

 GND		Pieces: 1/1
FM: DEP AIR RESOURCE MGMT P. Adams DIRECTOR OFFICE STE 23 111 S MAGNOLIADR TALLAHASSEE, FL 32301 UNITED STATES Phone: 850-921-9505 To: U.S. EPA REGION 4 MR. GREGG M. WORLEY 61 FORSYTH STREET AIR PERMITS SECTION ATLANTA, GA 30303 UNITED STATES		
ORIGIN: TLH Sender's ref: 37550201000 A7 AP255 POSTCODE: 30303		
TEL: 404-562-9141		
Description: PSD-FL-392 application		Weight: 1 lbs for 1 pcs Date: 2007-08-27
DHL standard terms and conditions apply.		
28TH Day		
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WAYBILL: 22240498254 (Non-Negotiable)		

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To (Company):

U.S. EPA Region 4
 Air Permits Section
 61 Forsyth Street

Atlanta, GA 30303
 UNITED STATES

Attention To: Mr. Gregg M. Worley
 Phone#: 404-562-9141

Sent By: P. Adams
 Phone#: 850-921-9505

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 Protection: Not Required
 Description: PSD-FL-392 application

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 Dimensions: 0 x 0 x 0

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Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

June 27, 2007

Mr. Gregg M. Worley, Chief
Air Permits Section
U.S. EPA, Region 4
61 Forsyth Street
Atlanta, Georgia 30303-8960


RE: Progress Energy
Crystal River Unit 3 Uprate Project
0170004-018-AC, PSD-FL-392

Dear Mr. Worley:

Enclosed for your review and comment is a PSD permit application from Progress Energy for the Crystal River Unit 3 Uprate Project in Crystal River, Citrus County, Florida.

Your comments may be forwarded to my attention at the letterhead address or faxed to the Bureau of Air Regulation at 850/921-9533. If you have any questions, please contact me at 850/921-9236.

Sincerely,

for 

Jeffrey F. Koerner, Program Administrator
Permitting North Section

JFK/pa

Enclosure

Progress Energy

PSD PERMIT APPLICATION FOR CRYSTAL RIVER UNIT 3 UPRATE PROJECT



original



**Golder
Associates**

June 2007

07389531

Golder Associates Inc.

5100 West Lemon Street, Suite 114
Tampa, FL USA 33609
Telephone (813) 287-1717
Fax (813) 287-1716
www.golder.com



**PSD PERMIT APPLICATION
COOLING TOWER INSTALLATION
CRYSTAL RIVER UNIT 3 UPRATE PROJECT
CRYSTAL RIVER, CITRUS COUNTY, FLORIDA**

Submitted to:

*Progress Energy Florida
100 Central Avenue
St. Petersburg, Florida 33701*

RECEIVED
JUN 11 2007
BUREAU OF AIR REGULATION

Submitted by:

*Golder Associates Inc.
5100 West Lemon Street
Suite 114
Tampa, Florida 33609*

Distribution:

4 Copies Department of Environmental Protection
2 Copies Progress Energy Florida
2 Copies Golder Associates Inc.

June 2007

073-89531

Golder Associates

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PART II – PSD APPLICATION

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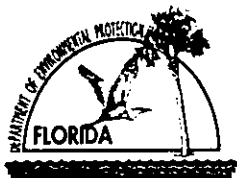
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PART I

FDEP APPLICATION FOR AIR PERMIT



Department of Environmental Protection

Division of Air Resource Management

APPLICATION FOR AIR PERMIT - LONG FORM

I. APPLICATION INFORMATION

Air Construction Permit – Use this form to apply for an air construction permit for a proposed project:

- subject to prevention of significant deterioration (PSD) review, nonattainment area (NAA) new source review, or maximum achievable control technology (MACT) review; or
- where the applicant proposes to assume a restriction on the potential emissions of one or more pollutants to escape a federal program requirement such as PSD review, NAA new source review, Title V, or MACT; or
- at an existing federally enforceable state air operation permit (FESOP) or Title V permitted facility.

Air Operation Permit – Use this form to apply for:

- an initial federally enforceable state air operation permit (FESOP); or
- an initial/revised/renewal Title V air operation permit.

Air Construction Permit & Revised/Renewal Title V Air Operation Permit (Concurrent Processing Option)

– Use this form to apply for both an air construction permit and a revised or renewal Title V air operation permit incorporating the proposed project.

To ensure accuracy, please see form instructions.

Identification of Facility

1. Facility Owner/Company Name: PROGRESS ENERGY FLORIDA, INC.	
2. Site Name: CRYSTAL RIVER POWER PLANT	
3. Facility Identification Number:	
4. Facility Location...: Street Address or Other Locator: NORTH OF CRYSTAL RIVER, WEST OF U.S. 19 City: CRYSTAL RIVER County: CITRUS Zip Code: 34428	
5. Relocatable Facility? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	6. Existing Title V Permitted Facility? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Application Contact

1. Application Contact Name: DAVE MEYER, SENIOR ENVIRONMENTAL SPECIALIST	
2. Application Contact Mailing Address... Organization/Firm: PROGRESS ENERGY FLORIDA Street Address: 299 FIRST AVENUE NORTH, PEF 903 City: ST. PETERSBURG State: FL Zip Code: 33701	
3. Application Contact Telephone Numbers... Telephone: (727) 820-5295 ext. Fax: (727) 820-5229	
4. Application Contact Email Address: DAVE.MEYER@PGNMAIL.COM	

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	6-11-07
2. Project Number(s):	0170004-018-AC
3. PSD Number (if applicable):	PSD-FL-392
4. Siting Number (if applicable):	

APPLICATION INFORMATION

Purpose of Application

This application for air permit is submitted to obtain: (Check one)

Air Construction Permit

☒ Air construction permit.

Air Operation Permit

- ☐ Initial Title V air operation permit.
- ☐ Title V air operation permit revision.
- ☐ Title V air operation permit renewal.
- ☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is required.
- ☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is not required.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit (Concurrent Processing)

- ☐ Air construction permit and Title V permit revision, incorporating the proposed project.
- ☐ Air construction permit and Title V permit renewal, incorporating the proposed project.

Note: By checking one of the above two boxes, you, the applicant, are requesting concurrent processing pursuant to Rule 62-213.405, F.A.C. In such case, you must also check the following box:

- ☐ I hereby request that the department waive the processing time requirements of the air construction permit to accommodate the processing time frames of the Title V air operation permit.

Application Comment

Progress Energy is proposing to install additional mechanical draft cooling towers, referred to as the South Cooling Towers (SCT) at the Crystal River Power Plant, as part of the CR3 nuclear unit uprate project. See Part II for details of the proposed cooling tower project.

APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
	Mechanical Draft Cooling Towers		NA

Application Processing Fee

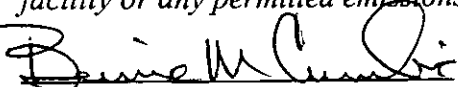
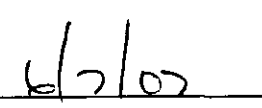
Check one: ☒ Attached - Amount: \$ 7,500

☐ Not Applicable

APPLICATION INFORMATION

Owner/Authorized Representative Statement

Complete if applying for an air construction permit or an initial FESOP.

