EXHIBIT D

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: *Fossil Fuel Steam Generator* [ ] New[1] [X] Existing[1]

APPLICATION TYPE: [ ] Construction [ ] Operation [X] *Amendment to existing Operation Permit*

COMPANY NAME: *Florida Power & Light Company* COUNTY: *Volusia*

Identify the specific emission point source(s) addressed in this application (i.e., Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) *Sanford Unit 4*

SOURCE LOCATION: Street *Lake Monroe off Highway 17-92* City *Sanford*

UTM: East *17-468.3* North *3190.3*

Latitude *28* ° *50* ' *31* "N Longitude *81* ° *19* ' *32* "W

APPLICANT NAME AND TITLE: *Charles D. Henderson, P.E., Manager of Air & Water Permitting and Programs*

APPLICANT ADDRESS: *P.O. Box 078768, West Palm Beach, FL 33407-0768*

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of *Florida Power & Light*

I certify that the statements made in this application for an *amendment to existing Operation Permit* permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

*Attach letter of authorization

Signed: C. D. Henderson

Charles D. Henderson, P.E.,
Mgr of Air & Water Permitting and Programs
Name and Title (Please Type)

Date: *5/13/92* Telephone No. *(407) 697-6960*

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)
This is to certify that the engineering features of this pollution control project have been ~~designed~~/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that

[1]See Florida Administration Code Rule 17-2.100(57) and (104)

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed _____

Kennard F. Kosky

Name (Please Type)

KBN Engineering and Applied Sciences, Inc.

Company Name (Please Type)

1034 N.W. 57th Street, Gainesville, FL 32605

Mailing Address (Please Type)

Florida Registration No. *14996* Date: *5/8/92* Telephone No. *(904) 331-9000*

SECTION II: GENERAL PROJECT INFORMATION

A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

Co-firing of Orimulsion with natural gas and residual oil. The amount of Orimulsion fired with natural gas will be controlled to meet proposed emission limits of 1.6 lb $SO_2/10^6$ Btu heat input and 0.1 lb particulate/10^6 Btu heat input (plus an allowance for soot blowing). See Attachment A for further description.

B. Schedule of project covered in this application (Construction Permit Application Only)

Start of Construction *NA (SEE NOTE BELOW)* Completion of Construction *NA (SEE NOTE BELOW)*

C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

No change in the existing pollution control equipment, i.e. cyclones (see Section III D).

D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

AO64-132055 Issued 12/16/87 Expires 10/17/92

AC64-180842 Issued 10/2/90 (test burn permit) Expires 6/30/92 or upon consumption of 90 full-power burn days.

Note: The proposed co-firing natural gas and Orimulsion does not require any physical changes to the unit or fuel system.

E. Requested permitted equipment operating time: hrs/day *24*; days/wk *7*; wks/yr *52*;

If power plant, hrs/yr *8,760*; if seasonal, describe: _____

F. If this is a new source or major modification, answer the following questions. (Yes or No) ***Not Applicable***

1. Is this source in a non-attainment area for a particular pollutant? _____

a. If yes, has "offset" been applied? _____

b. If yes, has "Lowest Achievable Emission Rate" been applied? _____

c. If yes, list non-attainment pollutants. _____

2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. _____

3. Does the State "Prevention of Significant Deterioration" (PSD) requirement apply to this source? If yes, see Sections VI and VII. _____

4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? _____

5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? _____

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? *No*

a. If yes, for what pollutants? _____

b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

Attach all supportive information related to any answer of "Yes". Attach any justification for any answer of "No" that might be considered questionable.

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable: *No change from existing condition*

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): *N/A*

2. Product Weight (lbs/hr): *N/A*

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

(SEE ATTACHMENT A, TABLE A-1)

Name of Contaminant	Emission[1]		Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission lbs/hr	Potential[4] Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	

[1]See Section V, Item 2.

[2]Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

[3]Calculated from operating rate and applicable standard.

[4]Emission, if source operated with~~out~~ control (See Section V, Item 3).

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency[a]	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
Multicyclones	*Particulate*	*30.3%*	*0-5 μm*	*Manufacturer*
		66.2%	*5-10 μm*	*Manufacturer*
		86.6%	*10-20 μm*	*Manufacturer*
		99.1%	*20-45 μm*	*Manufacturer*
		99.5%	*> 45 μm*	*Manufacturer*

[a] *Actual efficiency expected to be lower for fossil fuel combustion products.*

E. Fuels *(Maximum Orimulsion contribution during co-firing with a corresponding amount of natural gas; see Attachment A)*

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
Orimulsion	*NA*	*136,615 lb/hr*	*1,776*
Natural gas	*NA*	*2.54[a] MMCF*	*2,538*
Total		*264,927 lb/hr*	*4,314*

*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, others--lbs/hr.
[a] *Natural gas heating value = 1,000 Btu/scf and 19,780 Btu/lb; NA = not applicable.*

Fuel Analysis: *(TYPICAL UNLESS OTHERWISE NOTED)*

Percent Sulfur: *1 grain per 100 CF-gas/2.8 Orimulsion* Percent Ash: *0.21 for Orimulsion*

Density: *8.4 for Orimulsion* lbs/gal Typical Percent Nitrogen: *0.5 for Orimulsion*

Heat Capacity: *19,780 gas/13,000 Orimulsion* BTU/lb *110,000 for Orimulsion* BTU/gal

Other Fuel Contaminants (which may cause air pollution): *see Tables A-1, A-2, and A-3.*

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average *N/A* Maximum

G. Indicate liquid or solid wastes generated and method of disposal.

No change from disposal methods currently approved by the Department.

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: *400* ft. Stack Diameter: *19.2* ft.

Gas Flow Rate: *~1,600,000* ACFM *~840,000* DSCFM Gas Exit Temperature: *~375-400* °F.

Water Vapor Content: *~17* % Velocity: *~92* FPS

Note: Natural gas and Orimulsion co-firing flow characteristics were developed from co-firing tests.

SECTION IV: INCINERATOR INFORMATION

Not Applicable

Type of Waste	Type 0 (Plastics)	Type II (Rubbish)	Type III (Refuse)	Type IV (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste _____

Total Weight Incinerated (lbs/hr) _____ Design Capacity (lbs/hr) _____

Approximate Number of Hours of Operation per day _____ day/wk _____ wks/yr. _____

Manufacturer _____

Date Constructed _____ Model No. _____

	Volume $(ft)^3$	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: _____ ft. Stack Diameter: _____ Stack Temp. _____

Gas Flow Rate: _____ ACFM _____ DSCFM* Velocity: _____ FPS

*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control devices: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify) _____

Brief description of operating characteristics of control devices: _____

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
   Not Applicable
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods, 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.
   See Attachment A; Table A-1; Table A-3
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
   See Attachment A; Table A-1
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)
   Not Applicable
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency). ***Not Applicable***

6. An 8 ½" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained. ***See Attachment A; Figure A-3***

7. An 8 ½" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map).
   See Attachment A; Figure A-1
8. An 8 ½" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.
   See Attachment A; Figure A-2

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation. ***Applicable fee enclosed***

10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit. ***Not Applicable***

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

Not Applicable

A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

[ ] Yes [ ] No

Contaminant	Rate or Concentration

B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

[ ] Yes [ ] No

Contaminant	Rate or Concentration

C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration

D. Describe the existing control and treatment technology (if any).

1. Control Device/System:
2. Operating Principles:
3. Efficiency:*
4. Capital Costs:

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary).

1.

a. Control Devices:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected:

1. Control Device:

2. Efficiency:[1]

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:[2]

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

b. (1) Company:

(2) Mailing Address:

(3) City: (4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

10. Reason for selection and description of systems:

[1]Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

Not Applicable

A. Company Monitored Data

1. _____ no. sites _____ TSP _____ ( ) SO^{2*} _____ Wind spd/dir

Period of Monitoring ____/____/____ to ____/____/____
month day year month day year

Other data recorded _____

Attach all data or statistical summaries to this application.

*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

a. Was instrumentation EPA referenced or its equivalent? [ ] Yes [ ] No

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

B. Meteorological Data Used for Air Quality Modeling

1. _____ Year(s) of data from _____/_____/_____ to _____/_____/_____
month day year month day year

2. Surface data obtained from (location)_____

3. Upper air (mixing height) data obtained from (location) _____

4. Stability wind rose (STAR) data obtained from (location) _____

C. Computer Models Used

1. _____ Modified? If yes, attach description.

2. _____ Modified? If yes, attach description.

3. _____ Modified? If yes, attach description.

