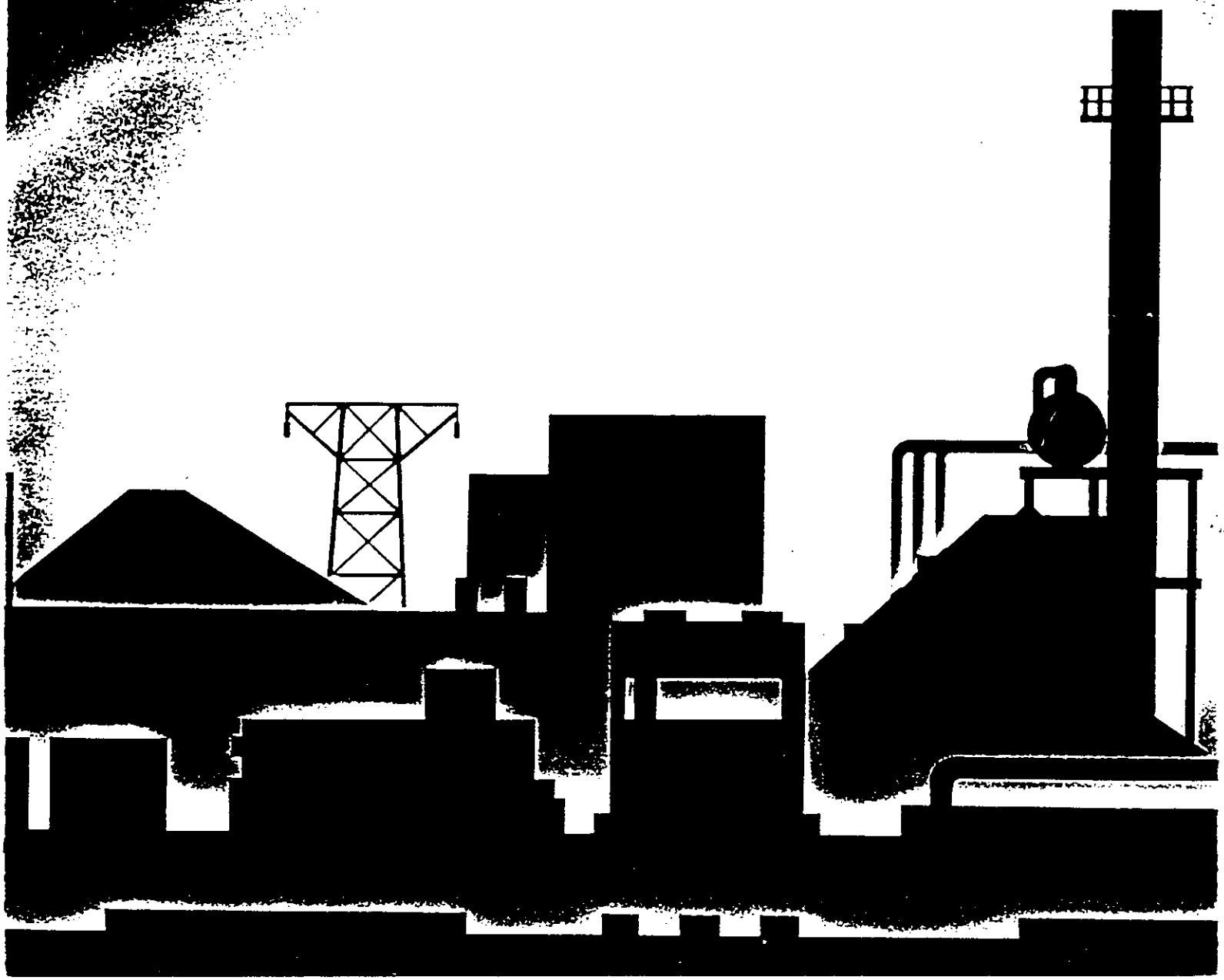
PROCESS FLOW DIAGRAM



WESTINGHOUSE ELECTRIC CORP. POWER GENERATION PROJECTS DIVISION - ORLANDO, FL	REV. 0
CCD DOCUMENT NO. - CCD-HB-1126	LEVEL: 1
PREPARED BY: M. Krouch	DATE: 4/2/92
APPROVED BY: E. W. Gardner	DATE: 4/2/92

Westinghouse
W501D Combustion Turbine

Guide to
System



Is your RETURN ADDRESS completed on the reverse side?