1. Owner/Authorized Representative Name :
BERNIE CUMBIE, PLANT MANAGER
2. Owner/Authorized Representative Mailing Address... Organization/Firm: PROGRESS ENERGY Street Address: 299 FIRST AVENUE NORTH, CN-77 City: ST PETERSBURG State: FLORIDA Zip Code: 33701
3. Owner/Authorized Representative Telephone Numbers... Telephone: (352) 563-4484 ext. Fax: (352) 563-4496
4. Owner/Authorized Representative Email Address: BERNIE.CUMBIE@PGNMAIL.COM
5. Owner/Authorized Representative Statement: <i>I, the undersigned, am the owner or authorized representative of the facility addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other requirements identified in this application to which the facility is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit.</i>  Signature  Date

APPLICATION INFORMATION

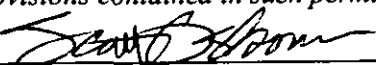
Application Responsible Official Certification

Complete if applying for an initial/revised/renewal Title V permit or concurrent processing of an air construction permit and a revised/renewal Title V permit. If there are multiple responsible officials, the "application responsible official" need not be the "primary responsible official."

1. Application Responsible Official Name:			
2. Application Responsible Official Qualification (Check one or more of the following options, as applicable): <input type="checkbox"/> For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C. <input type="checkbox"/> For a partnership or sole proprietorship, a general partner or the proprietor, respectively. <input type="checkbox"/> For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official. <input type="checkbox"/> The designated representative at an Acid Rain source.			
3. Application Responsible Official Mailing Address... Organization/Firm: Street Address: City: State: Zip Code:			
4. Application Responsible Official Telephone Numbers... Telephone: () - ext. Fax: () -			
5. Application Responsible Official Email Address:			
6. Application Responsible Official Certification: I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other applicable requirements identified in this application to which the Title V source is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application. Signature _____ Date _____			

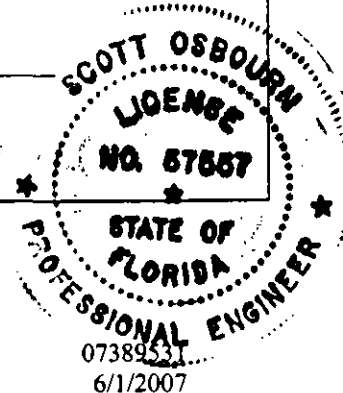
APPLICATION INFORMATION

Professional Engineer Certification

1. Professional Engineer Name: SCOTT OSBOURN Registration Number: 57557		
2. Professional Engineer Mailing Address... Organization/Firm: Golder Associates Inc.** Street Address: 5100 West Lemon St., Suite 114 City: Tampa State: FL Zip Code: 33609		
3. Professional Engineer Telephone Numbers... Telephone: (813) 287-1717 ext. 211 Fax: (813) 287-1716		
4. Professional Engineer Email Address: SOSBOURN@GOLDER.COM		
5. Professional Engineer Statement: <i>I, the undersigned, hereby certify, except as particularly noted herein*, that:</i> (1) <i>To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and</i> (2) <i>To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.</i> (3) <i>If the purpose of this application is to obtain a Title V air operation permit (check here <input type="checkbox"/>, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.</i> (4) <i>If the purpose of this application is to obtain an air construction permit (check here <input checked="" type="checkbox"/>, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here <input type="checkbox"/>, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.</i> (5) <i>If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here <input type="checkbox"/>, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.</i> <div style="display: flex; justify-content: space-between;"><div>Signature  (seal)</div><div>Date <u>6/8/07</u></div></div>		

* Attach any exception to certification statement.

** Board of Professional Engineers Certificate of Authorization #00001670





FACILITY INFORMATION

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates... Zone 17 East (km) 334.3 North (km) 3204.5		2. Facility Latitude/Longitude... Latitude (DD/MM/SS) 28/57/34 Longitude (DD/MM/SS) 82/42/01	
3. Governmental Facility Code: 0	4. Facility Status Code: A	5. Facility Major Group SIC Code: 49	6. Facility SIC(s):
7. Facility Comment :			

Facility Contact

1. Facility Contact Name: DAVE MEYER, SENIOR ENVIRONMENTAL SPECIALIST			
2. Facility Contact Mailing Address... Organization/Firm: PROGRESS ENERGY Street Address: 299 FIRST AVENUE NORTH, PEF 903 City: ST PETERSBURG State: FLORIDA Zip Code: 33701			
3. Facility Contact Telephone Numbers: Telephone: (727) 820-5295 ext. Fax: (727) 820-5229			
4. Facility Contact Email Address: DAVE.MEYER@PGNMAIL.COM			

Facility Primary Responsible Official

Complete if an "application responsible official" is identified in Section I. that is not the facility "primary responsible official."

1. Facility Primary Responsible Official Name:			
2. Facility Primary Responsible Official Mailing Address... Organization/Firm: Street Address: City: State: Zip Code:			
3. Facility Primary Responsible Official Telephone Numbers... Telephone: () - ext. Fax: () -			
4. Facility Primary Responsible Official Email Address:			

FACILITY INFORMATION

Facility Regulatory Classifications

Check all that would apply *following* completion of all projects and implementation of all other changes proposed in this application for air permit. Refer to instructions to distinguish between a "major source" and a "synthetic minor source."

1. <input type="checkbox"/> Small Business Stationary Source	<input type="checkbox"/> Unknown
2. <input type="checkbox"/> Synthetic Non-Title V Source	
3. <input checked="" type="checkbox"/> Title V Source	
4. <input checked="" type="checkbox"/> Major Source of Air Pollutants, Other than Hazardous Air Pollutants (HAPs)	
5. <input type="checkbox"/> Synthetic Minor Source of Air Pollutants, Other than HAPs	
6. <input checked="" type="checkbox"/> Major Source of Hazardous Air Pollutants (HAPs)	
7. <input type="checkbox"/> Synthetic Minor Source of HAPs	
8. <input checked="" type="checkbox"/> One or More Emissions Units Subject to NSPS (40 CFR Part 60)	
9. <input checked="" type="checkbox"/> One or More Emissions Units Subject to Emission Guidelines (40 CFR Part 60)	
10. <input type="checkbox"/> One or More Emissions Units Subject to NESHAP (40 CFR Part 61 or Part 63)	
11. <input type="checkbox"/> Title V Source Solely by EPA Designation (40 CFR 70.3(a)(5))	
12. Facility Regulatory Classifications Comment:	

FACILITY INFORMATION

List of Pollutants Emitted by Facility

1. Pollutant Emitted	2. Pollutant Classification	3. Emissions Cap [Y or N]?
PM	A	N
PM10	A	N

List of Pollutants Emitted by Facility

DEP Form No. 62-210.900(1) – Form
Effective: 06/16/03

FACILITY INFORMATION

C. FACILITY ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Facility Plot Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Previously Submitted, Date: _____
2. Process Flow Diagram(s): (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Previously Submitted, Date: _____
3. Precautions to Prevent Emissions of Unconfined Particulate Matter: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Previously Submitted, Date: _____