4. _____ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate
TSP	_____ grams/sec
SO^2	_____ grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e, jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

ATTACHMENT A

1.0 BACKGROUND

The Florida Power & Light Company (FPL) Sanford Plant is located in Volusia County adjacent to Lake Monroe (see Figure A-1). The Sanford Plant comprises three fossil-fuel-fired steam electric generating units, designated as Units No. 3, 4, and 5 (see Figure A-2). Unit No. 3 is a 160-megawatt (MW) class unit placed in service in 1959, and Units No. 4 and 5 are 400-MW class units placed in service in 1972 and 1973, respectively.

Sanford Unit No. 4 includes a Foster-Wheeler steam generator originally designed to fire a variety of fossil fuels and has been typically fired with liquid fossil fuels and natural gas, as currently authorized under Florida Department of Environmental Regulation (FDER) air permit No. AO64-132055. The unit is classified as an "existing fossil fuel steam generator" and is subject to the emission-limiting standards set forth in Florida Administrative Code (FAC) Rule 17-2.600(5)(a).

Orimulsion is a heavy hydrocarbon fuel consisting of an emulsion of a heavy bitumen in water. On October 4, 1990, FPL received authorization (FDER permit number AC64-180842; PSD-FL-150; Research and Testing Order) to test burn Orimulsion in Unit 4. The results of this test indicated that Orimulsion could effectively be burned in Unit 4 as an alternative fuel either by itself or in conjunction with natural gas.

In January 1992, FPL requested an amendment to its air operation permit for Sanford Unit No. 4 (AO64-132055) to co-fire natural gas and the Orimulsion remaining at the Sanford plant and at the Port of Jacksonville. On February 12, 1992, the air operation permit for Unit No. 4 was amended to allow FPL to co-fire approximately 200,000 barrels of Orimulsion with natural gas through June 30, 1992. The remaining Orimulsion was co-fired with natural gas under the terms of the permit, as amended, concluding on April 17, 1992.

2.0 PROJECT DESCRIPTION

Sanford Unit 4 currently has the full capability of burning residual oil, natural gas, and Orimulsion. No additional equipment or modifications to