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 will show to whom the article was delivered and the date delivered.

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:

Mr. Don Fields
Executive Director
Auburndale Power Partners, L.P.
Auburndale, Florida 33823
1501 Derby Avenue

4a. Article Number
z127 632 551

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

7. Date of Delivery
10-31

5. Signature (Addressee)
Peggy L. Morgan

6. Signature (Agent)

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

PS Form 3811, December 1991 ☆U.S. GPO: 1993—352-714 **DOMESTIC RETURN RECEIPT**

Thank you for using Return Receipt Service.

Z 127 632 551

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

UNITED STATES POSTAL SERVICE

Sent to
Mr. Don Fields, Exec. Dir.
Auburndale Power Partners, L.
1501 Derby Avenue
P.O., State and ZIP Code
Auburndale, Florida 33823

Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, and Addressee's Address	
TOTAL Postage & Fees	$

Postmark or Date
10/25/95 Fee Request

PS Form 3800, March 1993

Oxel:cc

Department of Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

October 25, 1995

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

Mr. Don Fields
Executive Director
Auburndale Power Partners, L.P.
1501 Derby Avenue
Auburndale, Florida 33823

Dear Mr. Fields:

The Bureau of Air Regulation received your September 15, 1995, request to amend permit AC53-208321 issued to Auburndale Power Partners, L.P. According to Rule 62-4.050(4)(q) 4., before we can begin processing your request, we will need a $250 processing fee. If you have any questions, please call Patty Adams at (904)488-1344.

Sincerely,

A. A. Linero, P.E.
Administrator
Bureau of Air Regulation

AAL/kw

MISSION OPERATION & MAINTENANCE, INC.
AUBURNDALE POWER PROJECT
1501 DERBY AVE. 813-965-1561
AUBURNDALE, FL 33823

1632

63-27/631
40

Nov. 7 19 95

Pay to the order of Florida Department of Environmental Protection $ 250.00

Two hundred fifty and 00/100 Dollars

NationsBank | USA
Official Sponsor 1994/1996 U.S. Olympic Teams

NationsBank of Florida, N.A.
Winter Haven, Florida 40

For Permit Amendment 520-111000

David K. Sanchez

⑈001632⑈ ⑆063100277⑆ 3603254333⑈

AUBURNDALE POWER PARTNERS

LIMITED PARTNERSHIP

12500 Fair Lakes Circle • Suite 300
Fairfax, Virginia 22033-3804
Phone (703) 222-0445 • Fax (703) 222-5524

1501 Derby Avenue
Auburndale, Florida 33823
Phone (813) 967-0300 • Fax (813) 967-8847

May 19, 1994
APP.423

Mr. Preston Lewis
Florida Department of
Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RE: Auburndale Power Partners Limited Partnership
FDEP AC53-208321
PSD-FL-185

Dear Mr. Lewis:

The purpose of this letter is to request revisions to the allowable emission rates for the Auburndale Power Partners cogeneration project. As discussed with Ms. Theresa Heron, a review of the above referenced permit indicated discrepancies between requested and permitted emission rates for three trace metal contaminants. Emission estimates for mercury (Hg), arsenic (As), and lead (Pb) were provided to the Florida Department of Environmental Protection in correspondence dated April 27, 1992, which is attached. A comparison between these requested emission rates and the current permitted rates contained in Table 1 of FDEP permit AC53-208321 is provided as follows:

Pollutant	Fuel	Units	Requested Emissions	Permitted Emissions
Mercury	Gas	lb/hr	0.014	0.001
Arsenic	Oil	ton/yr	0.88	0.05
Lead	Oil	ton/yr	0.57	0.51

The requested emission rates are consistent with the permitted rates specified in terms of pounds per million British thermal units (lb/MMBtu). Auburndale Power Partners would therefore appreciate having FDEP permit AC53-208321 revised to reflect the requested emission rates shown above for Hg, As and Pb.