Additional Requirements for Air Construction Permit Applications

1. Area Map Showing Facility Location: <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable (existing permitted facility)
2. Description of Proposed Construction or Modification: <input checked="" type="checkbox"/> Attached, Document ID: PART II
3. Rule Applicability Analysis: <input checked="" type="checkbox"/> Attached, Document ID: PART II
4. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.): <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable (no exempt units at facility)
5. Fugitive Emissions Identification (Rule 62-212.400(2), F.A.C.): <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable
6. Preconstruction Air Quality Monitoring and Analysis (Rule 62-212.400(5)(f), F.A.C.): <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable
7. Ambient Impact Analysis (Rule 62-212.400(5)(d), F.A.C.): <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable
8. Air Quality Impact since 1977 (Rule 62-212.400(5)(h)5., F.A.C.): <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable
9. Additional Impact Analyses (Rules 62-212.400(5)(e)1. and 62-212.500(4)(e), F.A.C.): <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable
10. Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.): <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable

FACILITY INFORMATION

Additional Requirements for FESOP Applications

1. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.):
☐ Attached, Document ID: _____ ☐ Not Applicable (no exempt units at facility)

Additional Requirements for Title V Air Operation Permit Applications

1. List of Insignificant Activities (Required for initial/renewal applications only):
☐ Attached, Document ID: _____ ☐ Not Applicable (revision application)
2. Identification of Applicable Requirements (Required for initial/renewal applications, and for revision applications if this information would be changed as a result of the revision being sought):
☐ Attached, Document ID: _____
☐ Not Applicable (revision application with no change in applicable requirements)
3. Compliance Report and Plan (Required for all initial/revision/renewal applications):
☐ Attached, Document ID: _____
Note: A compliance plan must be submitted for each emissions unit that is not in compliance with all applicable requirements at the time of application and/or at any time during application processing. The department must be notified of any changes in compliance status during application processing.
4. List of Equipment/Activities Regulated under Title VI (If applicable, required for initial/renewal applications only):
☐ Attached, Document ID: _____
☐ Equipment/Activities On site but Not Required to be Individually Listed
☐ Not Applicable
5. Verification of Risk Management Plan Submission to EPA (If applicable, required for initial/renewal applications only):
☐ Attached, Document ID: _____ ☐ Not Applicable
6. Requested Changes to Current Title V Air Operation Permit:
☐ Attached, Document ID: _____ ☐ Not Applicable

Additional Requirements Comment

EMISSIONS UNIT INFORMATION

Section [1]

SOUTH COOLING TOWERS

III. EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Application - For Title V air operation permitting only, emissions units are classified as regulated, unregulated, or insignificant. If this is an application for Title V air operation permit, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each regulated and unregulated emissions unit addressed in this application for air permit. Some of the subsections comprising the Emissions Unit Information Section of the form are optional for unregulated emissions units. Each such subsection is appropriately marked. Insignificant emissions units are required to be listed at Section II, Subsection C.

Air Construction Permit or FESOP Application - For air construction permitting or federally enforceable state air operation permitting, emissions units are classified as either subject to air permitting or exempt from air permitting. The concept of an "unregulated emissions unit" does not apply. If this is an application for air construction permit or FESOP, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air permitting are required to be listed at Section II, Subsection C.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit Application - Where this application is used to apply for both an air construction permit and a revised/renewal Title V air operation permit, each emissions unit is classified as either subject to air permitting or exempt from air permitting for air construction permitting purposes and as regulated, unregulated, or insignificant for Title V air operation permitting purposes. **The air construction permitting classification must be used to complete the Emissions Unit Information Section of this application for air permit.** A separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air construction permitting and insignificant emissions units are required to be listed at Section II, Subsection C.

If submitting the application form in hard copy, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application must be indicated in the space provided at the top of each page.

EMISSIONS UNIT INFORMATION

Section [1]

SOUTH COOLING TOWERS

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)
- ☒ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.
- ☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)
- ☒ This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).
- ☐ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.
- ☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in this Section: **MECHANICAL DRAFT COOLING TOWERS, REFERRED TO AS THE SOUTH COOLING TOWERS (SCT)**

3. Emissions Unit Identification Number:

4. Emissions Unit Status Code: C	5. Commence Construction Date:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code: 49	8. Acid Rain Unit? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
--------------------------------------------	--------------------------------	--------------------------	------------------------------------------------------	----------------------------------------------------------------------------------------------

9. Package Unit:

Manufacturer: **Unknown**

Model Number: **Unknown**

10. Generator Nameplate Rating: **MW**

11. Emissions Unit Comment:

EMISSIONS UNIT INFORMATION

Section [1]

SOUTH COOLING TOWERS

Emissions Unit Control Equipment

1. Control Equipment/Method(s) Description:
DRIFT ELIMINATORS

2. Control Device or Method Code(s): **151**

EMISSIONS UNIT INFORMATION

Section [1]

SOUTH COOLING TOWERS

B. EMISSIONS UNIT CAPACITY INFORMATION

(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate:	1.8 E11 Gallons per year	
2. Maximum Production Rate:		
3. Maximum Heat Input Rate:	million Btu/hr	
4. Maximum Incineration Rate:	pounds/hr tons/day	
5. Requested Maximum Operating Schedule:		
	24hours/day	7days/week
	52weeks/year	8760hours/year
6. Operating Capacity/Schedule Comment:		
<p>Throughput rate = circulation water flow rate = 342,306 GPM x 60 min/hr x 8,760 hours of maximum operation per year = 1.8 E11 gallons per year.</p> <p>Since the emissions from the cooling tower are directly related to the amount of circulation water through the tower, it is proposed that the facility be restricted to an annual circulation water consumption of 1.8 E11 gallons and not hours per year operational limit. Limiting the facility in this manner gives the facility operational flexibility while maintaining assurance that the actual PM emissions are within the limits defined in this application.</p>		

EMISSIONS UNIT INFORMATION

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SOUTH COOLING TOWERS**C. EMISSION POINT (STACK/VENT) INFORMATION**
(Optional for unregulated emissions units.)**Emission Point Description and Type**

1. Identification of Point on Plot Plan or Flow Diagram:		2. Emission Point Type Code: 3	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking: Rectangular cooling tower cells.			
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:			
5. Discharge Type Code: V	6. Stack Height: 73 feet	7. Exit Diameter: TBD feet	
8. Exit Temperature: °F	9. Actual Volumetric Flow Rate: 1.5 MM acfm	10. Water Vapor: %	
11. Maximum Dry Standard Flow Rate: dscfm		12. Nonstack Emission Point Height: feet	
13. Emission Point UTM Coordinates... Zone: East (km): North (km):		14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS) Longitude (DD/MM/SS)	
15. Emission Point Comment: Number of cooling towers equal 18 cooling tower cells. See Part II, Table 2-2. Stack height assumes tower cell height of 59 ft and stack an additional 14 ft. Actual volumetric flow rate is per cell.			