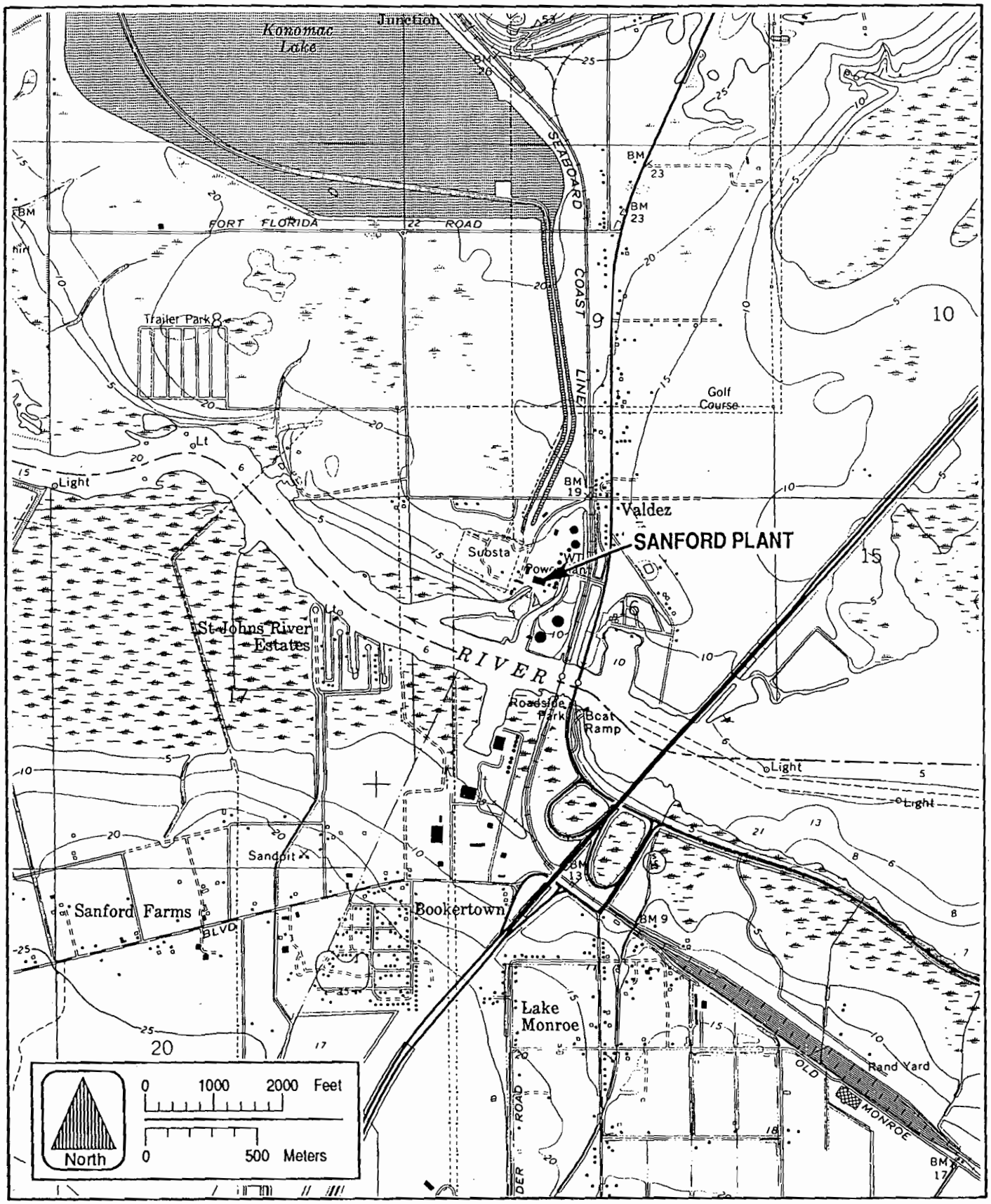

Figure A-1 SANFORD PLANT LOCATION MAP

KBN

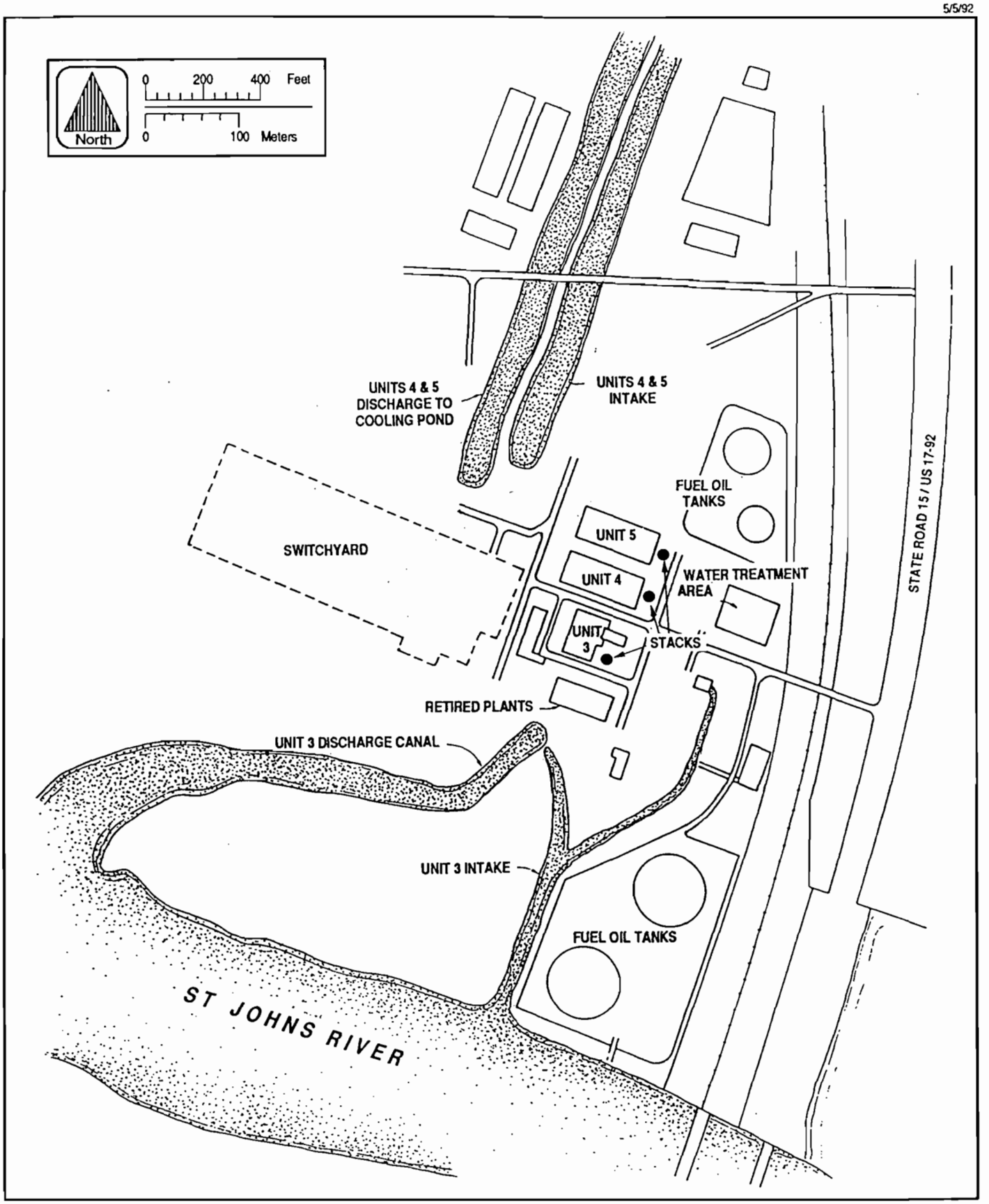

Figure A-2 PLOT PLAN OF FPL SANFORD PLANT

KBN

existing equipment will be required for co-firing. A flow diagram of Unit No. 4 is provided in Figure A-3. FPL proposes to co-fire a mixture of natural gas and Orimulsion. The maximum amount of Orimulsion that will be co-fired with natural gas will be consistent with the proposed emission limits. The proposed emission limits are at or below those currently authorized for Unit 4.

Because the cost of Orimulsion is lower than residual oil or natural gas, this project will allow FPL's customers to directly benefit from co-firing.

During certain operating conditions, Orimulsion, natural gas, and residual oil will be co-fired. Under these conditions, the amount of Orimulsion and natural gas co-fired will be reduced, but in proportion to meet the proposed emission limits. Residual oil will be used to make up any difference between the load with Orimulsion/natural gas co-firing and full load. For example, if natural gas and Orimulsion make up 50 percent of full load, the ratio will be approximately 30:20 with the remaining 50 percent load made up by firing residual oil. The amount of Orimulsion and residual oil used during co-firing will meet the proposed emission limits.

3.0 REGULATED POLLUTANT EMISSIONS

Maximum potential air emissions from Unit No. 4 when burning either No. 6 oil, natural gas, or natural gas and Orimulsion are presented in Table A-1. The maximum allowable emissions when burning No. 6 (i.e., residual) oil, based upon limitations in Rule 17-2.600 (5)(a) Florida Administrative Code (FAC) and the current operating permit, are as follows:

Particulate matter	- 0.1 lb/million (MM) Btu (steady state)
	- 0.3 lb/MM Btu, maximum 3-hours (soot blowing/load changes)
Sulfur dioxide	- 2.75 lb/MM Btu
Visible Emissions	- 40 percent opacity (steady state)
	- 60 percent opacity (soot blowing/load changes)

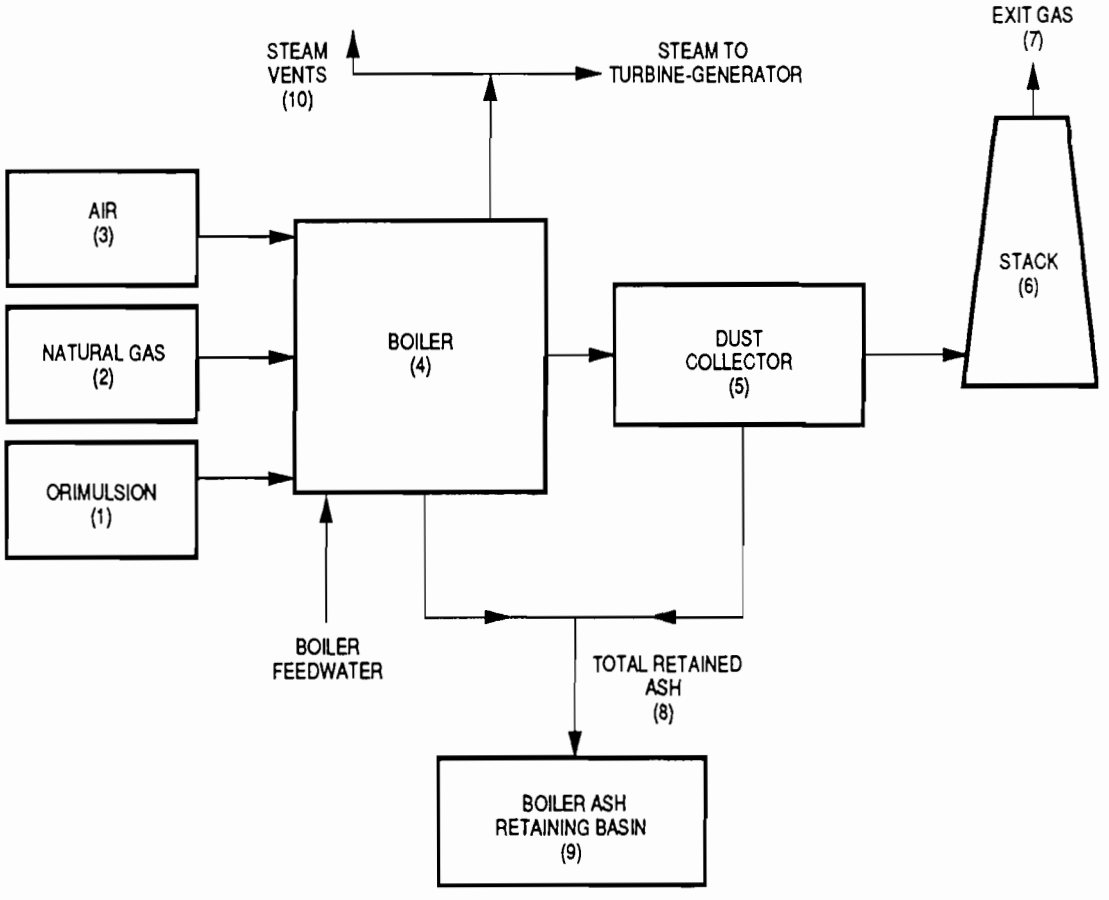

Figure A-3 FLOW DIAGRAM, SANFORD UNIT 4

Table A-1. Maximum Estimated Emissions for Residual Oil, Natural Gas and Natural Gas/Orimulsion Firing at FPL Sanford Unit 4 (Page 1 of 2)

Data	Residual Oil	Natural Gas	Natural Gas and Orimulsion[a]
Heat Input (10^6 Btu/hr)	4,050	4,230	4,314
Fuel Flow (lb/hr)	221,311	213,852	264,927
Sulfur Dioxide			
Emissions Basis	Permit	See Note b	See Note c
Emissions Basis (lb/10^6 Btu)	2.75	0.00286	1.60
Emissions (lb/hour)	11,138	12	6,902
Emissions (tons/year)[d]	48,782	53	30,233
Particulate Matter			
Emissions Basis	Permit[e]	AP-42	Permit[e]
Emissions Basis (lb/10^6 Btu)	0.125	0.0050	0.125
Emissions (lb/hour)	506	21	539
Emissions (tons/year)[d]	2,217	93	2,262
Particulate Matter (PM10)			
Emissions Basis	Permit[e]	AP-42	Permit[e]
Emissions Basis (lb/10^6 Btu)	0.125	0.0050	0.125
Emissions (lb/hour)	506	21	539
Emissions (tons/year)[d]	2,217	93	2,362
Nitrogen Oxides			
Emissions Basis	AP-42[f]	AP-42	Test Results
Emissions Basis (lb/10^6 Btu)	0.70	0.55	0.56
Emissions (lb/hour)	2,834	2,327	2,426
Emissions (tons/year)[d]	12,412	10,190	10,626
Carbon Monoxide			
Emissions Basis	AP-42	AP-42	AP-42
Emissions Basis (lb/10^6 Btu)	0.03	0.04	0.04
Emissions (lb/hour)	135	169	161
Emissions (tons/year)[d]	591	741	704
Volatile Organic Compounds			
Emissions Basis	AP-42	AP-42	Test Results
Emissions Basis (lb/10^6 Btu)	0.005	0.0014	0.0032
Emissions (lb/hour)	20.5	5.9	13.7
Emissions (tons/year)[d]	89.8	25.9	59.9
Lead			
Emissions Basis	EPA(1989)	--	Test Results
Emissions Basis (lb/10^6 Btu)	2.80E-05	neg.	ND
Emissions (lb/hour)	0.11	0.00	ND
Emissions (tons/year)[d]	0.50	0	ND
Sulfuric Acid Mist			
Emissions Basis	AP-42	AP-42	Test Results
Emissions Basis (lb/10^6 Btu)	0.048	2.86E-05	0.0030
Emissions (lb/hour)	196	0.12	12.9
Emissions (tons/year)[d]	857	1	57
Total Fluorides			
Emissions Basis	EPA (1981)	EPA (1981)	
Emissions Basis (lb/10^6 Btu)	6.29E-06	neg.	2.59E-06
Emissions (lb/hour)	2.55E-02	0.00	1.12E-02
Emissions (tons/year)[d]	1.12E-01	0	4.89E-02
Mercury			
Emissions Basis	EPA (1989)	KBN (1992)	Test Results
Emissions Basis (lb/10^6 Btu)	3.20E-06	2.70E-08	1.02E-07
Emissions (lb/hour)	1.30E-02	1.14E-04	4.41E-04
Emissions (tons/year)[d]	5.68E-02	5.00E-04	1.93E-03