With respect to testing procedures, Specific Condition No. 10 of FDEP permit AC53-208321 states that ASTM D4292 can be used to determine the sulfur content of liquid fuels. Inasmuch as NSPS Subpart GG requires the use of ASTM D2880-71 for this analysis, it is requested that method ASTM D2280-71 also be allowed for the analysis of liquid fuel sulfur content. Specific Condition No. 12 requires the monitoring of mercury stack emissions or fuel sampling "using methods acceptable to the Department". As indicated in the Emission Testing Protocol recently approved by FDEP, EPA method 7471, Cold Vapor Atomic Absorption Spectrophometry, will be used to analyze the mercury content of liquid fuels. Because natural gas has a negligible mercury content, it is requested that Specific Condition 12 be revised to apply only to liquid fuels.

If you have any questions regarding this letter, please do not hesitate to call Neal Pospisil or me at (703) 222-0445.

Sincerely,

Edward P. Hopkins
Project Manager

EPH/pdk
cc: Don Fields
Patricia Haslach
Neal Pospisil
Bob Riley
Gene Bergfield (Mission O&M)

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.

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

5200 Newberry Road
Suite E-1
Gainesville, FL
32607

(904)
336-0444

FAX (904)
335-0373

(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.

GENERAL

(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 1.8×10^6 barrels, or 80×10^6 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, P.E.
Senior Engineer

TWD/tsw

Enclosures

cc: P. Haslach, Mission Energy

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 = 836,933 MMBtu/hr

   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 = 124,337 MMBtu/hr

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 = 206,435 MMBtu/yr

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

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

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 Rates (tpy)	Emission Reduction (tpy)	Economic Impacts: Installed Capital Cost ($)	Total Annualized Cost ($/yr)	Cost Effectiveness Over Baseline ($/ton)	Energy Impacts: Increase Over Baseline (MMBtu/yr)	Environmental Impacts: Toxic Impact (Y/N)	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	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

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

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

$$NO_x = \frac{(42.823 \text{ MM ft}^3\text{/hr}) * (43 \text{ ft}^3 \text{ NO}_x\text{/MM ft}_3) * (46 \text{ lb NO}_x\text{/lb-mole})}{(378.54 \text{ ft}^3 \text{ NO}_x\text{/lb-mole})}$$

NO_x = 224 lb/hr

NO_x = 230 lb/hr	(with margin for testing variability)

Natural Gas

$$NO_x = \frac{(40.978 \text{ MM ft}^3\text{/hr}) * (26 \text{ ft}^3 \text{ NO}_x\text{/MM ft}_3) * (46 \text{ lb NO}_x\text{/lb-mole})}{(378.54 \text{ ft}^3 \text{ NO}_x\text{/lb-mole})}$$

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:

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

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			NOx			CO			VOC		
			(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(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			NOx			CO			VOC		
			(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(lb/MMBtu)	(lb/hr)	(ton/yr)	(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