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SOUTH COOLING TOWERS**D. SEGMENT (PROCESS/FUEL) INFORMATION****Segment Description and Rate:** Segment 1 of 1

1. Segment Description (Process/Fuel Type): CIRCULATION WATER		
2. Source Classification Code (SCC):		3. SCC Units: Thousand Gallons Water
4. Maximum Hourly Rate: 20,538	5. Maximum Annual Rate: 179,916,037	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment: Hourly rate based on 342,306 GPM Annual rate based on 8,760 per year		

Segment Description and Rate: Segment ____ of ____

1. Segment Description (Process/Fuel Type):		
2. Source Classification Code (SCC):		3. SCC Units:
4. Maximum Hourly Rate:	5. Maximum Annual Rate:	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment:		

SOUTH COOLING TOWERS

List of Pollutants Emitted by Emissions Unit

[illegible]

EMISSIONS UNIT INFORMATION

POLLUTANT DETAIL INFORMATION

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SOUTH COOLING TOWERS

PM

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: PM	2. Total Percent Efficiency of Control:
3. Potential Emissions: 22.3 lb/hour 97.6 tons/year	4. Synthetically Limited? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: See Part II Reference:	7. Emissions Method Code: 0
8. Calculation of Emissions: See Tables 2-1 and 2-2 of Part II	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

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SOUTH COOLING TOWERS

POLLUTANT DETAIL INFORMATION

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**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: Other	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: NA	4. Equivalent Allowable Emissions: 22.3 lb/hour 97.6 tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

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PM10**F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL/ESTIMATED FUGITIVE EMISSIONS**

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: PM10		2. Total Percent Efficiency of Control:	
3. Potential Emissions: 1.35 lb/hour 5.9 tons/year		4. Synthetically Limited? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year			
6. Emission Factor: Reference:		7. Emissions Method Code: 0	
8. Calculation of Emissions: See Tables 2-1 and 2-2 of Part II.			
9. Pollutant Potential/Estimated Fugitive Emissions Comment:			

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PM10**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: Other	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: NA	4. Equivalent Allowable Emissions: 1.35 lb/hour 5.9 tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

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SOUTH COOLING TOWERS**POLLUTANT DETAIL INFORMATION**

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G. VISIBLE EMISSIONS INFORMATION

Complete if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation ____ of ____

1. Visible Emissions Subtype:	2. Basis for Allowable Opacity: <input type="checkbox"/> Rule <input type="checkbox"/> Other
3. Allowable Opacity: Normal Conditions: % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance:	
5. Visible Emissions Comment:	

Visible Emissions Limitation: Visible Emissions Limitation ____ of ____

1. Visible Emissions Subtype:	2. Basis for Allowable Opacity: <input type="checkbox"/> Rule <input type="checkbox"/> Other
3. Allowable Opacity: Normal Conditions: % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance:	
5. Visible Emissions Comment:	

EMISSIONS UNIT INFORMATION

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SOUTH COOLING TOWERS

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) <input checked="" type="checkbox"/> Attached, Document ID: <u>See Part II</u> <input type="checkbox"/> Previously Submitted, Date _____
2. Fuel Analysis or Specification (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Previously Submitted, Date _____
3. Detailed Description of Control Equipment (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) <input checked="" type="checkbox"/> Attached, Document ID: <u>See Part II</u> <input type="checkbox"/> Previously Submitted, Date _____
4. Procedures for Startup and Shutdown (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Previously Submitted, Date _____ <input checked="" type="checkbox"/> Not Applicable (construction application)
5. Operation and Maintenance Plan (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Previously Submitted, Date _____ <input checked="" type="checkbox"/> Not Applicable
6. Compliance Demonstration Reports/Records <input type="checkbox"/> Attached, Document ID: _____ Test Date(s)/Pollutant(s) Tested: _____ <input type="checkbox"/> Previously Submitted, Date: _____ Test Date(s)/Pollutant(s) Tested: _____ <input type="checkbox"/> To be Submitted, Date (if known): _____ Test Date(s)/Pollutant(s) Tested: _____ <input checked="" type="checkbox"/> Not Applicable Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.
7. Other Information Required by Rule or Statute <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable

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Section [1]

SOUTH COOLING TOWERS

Additional Requirements for Air Construction Permit Applications

- | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Control Technology Review and Analysis (Rules 62-212.400(6) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e))
<input checked="" type="checkbox"/> Attached, Document ID: <u>See Part II</u> <input type="checkbox"/> Not Applicable |
| 2. Good Engineering Practice Stack Height Analysis (Rule 62-212.400(5)(h)6., F.A.C., and Rule 62-212.500(4)(f), F.A.C.)
<input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable |
| 3. Description of Stack Sampling Facilities (Required for proposed new stack sampling facilities only)
<input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable |

Additional Requirements for Title V Air Operation Permit Applications

- | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Identification of Applicable Requirements
<input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable |
| 2. Compliance Assurance Monitoring
<input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable |
| 3. Alternative Methods of Operation
<input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable |
| 4. Alternative Modes of Operation (Emissions Trading)
<input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable |
| 5. Acid Rain Part Application
<input type="checkbox"/> Certificate of Representation (EPA Form No. 7610-1)
<input type="checkbox"/> Copy Attached, Document ID: _____
<input type="checkbox"/> Acid Rain Part (Form No. 62-210.900(1)(a))
<input type="checkbox"/> Attached, Document ID: _____
<input type="checkbox"/> Previously Submitted, Date: _____
<input type="checkbox"/> Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
<input type="checkbox"/> Attached, Document ID: _____
<input type="checkbox"/> Previously Submitted, Date: _____
<input type="checkbox"/> New Unit Exemption (Form No. 62-210.900(1)(a)2.)
<input type="checkbox"/> Attached, Document ID: _____
<input type="checkbox"/> Previously Submitted, Date: _____
<input type="checkbox"/> Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
<input type="checkbox"/> Attached, Document ID: _____
<input type="checkbox"/> Previously Submitted, Date: _____
<input type="checkbox"/> Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
<input type="checkbox"/> Attached, Document ID: _____
<input type="checkbox"/> Previously Submitted, Date: _____
<input type="checkbox"/> Phase II NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
<input type="checkbox"/> Attached, Document ID: _____
<input type="checkbox"/> Previously Submitted, Date: _____
<input type="checkbox"/> Not Applicable |

EMISSIONS UNIT INFORMATION

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SOUTH COOLING TOWERS

Additional Requirements Comment

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PART II

PSD APPLICATION

1.0 INTRODUCTION AND EXECUTIVE SUMMARY

The scope of the proposed project includes an uprate of 40 MW to CR3 associated with equipment modifications made during the 2009 refueling outage and 140 MW to be added after upgrades to the reactor during the 2011 refueling outage. The uprate will increase the output from CR3 and the associated circulating intake water flow rate will also increase. The air emission impacts associated with increased intake water flow (i.e., increased flow through additional cooling towers – SCTs) will trigger PSD for particulate matter (PM), but not for PM less than 10 microns (PM₁₀). Other regulated air emissions (e.g., NO_x and SO₂) will not be affected, as there will be no additional fuel combustion sources (e.g., additional diesel generator capacity) that may trigger PSD for these pollutants.

This application contains the technical information developed in accordance with Prevention of Significant Deterioration (PSD) regulations as promulgated by the Florida Department of Environmental Protection (FDEP). It presents an evaluation of regulated pollutants subject to PSD review, and a demonstration of Best Available Control Technology (BACT). Through this application, Progress Energy Florida (PEF) requests that FDEP issue an air construction permit and PSD approval for this Project.