Table A-1. Maximum Estimated Emissions for Residual Oil, Natural Gas and Natural Gas/Orimulsion Firing at FPL Sanford Unit 4 (Page 2 of 2)

Data	Residual Oil	Natural Gas	Natural Gas and Orimulsion[a]
Beryllium			
Emissions Basis	EPA (1989)	Test Results	
Emissions Basis (lb/10^6 Btu)	4.20E-06	neg.	2.53E-08
Emissions (lb/hour)	1.70E-02	0.00	1.09E-04
Emissions (tons/year)[d]	7.45E-02	0	4.78E-04
Arsenic			
Emissions Basis	EPA (1989)	Test Results	
Emissions Basis (lb/10^6 Btu)	1.90E-05	neg.	1.01E-06
Emissions (lb/hour)	7.70E-02	0.00	4.35E-03
Emissions (tons/year)[d]	3.37E-01	0	1.91E-02

[a] Based on 60% full load with natural gas(2,538 10^6 Btu/hr) and 40% full load on Orimulsion (1,776 10^6 Btu/hr).
[b] 1 grain sulfur/100 scf from Florida Gas Transmission data.
[c] Amount of Orimulsion will be adjusted to meet proposed emission limit (see Table A-2).
[d] assumes 8,760 hours per year operation.
[e] based on an average of 0.1 lb/10^6 Btu for 21 hours and excess emissions of 0.3 lb/10^6 Btu for 3 hours.
[f] based on vertical fired boilers, could be as high as 1 lb/10^6 Btu due to low excess air burners.

Sources: Environmental Protection Agency (EPA). 1989. Estimating Air Toxics Emissions from Coal and Oil Combustion Sources. EPA-450/2-89-001

KBN. 1992. Mercury Emission Inventory for Florida.

Environmental Protection Agency (EPA). 1981. Emissions Assessment of Conventional Stationary Systems: Volume III. External Combustion Sources of Electricity Generation. EPA-600/7-81-003a.

The proposed maximum emission limitations and opacity limits during any period that Orimulsion is co-fired in Unit 4 are:

Particulate matter	- 0.1 lb/MM Btu (steady state)
	- 0.3 lb/MM Btu, maximum 3-hours (soot blowing/load changes)
Sulfur dioxide	- 1.6 lb/MM Btu
Visible Emissions	- 35 percent opacity (steady state)
	- 60 percent opacity (soot blowing/load changes)

The maximum emissions of particulate matter will be no higher than the present limitations for residual oil. During the Orimulsion test burn, particulate matter testing was conducted on May 28 and 29, 1991, with Unit 4 co-firing natural gas and Orimulsion at a ratio of 60 and 40 percent of total heat input, respectively. Results of this testing indicated an emission rate of 0.09 lb/MMBtu and 0.15 lb/MMBtu during steady-state and soot blowing conditions, respectively. (These tests results for co-firing were transmitted to the FDER central district office on June 12, 1991.) Opacity during the co-firing particulate test, as measured by the continuous opacity measurement instrument, averaged 18 percent under steady-state conditions and 28.5 percent under soot-blowing conditions. Compliance with the proposed sulfur dioxide limit will be assured by limiting the maximum percentage of Orimulsion in the co-firing mixture to meet the proposed limit.

As shown in Table A-1, co-firing a mixture with the maximum component of Orimulsion with natural gas will result in emission rates, for virtually all regulated pollutants, that are lower than burning No. 6 fuel oil.

4.0 NONREGULATED POLLUTANT EMISSIONS

Nonregulated pollutant emissions from co-firing of natural gas and Orimulsion were estimated using test results taken by Entropy Environmentalists Inc. in April 1991 with Unit 4 operating on 100 percent Orimulsion. A copy of these test results has been submitted to FDER as part of the Orimulsion test burn program (May 1991). Table A-2 presents a comparison of nonregulated pollutant emissions for residual oil, natural

Table A-2. Maximum Estimated Emissions for Residual Oil, Natural Gas and Natural Gas/Orimulsion Firing at FPL Sanford Unit 4 (Non-regulated Pollutants) (Page 1 of 2)

Data	Residual Oil	Natural Gas	Natural Gas and Orimulsion[a]
Antimony			
Emissions Basis	EPA (1981)		Test Results
Emissions Basis (lb/10^6 Btu)	2.33E-05	neg.	1.08E-06
Emissions (lb/hour)	9.44E-02	0.00	4.65E-03
Emissions (tons/year)[b]	0.41	0	0.020
Barium			
Emissions Basis	EPA (1981)		Test Results
Emissions Basis (lb/10^6 Btu)	6.71E-05	neg.	1.72E-06
Emissions (lb/hour)	2.72E-01	0.00	7.41E-03
Emissions (tons/year)[b]	1.19	0	0.032
Cadmium			
Emissions Basis	EPA (1989)		Test Results
Emissions Basis (lb/10^6 Btu)	1.57E-05	neg.	2.34E-06
Emissions (lb/hour)	6.36E-02	0.00	1.01E-02
Emissions (tons/year)[b]	0.28	0	0.044
Chromium			
Emissions Basis	EPA (1989)		Test Results
Emissions Basis (lb/10^6 Btu)	2.10E-05	neg.	8.07E-06
Emissions (lb/hour)	8.51E-02	0.00	3.48E-02
Emissions (tons/year)[b]	0.37	0	0.152
Copper			
Emissions Basis	EPA (1989)		Test Results
Emissions Basis (lb/10^6 Btu)	2.80E-04	neg.	4.90E-06
Emissions (lb/hour)	1.13	0.00	2.11E-02
Emissions (tons/year)[b]	4.97	0	0.093
Manganese			
Emissions Basis	EPA (1989)		Test Results
Emissions Basis (lb/10^6 Btu)	2.60E-05	neg.	8.27E-06
Emissions (lb/hour)	0.11	0.00	3.57E-02
Emissions (tons/year)[b]	0.46	0	0.156
Nickel			
Emissions Basis	EPA (1989)		Test Results
Emissions Basis (lb/10^6 Btu)	1.26E-03	neg.	1.50E-03
Emissions (lb/hour)	5.10	0.00	6.48
Emissions (tons/year)[b]	22.35	0	28.39

Table A-2. Maximum Estimated Emissions for Residual Oil, Natural Gas and Natural Gas/Orimulsion Firing at FPL Sanford Unit 4 (Non-regulated Pollutants) (Page 2 of 2)

Data	Residual Oil	Natural Gas	Natural Gas and Orimulsion[a]
Phosphorus			
Emissions Basis	EPA (1981)		Test Results
Emissions Basis (lb/10^6 Btu)	5.83E-05	neg.	1.26E-05
Emissions (lb/hour)	0.24	0.00	0.054
Emissions (tons/year)[b]	1.03	0	0.24
Selenium			
Emissions Basis	EPA (1981)		Test Results
Emissions Basis (lb/10^6 Btu)	3.73E-05	neg.	5.19E-06
Emissions (lb/hour)	0.15	0.00	0.022
Emissions (tons/year)[b]	0.66	0	0.10
Silver			
Emissions Basis	EPA (1981)		Test Results
Emissions Basis (lb/10^6 Btu)	1.63E-05	neg.	1.26E-06
Emissions (lb/hour)	0.07	0.00	5.43E-03
Emissions (tons/year)[b]	0.29	0	0.02
Thallium			
Emissions Basis	EPA (1981)		Test Results
Emissions Basis (lb/10^6 Btu)	1.09E-05	neg.	ND
Emissions (lb/hour)	0.04	0.00	ND
Emissions (tons/year)[b]	0.19	0	--
Vanadium			
Emissions Basis	EPA (1981)		Test Results
Emissions Basis (lb/10^6 Btu)	8.52E-03	neg.	5.97E-03
Emissions (lb/hour)	34.50	0.00	25.75
Emissions (tons/year)[b]	151.11	0	112.79
Zinc			
Emissions Basis	EPA (1981)		Test Results
Emissions Basis (lb/10^6 Btu)	6.71E-05	neg.	1.48E-05
Emissions (lb/hour)	0.27	0.00	0.064
Emissions (tons/year)[b]	1.19	0	0.28

[a] Based on 60% of full load on natural gas (2,538 10^6 Btu/hr) and 40% of full load on Orimulsion (1,776 10^6 Btu/hr).
[b] assumes 8,760 hours per year operation.