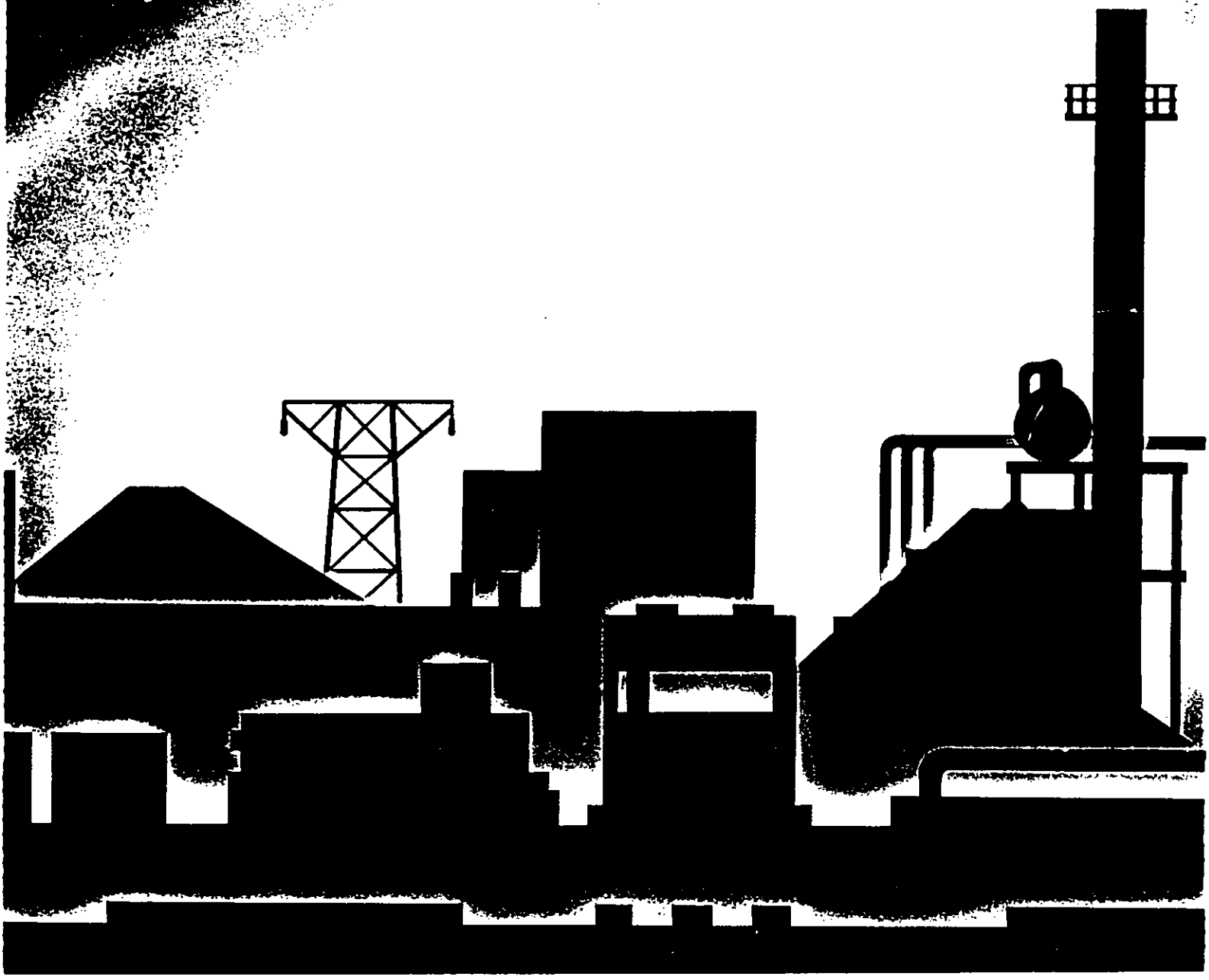
B. Distillate Fuel Oil (cont.)