1.1 PSD Requirements

The permitting of this Project in Florida requires an air construction permit and PSD approval. The Project will be a modification to an existing major air emissions source. The U.S. Environmental Protection Agency (EPA) has implemented regulations requiring PSD review for new or modified sources that increase air emissions above certain threshold amounts.

EPA's PSD regulations are promulgated under Title 40 of the Code of Federal Regulations (CFR), Parts 51.166 and 52.21, and are implemented in Florida through the approved PSD program of the FDEP. FDEP has adopted PSD regulations codified in Rule 62-212.400, Florida Administrative Code (F.A.C.).

PSD applicability for the Project is summarized below.

Pollutant	Annual Emissions (TPY)	PSD Threshold (TPY)	PSD Review Required (Y/N)
PM	97.6	25	Y
PM ₁₀	5.9	15	N

A PSD review is required for particulate matter (PM) as total suspended particulate matter (TSP).

Citrus County has been designated as an attainment, maintenance or unclassifiable area for all criteria pollutants. The county is also classified as a PSD Class II area for PM₁₀, SO₂, and NO₂. Therefore, the new source review will follow PSD regulations pertaining to such designations.

1.2 BACT Analysis

For the proposed Project, a BACT analysis was conducted for PM, the only pollutant for which the net increase exceeds the FDEP significance emission rate and, is therefore, subject to BACT review. The proposed BACT emission levels are as follow:

Proposed BACT Emission Levels

Pollutant	South Cooling Tower BACT (% Drift Rate)	Annual Circulation Water Consumption (Gallons/yr)
PM	0.0005	1.8 E11

1.3 Air Quality Analysis

Because PM was the only pollutant that triggered PSD review, a Class II air quality impact analysis as well as additional analysis of impacts due to the proposed project on soils, vegetation, visibility, growth, and air quality related values (AQRVs) in the nearest PSD Class I areas were not conducted.

2.0 PROJECT DESCRIPTION

2.1 Site Description

The Crystal River Energy Complex consists of four coal-fired fossil fuel steam generating (FFSG) units with electrostatic precipitators; two natural draft cooling towers for FFSG Units 4 and 5; helper mechanical cooling towers for FFSG Units 1, 2 and Nuclear Unit 3; coal, fly ash, and bottom ash handling facilities, and relocatable diesel fired generator(s).

2.2 Proposed Project Modifications

The scope of the proposed project includes an uprate of CR3, the nuclear unit. The uprate will increase the output from CR3 and the associated circulating intake water flow rate will also increase. The air emission impacts associated with increased intake water flow (i.e., increased flow through additional cooling towers, referred to as the South Cooling Towers (SCT) will trigger PSD for particulate matter (PM), but not for PM less than 10 microns (PM_{10}). Other regulated air emissions (e.g., NO_x and SO_2) will not be affected, as there will be no additional fuel combustion sources (e.g., additional diesel generator capacity) that may trigger PSD for these pollutants.

2.3 Proposed Cooling Tower Emissions

Wet cooling towers provide direct contact between cooling water and air passing through the tower. Cooling tower drift is created when a small amount of the cooling water becomes entrained in the air stream and carried out of the tower. PM emissions from cooling towers are related to the total dissolved solids (TDS) and amount of drift through the cooling tower. Drift eliminators are the control technology used to reduce the amount of drift and secondarily reduce the amount of PM emissions. The estimated PM and PM_{10} emissions from the proposed cooling towers (SCT) are presented in Table 2-1. Appendix A presents a description of the methodology and data used to estimate the fraction of PM emissions that would constitute PM_{10} . Table 2-2 provides a description of the physical characteristics, performance and annual emission estimates for the proposed SCT. PM_{10} emissions are a function of the cooling water TDS concentration. It should be noted that, although Table 2-1 indicates a PM_{10} emission rate of 0.238 lb/hr for a typical TDS concentration at the facility, PEF has conservatively assumed an emission rate of 1.349 lb/hr, which would reflect a worst-case TDS for PM_{10} purposes.

The project design is still evolving; however, as stated above, the engineering and design data currently indicate that the Project will be characterized as a major source subject to PSD. Therefore, this PSD application addresses Best Available Control Technology (BACT) for PM emissions, which are the significant emission increase of concern. Federal PSD requirements are contained in 40 CFR 51.166, *Prevention of Significant Deterioration of Air Quality*. The state of Florida's PSD regulations are found in Rule 62-212.400, F.A.C.

In addition to adding a SCT to remove the incremental heat required to be dissipated by the uprate, PEF is considering replacement of the existing modular cooling towers with additional permanent SCTs. Based on the relative design heat dissipation rates, approximately 11 additional cells equivalent to the existing permanent cooling tower cells will be required. Coupled with the 6 cells required to dissipate the incremental heat rejected due to the uprate project, this means a total of 17 cells would be required. Therefore, as the status of the existing modular cooling towers is unknown, in order to present a worst-case air quality assessment, it is assumed that the new permanent SCT will include a safety factor (of one cell) and consist of 18 cells arranged in a 9 by 2 configuration. The estimated cooling water flow from the proposed 18 cell HCT is approximately 342,306 gallons per minute (gpm). Again, this estimate assumes that the existing bank of modular towers would be replaced by the permanent SCT associated with this uprate project, which may not necessarily be the case.

2.4 Site Layout and Structures

A plot plan of the Project, showing cooling tower locations, is presented in Figure 2-1. This figure provides a conceptual layout of the proposed new cooling towers which have been designed and sited to offset the increased circulating water rejected heat. The new cooling towers have also been designed to avoid any increase in flow into the intake canal from Crystal Bay/Gulf of Mexico, and to avoid any increase in temperature rise leaving the discharge canal to Crystal Bay/Gulf of Mexico.

2.5 Stack Parameters

The known stack parameters for the Project are presented in Table 2-2. Preliminary vendor data is not yet available. In some cases, the stack parameters are designated as TBD (i.e., to be determined).

3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

Federal and state air regulatory requirements for a new source of air pollution are discussed in Sections 3.1 to 3.4. The applicability of these regulations to the proposed modifications at the Crystal River Energy Complex are discussed in each respective section. These regulations must be satisfied before the proposed Project can be approved.

3.1 National and State AAQS

The existing applicable national and Florida AAQS are presented in Table 3-1. Primary NAAQS were promulgated to protect the public health, and secondary NAAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Areas of the country in violation of NAAQS are designated as nonattainment areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements.

Florida has adopted state AAQS in Rule 62-204.240. These standards are the same as the NAAQS, except in the case of SO₂. For SO₂, Florida has adopted the former 24-hour secondary standard of 260 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), and former annual average secondary standard of 60 $\mu\text{g}/\text{m}^3$.

Because PM was the only pollutant that triggered PSD review, a Class II air quality impact analysis as well as additional analysis of impacts due to the proposed Project on soils, vegetation, visibility, growth, and air quality related values (AQRVs) in the nearest PSD Class I areas were not conducted.

3.2 Prevention of Significant Deterioration (PSD) Requirements

3.2.1 General Requirements

Under federal and State of Florida PSD review requirements, all major new or modified sources of air pollutants regulated under the Clean Air Act (CAA) must be reviewed and a pre-construction permit issued. Florida's State Implementation Plan (SIP), which contains PSD regulations, has been approved by EPA; therefore, PSD approval authority has been granted to the FDEP.