Sources: Environmental Protection Agency (EPA). 1989. Estimating Air Toxics Emissions from Coal and Oil Combustion Sources. EPA-450/2-89-001.

Environmental Protection Agency (EPA). 1981. Emissions Assessment of Conventional Stationary Systems: Volume III. External Combustion Sources of Electricity Generation. EPA-600/7-81-003a.

gas, and natural gas/Orimulsion. EPA emission factors were used to estimate emissions of residual oil firing. Natural gas is believed to contain negligible quantities of these pollutants.

Table A-2 indicates that nonregulated pollutant emissions produced by co-firing natural gas and Orimulsion are generally lower than those for residual oil firing except for nickel. Nickel emissions for co-firing are estimated to be 1.38 lb/hr higher than those estimated for residual oil.

5.0 EMISSION CALCULATIONS

Table A-3 presents the emission calculations for co-firing the maximum amount of Orimulsion co-fired with natural gas. EPA emission factors and the summary from the Entropy Environmentalists Inc. tests are attached. Table A-4 presents example emission calculations for co-firing Orimulsion, natural gas, and residual oil. This example is based on firing 20 percent Orimulsion, 30 percent natural gas, and 50 percent residual oil as a percent of full load. All emission rates when co-firing Orimulsion, natural gas, and residual oil will be equal to or lower than the corresponding pollutant emission rates when either firing only residual oil or co-firing the maximum percentage of Orimulsion and natural gas.

6.0 AIR QUALITY IMPACTS

The impacts of co-firing natural gas and Orimulsion will not exceed federal or state ambient air quality standards or Prevention of Significant Deterioration increments. This conclusion has been demonstrated in the modeling analysis performed for the test burn which evaluated 100 percent Orimulsion firing for Unit 4. A copy of the analysis can be found in the application for test burn.

FDER previously requested that the maximum air quality impact be determined for any potential toxic pollutants that may be emitted during co-firing. To evaluate the potential impacts of toxic pollutants, FDER has proposed a list of ambient air concentration levels for toxic pollutants (FDER, 1991). These levels are referred to as No Threat Levels (NTLs) and are intended to provide an adequate margin of safety for the maintenance of public health.

Table A-3. Emission Calculations for Co-Firing of Orimulsion and Natural Gas (Page 1 of 3)

Data	Orimulsion	Natural Gas	Total
Full Load (%)	40.00%	60.00%	100.00%
Heat Input (10^6 Btu/hr)[a]	1,776	2,538	4,314
Fuel Flow (lb/hr)	136,615	128,311	264,927
Sulfur Dioxide			
Emissions Basis	Fuel[b]	1 gr/100 cf	
Emissions Basis (lb/10^6 Btu)	Fuel[b]	0.00286	1.60
Emissions (lb/hour)	6,895	7	6,902
Particulate Matter			
Emissions Basis	Proposed[c]	AP-42	
Emissions Basis (lb/10^6 Btu)	Proposed[c]	0.0050	0.125
Emissions (lb/hour)	526	13	539
Particulate Matter (PM10)			
Emissions Basis	Proposed[c]	AP-42	
Emissions Basis (lb/10^6 Btu)	Proposed[c]	0.0050	0.125
Emissions (lb/hour)	526	13	539
Nitrogen Oxides			
Emissions Basis	Test Results[d]	AP-42	
Emissions Basis (lb/10^6 Btu)	0.58	0.55	0.562
Emissions (lb/hour)	1,030	1,396	2,426
Carbon Monoxide			
Emissions Basis	AP-42	AP-42	
Emissions Basis (lb/10^6 Btu)	0.03	0.04	0.037
Emissions (lb/hour)	59	102	161
Volatile Organic Compounds			
Emissions Basis	Test Results[d]	AP-42	
Emissions Basis (lb/10^6 Btu)	0.006	0.0014	0.003
Emissions (lb/hour)	10.1	3.6	13.7
Sulfuric Acid Mist			
Emissions Basis	Test Results	AP-42	
Emissions Basis (lb/10^6 Btu)	0.0072	2.86E-05	0.0030
Emissions (lb/hour)	12.8	0.12	12.9
Total Fluorides			
Emissions Basis	EPA (1981)		
Emissions Basis (lb/10^6 Btu)	6.29E-06	neg.	2.59E-06
Emissions (lb/hour)	0.01	0.00	1.12E-02

Table A-3. Emission Calculations for Co-Firing of Orimulsion and Natural Gas (Page 2 of 3)

Data	Orimulsion	Natural Gas	Total
Mercury			
Emissions Basis	Test Results	KBN (1992)	
Emissions Basis (lb/10^6 Btu)	2.10E-07	2.70E-08	1.02E-07
Emissions (lb/hour)	3.73E-04	6.85E-05	4.41E-04
Beryllium			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	6.15E-08	neg.	2.53E-08
Emissions (lb/hour)	1.09E-04	0.00	1.09E-04
Arsenic			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	2.45E-06	neg.	1.01E-06
Emissions (lb/hour)	4.35E-03	0.00	4.35E-03
Antimony			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	2.62E-06	neg.	1.08E-06
Emissions (lb/hour)	4.65E-03	0.00	4.65E-03
Barium			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	4.17E-06	neg.	1.72E-06
Emissions (lb/hour)	7.41E-03	0.00	7.41E-03
Cadmium			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	5.69E-06	neg.	2.34E-06
Emissions (lb/hour)	1.01E-02	0.00	1.01E-02
Chromium			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	1.96E-05	neg.	8.07E-06
Emissions (lb/hour)	3.48E-02	0.00	3.48E-02
Copper			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	1.19E-05	neg.	4.90E-06
Emissions (lb/hour)	2.11E-02	0.00	2.11E-02
Manganese			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	2.01E-05	neg.	8.27E-06
Emissions (lb/hour)	3.57E-02	0.00	3.57E-02

Table A-3. Emission Calculations for Co-Firing of Orimulsion and Natural Gas (Page 3 of 3)

Data	Orimulsion	Natural Gas	Total
Nickel			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	3.65E-03	neg.	1.50E-03
Emissions (lb/hour)	6.48	0.00	6.48
Phosphorus			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	3.05E-05	neg.	1.26E-05
Emissions (lb/hour)	5.42E-02	0.00	5.42E-02
Selenium			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	1.26E-05	neg.	5.19E-06
Emissions (lb/hour)	2.24E-02	0.00	2.24E-02
Silver			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	3.06E-06	neg.	1.26E-06
Emissions (lb/hour)	5.43E-03	0.00	5.43E-03
Vanadium			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	1.45E-02	neg.	5.97E-03
Emissions (lb/hour)	2.58E+01	0.00	2.58E+01
Zinc			
Emissions Basis	Test Results		
Emissions Basis (lb/10^6 Btu)	3.60E-05	neg.	1.48E-05
Emissions (lb/hour)	6.39E-02	0.00	6.39E-02

Note: lb/hr is calculated based on the heat input for the fuel specified. "Test Results" refer to the stack tests performed by Entropy Environmentalists Inc., April 1-5 and 8-12, 1991.

[a] The heat input based on 40% Orimulsion and 60% natural gas of full load.
Orimulsion = 4,440 10^6 Btu/hr * 0.40 = 1,776 10^6 Btu/hr
Natural Gas = 4,230 10^6 Btu/hr * 0.60 = 2,538 10^6 Btu/hr
The approximate sulfur dioxide-emission rate of Orimulsion under these conditions would be about 3.9 lb/10^6 BTU, which is in the lower sulfur range received during the co-firing test burn. This emission rate is equivalent to about 2.5 percent sulfur in Orimulsion.

[b] Based on a maximum emission rate when co-firing of 1.6 lb/10^6 Btu.

[c] Based on a maximum emission rate when co-firing of 0.1 lb/10^6 Btu under steady state (21 hours) and less than 0.3 lb/10^6 Btu for soot blowing/load changes (3 hours); PM and PM10 are assumed to be the same.

[d] Maximum from Entropy stack tests.