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

Westinghouse
W501D Combustion Turbine

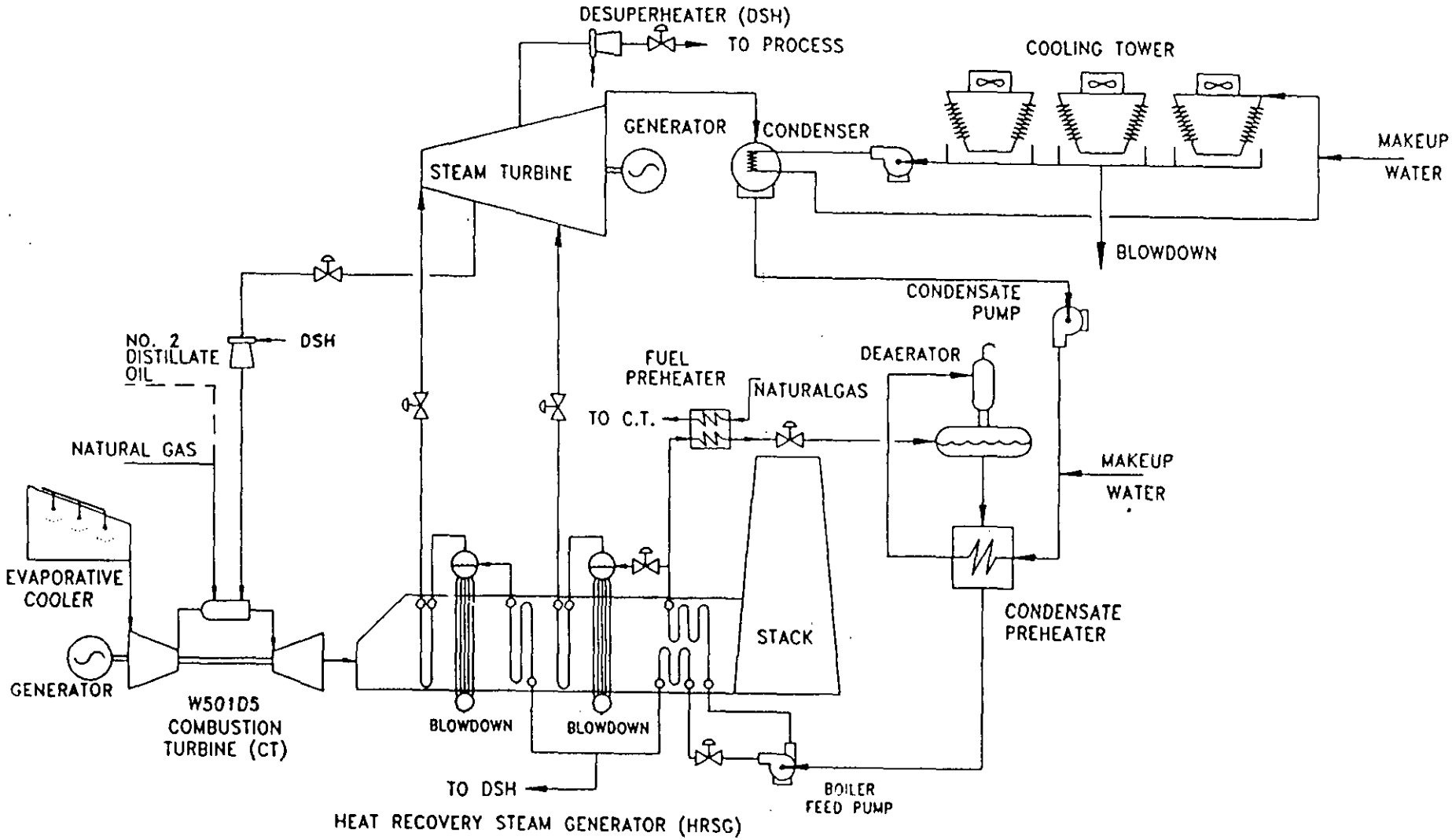
Guide to
System



AUBURNDALE POWER PARTNERS

COGENERATION POWER FACILITY

PROCESS FLOW DIAGRAM



WESTINGHOUSE ELECTRIC CORP. POWER GENERATION PROJECTS DIVISION - ORLANDO, FL		REV. 0
CCD DOCUMENT NO. - CCD-HB-1126	LEVEL: 1	
PREPARED BY: M. Kunsh	DATE: 4/2/92	
APPROVED BY: E. W. Faulmer	DATE: 4/2/92	

Patty file

AUBURNDALE POWER PARTNERS

LIMITED PARTNERSHIP

12500 Fair Lakes Circle • Suite 300
Fairfax, Virginia 22033-3804
Phone (703) 222-0445 • Fax (703) 222-5524

1501 Derby Avenue
Auburndale, Florida 33823
Phone (813) 967-0300 • Fax (813) 967-8847

March 28, 1994
APP.401

Mr. Preston Lewis
Supervisor of Air Permitting
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RE: Auburndale Power Partners, Limited Partnership Actual Start-Up Date

Dear Mr. Lewis:

To comply with Auburndale Power Partners, Limited Partnership's (APP) Prevention of Significant Deterioration Air Permit (Permit Number: AC53-208321, PSD-FL-185), APP is formally providing written notification of its actual start-up date. The combustion turbine was initially fired for start-up purposes on Friday, March 25, 1994.

If you have any questions regarding this protocol, please do not hesitate to call Neal Pospisil or me at (703) 222-0445.