A "major facility" is defined as any one of 28 named source categories that have the potential to emit 100 tons per year (TPY) or more or any other stationary facility that has the potential to emit 250 TPY or more of any pollutant regulated under the CAA. "Potential to emit" means the capability, at maximum design capacity, to emit a pollutant after the application of control equipment. Once a new source is determined to be a "major facility" for a particular pollutant, any pollutant emitted in amounts greater than the PSD significant emission rates is subject to PSD review. For an existing source for which a modification is proposed, the modification is subject to PSD review if the net increase in emissions due to the modification is greater than the PSD significant emission rates. The PSD significant emission rates are shown in Table 3-2.

EPA has promulgated limitations to increases above an air quality baseline concentration level of SO₂, PM₁₀, and NO₂ concentrations that would constitute significant deterioration. The EPA class designations and allowable PSD increments are presented in Table 3-1. The magnitude of the allowable increment depends on the classification of the area in which a new source (or modification) will be located or have an impact. Three classifications are designated based on criteria established in the CAA. Congress promulgated areas as Class I (international parks, national wilderness areas, memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres) or as Class II (all areas not designated as Class I). No Class III areas, which would be allowed greater deterioration than Class II areas, were designated. The State of Florida has adopted the EPA class designations and allowable PSD increments for SO₂, PM₁₀, and NO₂ increments.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified facility. The State of Florida has adopted the PSD regulations which have been approved by EPA. (Rule 62-212.400, F.A.C.). Major new facilities and major modifications are required to undergo the following analyses, as applicable, related to PSD for each pollutant emitted in significant amounts:

1. Control technology review;
2. Source impact analysis;
3. Air quality analysis (monitoring);
4. Source information; and
5. Additional impact analyses.

In addition to these analyses, a new facility also must be reviewed with respect to Good Engineering Practice (GEP) stack height regulations. Discussions concerning each of these requirements are presented in the following sections.

3.2.2 Control Technology Review

The control technology review requirements of the federal and state PSD regulations require that all applicable federal and state emission-limiting standards be met, and that BACT be applied to control emissions from the source. The BACT requirements are applicable to all regulated pollutants for which the increase in emissions from the facility exceeds the significant emission rate (Table 3-2).

BACT is defined in 40 CFR 52.21 (b)(12), and Rule 62-210.200(38), F.A.C. as:

An emissions limitation (including a visible emission standard) based on the maximum degree of reduction of each pollutant subject to regulation under the Act which would be emitted by any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant, which would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60 and 61. If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular part of a source or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reductions achievable by implementation of such design, equipment, work practice, or operation and shall provide for compliance by means, which achieve equivalent results.

BACT was promulgated within the framework of the PSD requirements in the 1977 amendments of the CAA [Public Law 95-95; Part C, Section 165(a)(4)]. The primary purpose of BACT is to optimize consumption of PSD air quality increments and thereby enlarge the potential for future economic growth without significantly degrading air quality (EPA, 1978; 1980). Guidelines for the evaluation of BACT can be found in EPA's *Guidelines for Determining Best Available Control Technology (BACT)* (EPA, 1978) and in the *PSD Workshop Manual* (EPA, 1980). These guidelines were issued by EPA to provide a consistent approach to BACT and to ensure that the impacts of alternative emission control systems are measured by the same set of parameters. In addition, through

implementation of these guidelines, BACT in one area may not be identical to BACT in another area. According to EPA (1980), "BACT analyses for the same types of emissions unit and the same pollutants in different locations or situations may determine that different control strategies should be applied to the different sites, depending on site-specific factors. Therefore, BACT analyses must be conducted on a case-by-case basis."

The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the proposed facility. BACT must, as a minimum, demonstrate compliance with new source performance standards (NSPS) for a source (if applicable). An evaluation of the air pollution control techniques and systems, including a cost-benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems, as well as the environmental benefits derived from these systems. A decision on BACT is to be based on sound judgment, balancing environmental benefits with energy, economic, and other impacts (EPA, 1978).

Historically, a "bottom-up" approach consistent with the BACT Guidelines and PSD Workshop Manual was used. With this approach, an initial control level, which is usually NSPS, is evaluated against successively more stringent controls until a BACT level is selected. However, EPA developed a concern that the bottom-up approach was not providing the level of BACT decisions originally intended. As a result, in December 1987, the EPA Assistant Administrator for Air and Radiation mandated changes in the implementation of the PSD program, including the adoption of a new "top-down" approach to BACT decision making.

The top-down BACT approach essentially starts with the most stringent (or top) technology and emissions limits that have been applied elsewhere to the same or a similar source category. The applicant must next provide a basis for rejecting this technology in favor of the next most stringent technology or propose to use it. Rejection of control alternatives may be based on technical or economic infeasibility. Such decisions are made on the basis of physical differences (e.g., fuel type), locational differences (e.g., availability of water), or significant differences that may exist in the environmental, economic, or energy impacts. The differences between the proposed facility and the facility on which the control technique was applied previously must be justified.

EPA has issued a draft guidance document on the top-down approach entitled *Top-Down Best Available Control Technology Guidance Document* (EPA, 1990). This document has not yet been issued as final guidance or as rule. EPA has also published the document entitled *OAQPS Cost Control Manual* (EPA, 1996) to assist industry and regulators in estimating capital and annual costs of pollution control equipment.

3.2.3 Additional Impact Analysis

In addition to air quality impact analyses, federal and State of Florida PSD regulations require analyses of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of the proposed source [Rule 62-212.400]. These analyses are to be conducted primarily for PSD Class I areas. Impacts as a result of general commercial, residential, industrial, and other growth associated with the source also must be addressed. These analyses are required for each pollutant emitted in significant amounts (Table 3-2).

Because PM was the only pollutant that triggered PSD review, and not PM₁₀, additional analysis of impacts due to the proposed Project on soils, vegetation, visibility, growth, and air quality related values (AQRVs) in the nearest PSD Class I areas were not conducted.

3.2.4 PSD Applicability for the Project

3.2.4.1 *Area Classification*

The Project site is located in Citrus County, which has been designated by EPA and FDEP as an attainment or maintenance area for all criteria pollutants. Citrus County and surrounding counties are designated as PSD Class II areas for SO₂, PM (TSP), and NO₂.

3.2.4.2 *Pollutant Applicability*

The existing Crystal River Energy Complex is considered to be a "major existing facility" because it is one of 28 named source categories and the annual emissions of several regulated pollutants from the facility are greater than 100 TPY. Therefore, PSD review is required for any modification that results in a net increase in emissions greater than the PSD significant emission rates.

The PSD applicability for the proposed project was presented in Section 1. As shown, the potential increase in emissions due to the proposed project exceeds the PSD significant emission rate for PM. As a result, PSD review applies for PM emissions.

3.3 Nonattainment Rules

Based on the current nonattainment provisions, all major new facilities and major modifications to existing major facilities located in a nonattainment area must undergo nonattainment review. A new major facility is required to undergo this review if the proposed pieces of equipment have the potential to emit 100 TPY or more of the nonattainment pollutant.

The Project site is located in Citrus County, which is classified as an attainment or maintenance area for all criteria pollutants. Therefore, nonattainment requirements are not applicable.