Table A-4. Example Emission Calculations for Co-Firing of Orimulsion, Natural Gas and Residual Oil
(Page 1 of 2)

Data	Orimulsion	Natural Gas	Residual Oil	Total
Full Load (%)	20.00%	30.00%	50.00%	100.00%
Heat Input (10^6 Btu/hr)[a]	888	1,269	2,025	4,182
Fuel Flow (lb/hr)	68,308	64,156	110,656	243,119
Sulfur Dioxide				
Emissions Basis	Fuel[b]	1 gr/100 cf	Fuel[b]	
Emissions Basis (lb/10^6 Btu)	Fuel[b]	0.00286	1.6	1.60
Emissions (lb/hour)	3,448	7	3,236	6,691
Particulate Matter				
Emissions Basis	Proposed[c]	AP-42	Permitted	
Emissions Basis (lb/10^6 Btu)	Proposed[c]	0.0050	0.125	0.125
Emissions (lb/hour)	257	13	253	523
Particulate Matter (PM10)				
Emissions Basis	Proposed[c]	AP-42	Permitted	
Emissions Basis (lb/10^6 Btu)	Proposed[c]	0.0050	0.125	0.125
Emissions (lb/hour)	257	13	253	523
Nitrogen Oxides				
Emissions Basis	Test Results[d]	AP-42	AP-42	
Emissions Basis (lb/10^6 Btu)	0.58	0.55	0.70	0.610
Emissions (lb/hour)	515	698	1,417	2,630
Carbon Monoxide				
Emissions Basis	AP-42	AP-42	AP-42	
Emissions Basis (lb/10^6 Btu)	0.03	0.04	0.03	0.034
Emissions (lb/hour)	30	51	67	148
Volatile Organic Compounds				
Emissions Basis	Test Results[d]	AP-42	AP-42	
Emissions Basis (lb/10^6 Btu)	0.006	0.0014	0.0051	0.004
Emissions (lb/hour)	5.1	1.8	10.3	17
Sulfuric Acid Mist				
Emissions Basis	Test Results	AP-42	AP-42	
Emissions Basis (lb/10^6 Btu)	0.0072	2.86E-05	4.83E-02	0.0242
Emissions (lb/hour)	6.4	0.0	97.8	104
Total Fluorides				
Emissions Basis	EPA (1981)		EPA (1981)	
Emissions Basis (lb/10^6 Btu)	6.29E-06	neg.	6.29E-06	4.25E-06
Emissions (lb/hour)	5.59E-03	0.00E+00	1.27E-02	1.83E-02
Mercury				
Emissions Basis	Test Results	KBN (1992)	EPA (1989)	
Emissions Basis (lb/10^6 Btu)	2.10E-07	2.70E-08	3.20E-06	1.55E-06
Emissions (lb/hour)	1.86E-04	3.43E-05	6.48E-03	6.70E-03
Beryllium				
Emissions Basis	Test Results		EPA (1989)	
Emissions Basis (lb/10^6 Btu)	6.15E-08	neg.	4.20E-06	1.98E-06
Emissions (lb/hour)	5.46E-05	0.00	8.51E-03	8.56E-03
Arsenic				
Emissions Basis	Test Results		EPA (1989)	
Emissions Basis (lb/10^6 Btu)	2.45E-06	neg.	1.90E-05	9.42E-06
Emissions (lb/hour)	2.18E-03	0.00	3.85E-02	4.07E-02
Antimony				
Emissions Basis	Test Results		EPA (1981)	
Emissions Basis (lb/10^6 Btu)	2.62E-06	neg.	2.33E-05	1.15E-05
Emissions (lb/hour)	2.33E-03	0.00	4.72E-02	4.95E-02
Barium				
Emissions Basis	Test Results		EPA (1981)	
Emissions Basis (lb/10^6 Btu)	4.17E-06	neg.	6.71E-05	3.24E-05
Emissions (lb/hour)	3.70E-03	0.00	1.36E-01	1.40E-01

Table A-4. Example Emission Calculations for Co-Firing of Orimulsion, Natural Gas and Residual Oil (Page 2 of 2)

Data	Orimulsion	Natural Gas	Residual Oil	Total
Cadmium				
Emissions Basis	Test Results		EPA (1989)	
Emissions Basis (lb/10^6 Btu)	5.69E-06	neg.	1.57E-05	8.54E-06
Emissions (lb/hour)	5.05E-03	0.00	3.18E-02	3.68E-02
Chromium				
Emissions Basis	Test Results		EPA (1989)	
Emissions Basis (lb/10^6 Btu)	1.96E-05	neg.	2.10E-05	1.39E-05
Emissions (lb/hour)	1.74E-02	0.00	4.25E-02	5.99E-02
Copper				
Emissions Basis	Test Results		EPA (1989)	
Emissions Basis (lb/10^6 Btu)	1.19E-05	neg.	2.80E-04	1.34E-04
Emissions (lb/hour)	1.06E-02	0.00	5.67E-01	5.78E-01
Manganese				
Emissions Basis	Test Results		EPA (1989)	
Emissions Basis (lb/10^6 Btu)	2.01E-05	neg.	2.60E-05	1.63E-05
Emissions (lb/hour)	1.78E-02	0.00	5.27E-02	7.05E-02
Nickel				
Emissions Basis	Test Results		EPA (1989)	
Emissions Basis (lb/10^6 Btu)	3.65E-03	neg.	1.26E-03	1.34E-03
Emissions (lb/hour)	3.24	0.00	2.55	5.79E+00
Phosphorus				
Emissions Basis	Test Results		EPA (1981)	
Emissions Basis (lb/10^6 Btu)	3.05E-05	neg.	5.83E-05	3.36E-05
Emissions (lb/hour)	2.71E-02	0.00	1.18E-01	1.45E-01
Selenium				
Emissions Basis	Test Results		EPA (1981)	
Emissions Basis (lb/10^6 Btu)	1.26E-05	neg.	3.73E-05	2.01E-05
Emissions (lb/hour)	1.12E-02	0.00	7.55E-02	8.67E-02
Silver				
Emissions Basis	Test Results		EPA (1981)	
Emissions Basis (lb/10^6 Btu)	3.06E-06	neg.	1.63E-05	8.29E-06
Emissions (lb/hour)	2.72E-03	0.00	3.30E-02	3.57E-02
Vanadium				
Emissions Basis	Test Results		EPA (1981)	
Emissions Basis (lb/10^6 Btu)	1.45E-02	neg.	8.52E-03	6.98E-03
Emissions (lb/hour)	1.29E+01	0.00	1.72E+01	3.01E+01
Zinc				
Emissions Basis	Test Results		EPA (1981)	
Emissions Basis (lb/10^6 Btu)	3.60E-05	neg.	6.71E-05	3.89E-05
Emissions (lb/hour)	3.20E-02	0.00	1.36E-01	1.68E-01

Note: lb/hr is calculated based on the heat input for the fuel specified. "Test Results" refer to the stack tests performed by Entropy Environmentalists Inc., April 1-5 and 8-12, 1991.

[a] The heat input based on 20% Orimulsion, 30% natural gas and 50% oil of full load.
Orimulsion = 4,440 10^6 Btu/hr * 0.20 = 888 10^6 Btu/hr
Natural Gas = 4,230 10^6 Btu/hr * 0.30 = 1,269 10^6 Btu/hr
Residual Oil = 4,050 10^6 Btu/hr * 0.5 = 2,025 10^6 Btu/hr

[b] Based on a maximum emission rate when co-firing of 1.6 lb/10^6 Btu.

[c] Based on a maximum emission rate when co-firing of 0.1 lb/10^6 Btu under steady state (21 hours) and less than 0.3 lb/10^6 Btu for soot blowing/load changes (3 hours); PM and PM10 are assumed to be the same.

[d] Maximum from Entropy stack tests.

If the maximum air quality impacts are below the NTL, the source is not considered to pose a health risk to the public. Maximum toxic element impacts of the FPL Sanford plant were determined using current regulatory-accepted air quality modeling techniques.

The appropriate model for predicting impacts for the Sanford plant is the Industrial Source Complex Short-Term (ISCST) model (EPA, 1990). The ISCST is approved by both EPA and FDER. The modeling was performed using a 5-year meteorological record of Orlando surface and Ruskin upper air data for the years 1982 to 1986.

A conservative modeling methodology was used initially to determine all total facility toxic pollutant impacts. First, the maximum impacts were determined for each Sanford unit separately using a generic emission rate. For the screening analysis, concentrations were predicted for each Sanford unit using a polar receptor grid with 10 ring distances of 900, 1200, 1600, 2000, 2500, 3000, 3500, 4000, 4500, and 5000 meters from the stack. The angular interval between adjacent receptors on the same ring was 10 degrees. Based on the screening modeling results, modeling refinements were made for the highest annual, 8-hour, and 24-hour predicted concentrations from each unit. The refined grid included downwind receptors every 200 m for the annual average and every 100 m for the 8-hour and 24-hour averaging times. The refined grid angular interval was 2 degrees.