Sincerely,

E.P. Hopkins
Project Manager

EPH/pdk

cc: Don Fields
Patricia Haslach
Neal Pospisil
Bob Riley
Gene Bergfield (Mission O&M)
Axel Santiago (Mission O&M)

Chief, Air Enforcement Branch
U.S. Environmental Protection Agency, Region IV
345 Courtland Street N.E.
Atlanta, GA 30365

File: 10-2.3.4

AUBURNDALE POWER PARTNERS

LIMITED PARTNERSHIP

Patty file

12500 Fair Lakes Circle • Suite 300
Fairfax, Virginia 22033
Phone (703) 222-0445 • Fax (703) 222-5524

1501 Derby Avenue
Auburndale, Florida 33823
Phone (813) 967-0300 • Fax (813) 967-8847

January 26, 1994
APP.320

Mr. Preston Lewis
Supervisor of Air Permitting
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RE: Auburndale Power Partners, Limited Partnership Anticipated Start-Up Date

Dear Mr. Lewis:

To comply with Auburndale Power Partners, Limited Partnerships (APP) Prevention of Significant Deterioration Air Permit (Permit Number: AC53-208321, PSD-FL-185), APP is formally providing written notification of its anticipated start-up date. Currently, APP is scheduled to initially fire the Combustion Turbine on March 11, 1994.

If you have any questions regarding the anticipated start-up schedule, please do not hesitate to call Neal Pospisil or me at (703) 222-0445.

Sincerely,

Ed Hopkins

Ed Hopkins
Project Manager

cc: Don Fields
Patricia Haslach
Bob Riley
Jim Lynn
Neal Pospisil
Dave Sanches (Mission O&M)
Bob Bitteker
Y. Harper, EPA Atlanta
File: 10-2.3
R. Harmon, SW Dist

Chief, Air Enforcement Branch
U.S. Environmental Protection Agency, Region IV
345 Courtland Street N.E.
Atlanta, GA 30365

AUBURNDALE POWER PARTNERS
LIMITED PARTNERSHIP
12500 Fair Lakes Circle, Suite 420 • Fairfax, Va 22033
(703) 222-0445 • (703) 222-0516 Fax

February 3, 1993
APP.020

Mr. Preston Lewis
Supervisor of Air Permitting
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

SUBJECT: NOTIFICATION OF COMMENCEMENT OF CONSTRUCTION

Dear Preston:

As we discussed earlier in our telephone conversation today, the Auburndale Power Partners, Limited Partnership (PSD Permit #AC53-208321) commenced construction on February 1, 1993. If you have any questions or comments, please do not hesitate to call me.

Sincerely,

Neal Pospisil
Environmental Engineer

NP/cvf

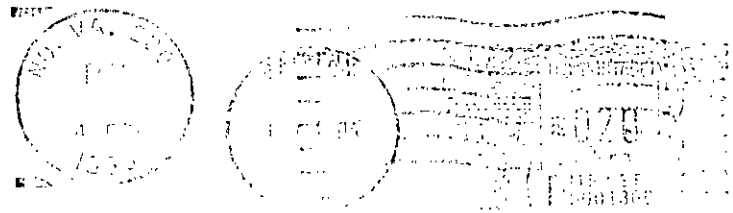
cc: Don Fields
Patricia Haslach
Ed Hopkins
Jim Lynn

File: 10-2.3

AUBURNDALE
POWER PARTNERS

12500 FAIR LAKES CIRCLE
SUITE 420

FAIRFAX, VIRGINIA
22033



Mr. Preston Lewis
Supervisor of Air Permitting
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

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

JAN 14 1993

4APT-AEB

RECEIVED

JAN 18 1993

Division of Air Resources Management

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 your final determination and Prevention of Significant Deterioration (PSD) permit for the above referenced facility, dated December 17, 1992. The proposed facility will produce approximately 156 megawatts (MW) of electricity and will also provide steam to several nearby manufacturing plants. The proposed combined cycle system will consist of one 104 MW Westinghouse 501D5 combustion turbine, one 52 MW steam turbine generator, and one unfired heat recovery steam 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. In addition, this facility will meet revised, lower NO_x limits no later than September 30, 1997, through advanced combustor design or the use of selective catalytic reduction.

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

Sincerely yours,

Brian L. Beals, Chief
Source Evaluation Unit
Air Enforcement Branch
Air, Pesticides, and Toxics
Management Division