3.4 Emission Standards

3.4.1 New Source Performance Standards

The NSPS are a set of national emission standards that apply to specific categories of new sources. As stated in the CAA Amendments of 1977, these standards "shall reflect the degree of emission limitation and the percentage reduction achievable through application of the best technological system of continuous emission reduction the Administrator determines has been adequately demonstrated." The NSPS are codified in 40 CFR Part 60.

There are no applicable NSPS standards for the proposed cooling towers.

4.0 AMBIENT MONITORING ANALYSIS

4.1 Monitoring Requirements

In accordance with requirements of 40 CFR 52.21(m) and Rule 62-212.400(5)(f), F.A.C., any application for a PSD permit must contain an analysis of continuous ambient air quality data in the area affected by the proposed major stationary facility or major modification. For a new major facility, the affected pollutants are those that the facility would potentially emit in significant amounts. For a major modification, the pollutants are those for which the net emissions increase exceed the significant emission rates (Table 3-2).

Ambient air monitoring for a period of up to one year is generally appropriate to satisfy the PSD monitoring requirements. A minimum of 4 months of data is required. Existing data from the vicinity of the proposed source may be used if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered. Guidance in designing a PSD monitoring network is provided in EPA's *Ambient Monitoring Guidelines for Prevention of Significant Deterioration* (1987).

An exemption from the preconstruction ambient monitoring requirements is also available if certain criteria are met. If the predicted increase in ambient concentrations, due to the proposed modification, is less than specified *de minimis* concentrations, then the modification can be exempted from the pre-construction air monitoring requirements for that pollutant per FDEP rule. The proposed Project will result in PSD review for only PM emissions and as such, no preconstruction ambient monitoring is required.

There is no PSD *de minimis* monitoring concentration established for VOC. However, an increase in VOC emissions of 100 TPY or more requires a preconstruction ambient monitoring analysis for ozone (O₃). The proposed Project will not result in VOC emissions and therefore no preconstruction ambient monitoring analysis is required.

5.0 BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

5.1 Requirements and BACT Summary

The 1977 CAA Amendments established requirements for the approval of pre-construction permit applications under the PSD program. As discussed in Section 3.2.2, one of these requirements is that BACT be installed for those pollutants requiring PSD review. BACT determinations must be made on a case-by-case basis considering technical, economic, energy, and environmental impacts for various BACT alternatives. To bring consistency to the BACT process, the EPA developed the "top-down" approach to BACT determination that is followed by FDEP.

The first step in a top-down BACT analysis is to determine, for each applicable pollutant, the most stringent control alternative available for a similar source or source category. If it can be shown that this level of control is not feasible on the basis of technical, economic, energy, or environmental impacts for the source in question, then the next most stringent level of control is identified and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any technical, economic, energy, or environmental consideration.

In the case of the proposed project, PM emissions require a BACT analysis. The following table summarizes the proposed BACT limits and the BACT analysis is presented in the following sections.

Pollutant	Proposed Cooling Tower BACT (% Drift Rate)
PM	0.0005 (w/Mist Eliminators) and 1.8 E11 gallons per year of circulation water.

5.2 Cooling Tower BACT Analysis

5.2.1 Particulate Matter (PM)

5.2.1.1 *Previous BACT Determinations*

As part of the BACT analysis, a review was performed of previous PM BACT determinations for cooling towers listed in the RACT/BACT/LAER Clearinghouse on EPA's web page. A summary of BACT determinations from this review are presented in Table 5-1. Determinations issued during the last 3 years are shown in the table.

Table 5-1. RACT/BACT/LAER Clearinghouse, Cooling Towers Permitted from 2003 to 2006.

Facility	Recirculation Water Flow % Drift Rate	Control Technology	State	Basis	Date
PEF Anclote	0.0005	Drift Eliminators	FL	BACT- PSD	10/20/06
Diamond Wanapa I, L. P.	0.0005	Drift Eliminators	OR	BACT- PSD	8/8/2005
Auburn Nugget	0.005	Drift Eliminators	IN	BACT- PSD	5/31/2005
Newmont Nevada Energy Investment, LLC	0.0005	Drift Eliminators	NV	BACT- PSD	5/5/2005
Tigen-Nassua Energy Corp.	0.0005	Drift Eliminators	NY	BACT- PSD	3/31/2005
Mirant Mid-Atlantic, LLC	0.001	Drift Eliminators	MD	BACT- PSD	11/5/2004
Midamerican Energy Company	0.001	Drift Eliminators	IA	BACT- PSD	6/17/2003
Wallula Generation, LLC	0.0005	Drift Eliminators	WA	LAER	1/3/2003

From the review of previous BACT determinations, it is evident that PM BACT determinations for cooling towers have exclusively been based on drift elimination.

5.2.1.2 *Control Technology Feasibility*

The types and sources of air emissions associated with the Project consist of a mechanical draft cooling tower, referred to as the South Cooling Tower (SCT). PM and PM₁₀ emissions are emitted from the SCT in the form of drift. Drift is water aerosols emitted from the cooling tower containing

dissolved minerals from the water circulating in the cooling tower. The dissolved minerals become PM, including PM₁₀, when the water in the drift is evaporated. As stated previously, drift eliminators are the control technology utilized for cooling towers. Drift eliminators are usually incorporated into the tower design to remove as many droplets as practical from the air stream before exiting the tower. The drift eliminators used in cooling towers rely on the inertial separation caused by directional changes in the airflow while passing through the eliminators. Types of drift eliminator configurations include herringbone (blade type), wave form, and cellular (or honeycomb) designs. The cellular units generally are the most efficient. Drift eliminators may include various materials, such as ceramics, fiber reinforced cement, fiberglass, metal, plastic, and wood installed or formed closely spaced slats, sheets, honeycomb assemblies, or tiles. The materials may include other features, such as corrugations and water removal channels, to enhance the drift removal further.

5.2.1.3 PM BACT Selection

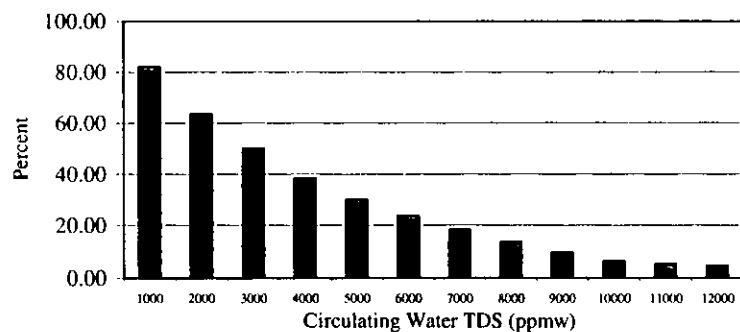
Cooling tower drift will be controlled using mist eliminators that will be designed to limit drift to 0.0005 percent of the circulating water rate of the cooling tower. This level of control represents the best that is currently available. The total circulation water use will be limited to 1.8 E11 gallons per year, based on 8,760 hours per year at a maximum circulation rate of 342,306 gpm.