The maximum concentrations for each toxic element were determined by multiplying the applicable generic maximum concentrations times each unit's toxic pollutant emission rate for each applicable averaging time and dividing by the generic emission rate. The maximum concentrations for each unit were then summed, regardless of their receptor location (thereby making the analysis conservative). The resulting summed concentrations were then compared to the NTL for each applicable averaging time. Some elements, such as nickel, have multiple NTLs for different forms. If the form of the element emitted did not have an NTL or if the NTL was not

known, a conservative NTL was chosen from the other available element forms (assuming the form selected could be reasonably emitted).

For most pollutants examined, the above procedure predicted maximum impacts significantly below the NTLs. The results for nickel, however, suggested that further modeling refinements be performed. For this element, a multi-source ISCST modeling analysis was performed, inputting each source's actual nickel element emission rate into the ISCST model. The screening and refinement modeling analyses were then conducted as before. The maximum obtained annual, 8-hour, and 24-hour concentrations were then compared directly to NTLs.

The maximum toxic element concentrations for the annual, 8-hour, and 24-hour averaging times are presented in Table A-5. The results of the modeling analysis indicate that all predicted element concentration levels are below their respective NTLs except for the maximum annual impact predicted for nickel. It should be recognized that the maximum annual impacts were determined by assuming each unit operates at 100 percent capacity factor and maximum emissions. This assumption is extremely conservative in that capacity factors for FPL's fossil steam units rarely exceed 70 percent. Therefore, it is expected that the annual impact of nickel emissions would be less than the NTL. Based on this analysis, toxic emissions from the Sanford plant as a result of co-firing an amount of Orimulsion with natural gas which meets the proposed emission limits are not considered to pose a health risk to the public.

7.0 SUMMARY

From an evaluation of the proposed co-firing of Orimulsion, natural gas, and residual oil in Sanford Unit 4, it can be concluded that: 1) emissions will be less than or equal to the applicable emission limits, 2) the maximum predicted impacts will be less than the federal and state ambient air quality standards and Prevention of Significant Deterioration (PSD) increments, 3) emissions are not considered to pose a health risk to the public, and 4) neither the new source performance standards (NSPS) nor the

Table A-5. FPL Sanford Maximum Predicted Trace Element Impacts[a] - Units 3 & 5 on Residual Oil and Unit 4 Co-Firing Orimulsion and Natural Gas (Page 1 of 2)

Pollutant		Total Facility Emissions (lb/hr)	Concentration(µg/m) 8-Hr	24-Hr	Annual
Total Fluorides	ALL UNITS	0.0471	0.0016	0.0007	0.00003
	NTL		25	6	NA
	NTL/Impact		15707	9001	NA
Mercury	ALL UNITS	0.0187	0.0007	0.0003	0.00001
	NTL		0.5	0.12	0.3
	NTL/Impact		686	384	22623
Beryllium	ALL UNITS	0.0240	0.0009	0.0004	0.00002
	NTL		0.02	0.0048	0.00042
	NTL/Impact		21	12	24
Arsenic	ALL UNITS	0.1126	0.0043	0.0019	0.0001
	NTL		2	0.48	0.00023
	NTL/Impact		461	259	3
Antimony	ALL UNITS	0.1375	0.0053	0.0023	0.0001
	NTL		5	0.12	0.3
	NTL/Impact		941	53	3107
Barium	ALL UNITS	0.3902	0.0152	0.0065	0.0003
	NTL		5	1.2	50
	NTL/Impact		329	184	180429
Cadmium	ALL UNITS	0.0996	0.0037	0.0016	0.0001
	NTL		0.5	0.12	0.00056
	NTL/Impact		136	76	8
Chromium (metal)	ALL UNITS	0.1546	0.0053	0.0022	0.0001
	NTL		5	1.2	1000
	NTL/Impact		949	543	10^6
Copper	ALL UNITS	1.6115	0.0631	0.0271	0.0011
	NTL		1	0.24	NA
	NTL/Impact		16	9	NA
Manganese	ALL UNITS	0.1905	0.0067	0.0028	0.0001
	NTL		50	12	NA
	NTL/Impact		7499	4271	NA
Nickel[b]	ALL UNITS	13.6577	0.24	0.08	0.0046
	NTL		0.5	0.12	0.0042
	NTL/Impact		2.1	1.5	0.9

Table A-5. FPL Sanford Maximum Predicted Trace Element Impacts[a] - Units 3 & 5 on Residual Oil and Unit 4 Co-Firing Orimulsion and Natural Gas (Page 2 of 2)

Pollutant		Total Facility Emissions (lb/hr)	Concentration(µg/m) 8-Hr	24-Hr	Annual
Phosphorus	ALL UNITS	0.3920	0.0142	0.0060	0.0003
	NTL		1	0.24	NA
	NTL/Impact		71	40	NA
Selenium	ALL UNITS	0.2351	0.0087	0.0037	0.0002
	NTL		2	0.48	NA
	NTL/Impact		230	130	NA
Silver	ALL UNITS	0.1039	0.0040	0.0017	0.0001
	NTL		0.1	0.024	3
	NTL/Impact		25	14	41687
Thallium	ALL UNITS	0.0563	0.0022	0.0010	0.00004
	NTL		1	0.24	0.5
	NTL/Impact		450	252	12330
Vanadium Pentoxide[c]	ALL UNITS	8.6763	0.2729	0.1128	0.0047
	NTL		0.5	0.12	20
	NTL/Impact		1.8	1.1	4270
Zinc (oxide)	ALL UNITS	0.4440	0.0160	0.0068	0.0003
	NTL		50	12	NA
	NTL/Impact		3126	1772	NA

Note: NTL = No-threat level.

[a] Maximum concentrations for each averaging time = Unit 3 Only Maximum + Unit 4 Only Maximum + Unit 5 Only Maximum.

[b] Maximum impacts determined from refined ISCST modeling of all three units.

[c] The vanadium pentoxide emission rate, based on worst-case estimate from Entropy tests, was 1.72×10^{-3} lb/10^6 Btu. The same emission factor was also used for residual oil firing. Using this factor for residual oil would produce conservative results since the concentration of vanadium in Orimulsion is generally higher than in residual oil being burned at the Sanford Plant.

PSD requirements are applicable to the proposed co-firing of Orimulsion, natural gas, and residual oil.

ATTACHMENT B

EMISSION FACTORS

United States
Environmental Protection
Agency

Office of Air Quality
Planning And Standards
Research Triangle Park, NC 27711

EPA-450/2-89-001
April 1989

AIR

EPA

ESTIMATING AIR TOXICS EMISSIONS FROM COAL AND OIL COMBUSTION SOURCES

TABLE 4-1. SUMMARY OF TOXIC POLLUTANT EMISSION FACTORS FOR OIL COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^{12}$ Btu)	
	Residual Oil	Distillate Oil
Arsenic	19	4.2
Beryllium	4.2	2.5
Cadmium	15.7	10.5
Chromium	21	48
Copper	280	280
Lead	28[c]	8.9[d]
Mercury	3.2	3.0
Manganese	26	14
Nickel	1260	170
POM	8.4[b]	22.5
Formaldehyde	405[e]	405[e]

[a]All emission factors are uncontrolled, and are applicable to oil-fired boilers and furnaces in all combustion sectors unless otherwise noted.

[b]This value was calculated using all available residual oil data given in Table 4-35. If the upper end of the range of available data is excluded when calculating an average value (which could be used in this table), the average factor for POM from residual oil combustion becomes 4.1 $lb/10^{12}$ BTU.

[c]Applicable to utility boilers only.

[d]Applicable to industrial, commercial, and residential boilers.

[e]The formaldehyde factors are based on very limited and relatively old data. Consult Table 4-37 and accompanying discussion for more detailed information.

PB81-145195

Emissions Assessment of Conventional Stationary Systems: Volume III. External Combustion Sources for Electricity Generation

TRW Environmental Engineering Div.
Redondo Beach, CA

Prepared for

Industrial Environmental Research Lab.
Research Triangle Park, NC

Jan-81

TABLE 71. EMISSION FACTORS AND MEAN SOURCE SEVERITIES OF TRACE ELEMENT EMISSIONS FROM OIL-FIRED UTILITY BOILERS

Trace Element	Concentration, ppm	Emission Factor, pg/J	Mean Severity Factor	
			Tangentially-fired Boilers	Wall-fired Boilers
Aluminum (Al)	3.8	87	0.0074	0.0027
Arsenic (As)	0.8	18	0.016	0.0059
Boron (B)	0.41	9.4	0.0013	0.0005
Barium (Ba)	1.26	28.8	0.025	0.0094
Beryllium (Be)	0.08	1.8	0.40	0.15
Bromine (Br)	0.13	3.0	0.0001	<0.0001
Calcium (Ca)	14	320	0.014	0.0052
Cadmium (Cd)	2.27	51.9	0.11	0.042
Chlorine (Cl)	12	274	0.018	0.0066
Cobalt (Co)	2.21	50.5	0.22	0.082
Chromium (Cr)	1.3	30	0.026	0.0098
Copper (Cu)	2.8	64	0.14	0.052
Fluorine (F)	0.12	2.7	0.0005	0.0002
Iron (Fe)	18	411	0.023	0.0086
Mercury (Hg)	0.04	0.9	0.0079	0.0029
Potassium (K)	34	777	0.0064	0.0024
Lithium (Li)	0.06	1.4	0.028	0.010
Magnesium (Mg)	13	297	0.022	0.0081
Manganese (Mn)	1.33	30.4	0.0027	0.0010
Molybdenum (Mo)	0.9	21	0.0018	0.0007
Sodium (Na)	31	708	0.0059	0.0022
Nickel (Ni)	42.2	964	4.2	1.6
Phosphorus (P)	1.1	25	0.11	0.041
Lead (Pb)	3.5	80	0.23	0.087
Antimony (Sb)	0.44	10	0.0088	0.0033
Selenium (Se)	0.7	16	0.035	0.013
Silicon (Si)	17.5	400	0.018	0.0065
Tin (Sn)	6.2	142	0.031	0.012
Strontium (Sr)	0.15	3.4	0.0005	0.0002
Thorium (Th)	<0.001	<0.02	<0.0001	<0.0001
Uranium (U)	0.7	16	0.035	0.013
Vanadium (V)	160	3656	3.2	1.2
Zinc (Zn)	1.26	28.8	0.0032	0.0012

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-450/2-80-074
June 1980

Air

EPA

Health Impacts, Emissions, and Emission Factors for Noncriteria Pollutants Subject to De Minimis Guidelines and Emitted from Stationary Conventional Combustion Processes

TABLE 4-3 TRACE ELEMENT EMISSION FACTORS FOR OIL-FIRED AND GAS-FIRED UTILITY AND INDUSTRIAL BOILERS

FURNACE TYPE	RESIDUAL OIL[a] pg/J			NATURAL GAS[b] pg/J		
	Hg	Be	F	Hg	Be	F
UNCONTROLLED[c]						
Tangential firing	23C	24C	23C	4.9	Nil	Nil
Wall firing	23C	24C	23C	4.9	Nil	Nil

(a) Emission factors for residual oil are calculated based on characterization of eleven residual oil samples and the assumption that all trace elements in the oil feed are emitted through the stack (Shih, et al, October 1979). C indicates the concentration of trace element in residual oil, in ppm.

(b) Based on stack test measurements for gas-fired utility boilers (1.).

(c) When boilers are equipped with wet scrubbers (used for flue gas desulfurization), the emission factor for Be may be assumed to be 0.01 times the uncontrolled factor given above, and emissions of Hg and F are .2 times the values given above (1.).

NOTE: To convert emission factor units to LB/10^{12}BTU, multiply factors by 2.33.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

STATIONARY SOURCE SAMPLING REPORT

REFERENCE NO. 8165A

FLORIDA POWER AND LIGHT COMPANY

SANFORD PLANT

SANFORD, FLORIDA

EMISSIONS TESTING FOR:

Metals
Nitrogen Oxides
Particulate
Sulfur Dioxide
Sulfur Trioxide
Sulfuric Acid Mist
Total Hydrocarbons

UNIT NO. 4

APRIL 1 THROUGH 5 AND 8 THROUGH 12, 1991

TABLE 2-1

EMISSION RATES SUMMARY, LB/MMBTU

Unit No. 4 Stack

	Repetition 1	Repetition 2	Repetition 3	Average
April 1, 1991				
Nitrogen Oxides	0.512	0.472	0.485	0.490
Particulate	0.126	0.134	0.123	0.128
Sulfur Dioxide	4.228	4.198	4.208	4.211
Total Hydrocarbons	0.00336	0.00174	0.00120	0.00210
April 2, 1991				
Nitrogen Oxides	0.516	0.513	0.496	0.508
Particulate	0.137	0.138	0.126	0.134
Sulfur Dioxide	4.208	4.190	4.224	4.207
Total Hydrocarbons	0.00676	0.00596	0.00438	0.00570
April 3, 1991				
Nitrogen Oxides	0.534	0.559	0.552	0.548
Particulate	0.220	0.166	0.182	0.189
Sulfur Dioxide	4.233	4.189	4.237	4.220
Total Hydrocarbons	0.00272	0.00205	0.00259	0.00245
April 4, 1991				
Nitrogen Oxides	0.542	0.599	0.588	0.576
Particulate	0.156	0.169	0.169	0.165
Sulfur Dioxide	4.202	4.146	4.199	4.182
Total Hydrocarbons	0.00302	0.00286	0.00147	0.00245
April 5, 1991				
Nitrogen Oxides	0.466	0.480	0.442	0.463
Particulate	0.173	0.187	0.127	0.162
Sulfur Dioxide	4.170	4.155	4.232	4.186
Total Hydrocarbons	0.00210	0.00185	0.00168	0.00187
April 8, 1991				
Metals				
Antimony	3.62E-006	1.72E-006	2.52E-006	2.62E-006
Arsenic	2.62E-006	2.33E-006	2.39E-006	2.45E-006
Barium	ND	1.25E-005	ND	4.17E-006
Beryllium	7.50E-008	6.43E-008	4.51E-008	6.15E-008
Cadmium	5.09E-006	5.64E-006	6.35E-006	5.69E-006

Note: Compliance limits are 0.3 lb/MMBtu and 4.3 lb/MMBtu, for particulate and sulfur dioxide, respectively.

(continued next page)

TABLE 2-1 (continued)

EMISSION RATES SUMMARY, LB/MMBTU

Unit No. 4 Stack

	Repetition 1	Repetition 2	Repetition 3	Average
April 8, 1991				
Metals				
Chromium	2.22E-005	2.01E-005	1.65E-005	1.96E-005
Copper	1.46E-005	1.16E-005	9.53E-006	1.19E-005
Lead	ND	ND	ND	ND
Manganese	2.10E-005	1.76E-005	2.16E-005	2.01E-005
Mercury	2.00E-007	2.48E-007	1.81E-007	2.10E-007
Nickel	0.00394	0.00353	0.00349	0.00365
Phosphorous	3.40E-005	3.10E-005	2.65E-005	3.05E-005
Selenium	1.56E-005	1.16E-005	1.07E-005	1.26E-005
Silver	5.09E-006	4.08E-006	ND	3.06E-006
Thallium	ND	ND	ND	ND
Vanadium	0.0155	0.0141	0.0140	0.0145
Zinc	4.00E-005	2.98E-005	3.81E-005	3.60E-005
Nitrogen Oxides	0.534	0.556	0.571	0.554
Particulate	0.199	0.155	0.153	0.169
Sulfur Dioxide	4.282	4.214	4.187	4.228
Total Hydrocarbons	0.000897	0.00146	0.000677	0.00101
April 9, 1991				
Nitrogen Oxides	0.466	0.477	0.484	0.476
Particulate	0.195	0.186	0.263	0.215
Sulfur Dioxide	4.159	4.159	4.135	4.151
Total Hydrocarbons	0.00133	0.00151	0.00129	0.00137
April 10, 1991				
Nitrogen Oxides	0.548	0.437	0.549	0.511
Particulate	0.154	0.161	0.147	0.154
Sulfur Dioxide	4.216	4.233	4.206	4.218
Sulfuric Acid Mist (including SO3)	0.00395	0.0101	0.00753	0.00719
Total Hydrocarbons	0.000423	0.000339	0.000678	0.000480

Note: Compliance limits are 0.3 lb/MMBtu and 4.3 lb/MMBtu, for particulate and sulfur dioxide, respectively.

(continued next page)

TABLE 2-1 (continued)

EMISSION RATES SUMMARY, LB/MMBTU

Unit No. 4 Stack

	Repetition 1	Repetition 2	Repetition 3	Average
April 11, 1991				
Nitrogen Oxides	0.437	0.510	0.509	0.485
Particulate	0.189	0.234	0.210	0.211
Sulfur Dioxide	4.196	4.147	4.155	4.166
Total Hydrocarbons	0.000754	0.00115	0.00111	0.00101
April 12, 1991				
Nitrogen Oxides	0.485	0.520	0.518	0.508
Particulate	0.180	0.179	0.174	0.178
Sulfur Dioxide	4.166	4.133	4.154	4.151
Total Hydrocarbons	0.000043	0.000474	0.000517	0.000345

Note: Compliance limits are 0.3 lb/MMBtu and 4.3 lb/MMBtu, for particulate and sulfur dioxide, respectively.