APPENDIX A
PM₁₀ EMISSION CALCULATION

Table 2-1. Potential PM and PM₁₀ Emissions

TDS (ppmw)	PM Emission Rate (lb/hr)	Percent of Emissions < or = PM10 %	PM10 Emissions (lb/hr)		Tower Circulation Rate (GPM)	Drift Rate %	Calculated PM10 % < or = PM10 %
1000	0.88	82.04	0.722		342,306	0.0005	82.04
2000	1.76	63.50	1.118				63.50
3000	2.64	50.00	1.320				50.00
4000	3.52	38.33	1.349	max			38.33
5000	4.40	29.97	1.319		Salt water density (lb/gal)		29.97
6000	5.28	23.59	1.246	swd	8.57		23.59
7000	6.16	18.20	1.121		64.2 lb per cu ft		18.20
8000	7.04	13.57	0.955				13.57
9000	7.92	9.65	0.764				9.65
10000	8.80	6.28	0.553				6.28
11000	9.68	5.11	0.495				5.11
12000	10.56	4.46	0.471				4.46
25307	22.27	1.07	0.238				1.07
29000	25.52	0.82	0.209				0.82
89600	78.85	0.22	0.173				0.22

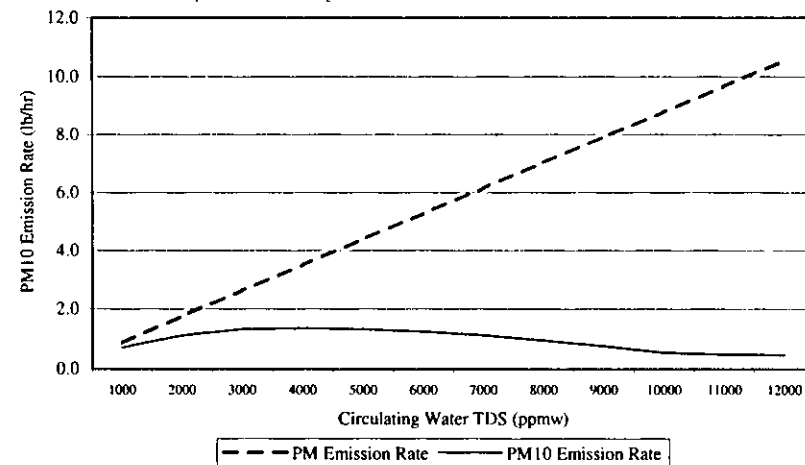
Percentage of Drift PM that Evaporates to PM10



Source: Reisman, Joel and Gordon Frisbie, *Calculating Realistic PM10 Emissions from Cooling Towers*, Abstract No. 216, Greystone Environmental Consultants, Inc.

PM10 Emission Rate vs TDS

Data presented for wet cooling tower with water circulation rate of 306,000 GPM and 0.0005% drift rate.



Reisman, Joel and Gordon Frisbie, *Calculating Realistic PM10 Emissions from Cooling Towers*, Abstract No. 216, Greystone Environmental Consultants, Inc.

Table 2-2. Physical, Performance, and Annual Emissions Data for the SCT

Parameter	Vendor (TBD)
<u>Physical Data</u>	
Number of Cells	18
Deck Dimensions, ft	
Length	50
Width	50
Height(Tower Height)	59
Stack Dimensions	
Height, ft	14
Stack Top Effective Inner Diameter, per cell, ft	TBD
Effective Diameter, all cells, ft	TBD
<u>Performance Data (per cell)</u>	
Discharge Velocity, acfm	1,500,000
Circulating Water Flow Rate (CWFR), gal/min	342,306
Design hot water temperature, °F	103
Design Air Flow Rate per cell, acfm, (estimated)	TBD
Hours of operation	8,760
<u>Emission Data</u>	
Drift Rate ^a (DR), percent	0.0005
Total Dissolved Solids (TDS) Concentration ^b , average ppm	25,307
Solution Drift ^c (SD), lb/hr	880.1
PM Drift ^d , lb/hr	22.3
tons/year	97.6
PM ₁₀ Drift ^e	
PM ₁₀ Emissions, lb/hr	1.35
tons/year	5.9

^a Drift rate is the percent of circulating water.

^b A TDS of 25,307 Average Value from Historical Data (Ron Johnson email 12/13/05)

^c Includes water and based on circulating water flow rate and drift rate
(CWFR x DR x 8.57 lb/gal x 60 min/hr).

^d PM calculated based on total dissolved solids and solution drift (TDS x SD).

^e PM₁₀ based on Cooling Tower PM₁₀ emissions study see Attachment A.

Source: Progress Energy, 2007; Golder, 2007.

Table 3-1. National and State AAQS, Allowable PSD Increments, and Significant Impact Levels

Pollutant	Averaging Time	AAQS ($\mu\text{g}/\text{m}^3$)			PSD Increments ($\mu\text{g}/\text{m}^3$)		Significant Impact Levels ($\mu\text{g}/\text{m}^3$) ^b
		Primary Standard	Secondary Standard	Florida	Class I	Class II	
Particulate Matter ^c (PM ₁₀)	Annual Arithmetic Mean	50	50	50	4	17	1
	24-Hour Maximum	150	150	150	8	30	5
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20	1
	24-Hour Maximum	365	NA	260	5	91	5
	3-Hour Maximum	NA	1,300	1,300	25	512	25
Carbon Monoxide	8-Hour Maximum	10,000	10,000	10,000	NA	NA	500
	1-Hour Maximum	40,000	40,000	40,000	NA	NA	2,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25	1
Ozone ^c	8-Hour Maximum ^d	157	157	157	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	1.5	NA	NA	NA

Note: Particulate matter (PM₁₀) = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.

NA = Not applicable, i.e., no standard exists.

^a Short-term maximum concentrations are not to be exceeded more than once per year.

^b Maximum concentrations are not to be exceeded.

^c On July 18, 1997, EPA promulgated revised AAQS for particulate matter and ozone. For particulate matter, PM_{2.5} standards were introduced with a 24-hour standard of 65 $\mu\text{g}/\text{m}^3$ (3-year average of 98th percentile) and an annual standard of 15 $\mu\text{g}/\text{m}^3$ (3-year average at community monitors).

^d 0.08 ppm; achieved when 3-year average of 99th percentile is 0.08 ppm or less. FDEP has not yet adopted these standards.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978.

40 CFR 50; 40 CFR 52.21.

Chapter 62-204, F.A.C.

Table 3-2. PSD Significant Emission Rates and *De Minimis* Monitoring Concentrations

Pollutant	Regulated Under	Significant Emission Rate (TPY)	<i>De Minimis</i> Monitoring Concentration ^a (µg/m ³)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter [PM(TSP)]	NSPS	25	10, 24-hour
Particulate Matter (PM ₁₀)	NAAQS	15	10, 24-hour
Nitrogen Dioxide	NAAQS, NSPS	40	14, annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY ^b
Lead	NAAQS	0.6	0.1, 3-month
Sulfuric Acid Mist	NSPS	7	NM
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.2, 1-hour
Mercury	NESHAP	0.1	0.25, 24-hour

Note: Ambient monitoring requirements for any pollutant may be exempted if the impact of the increase in emissions is below *de minimis* monitoring concentrations.

NAAQS = National Ambient Air Quality Standards.

NM = No ambient measurement method established; therefore, no *de minimis* concentration has been established.

NSPS = New Source Performance Standards.

NESHAP = National Emission Standards for Hazardous Air Pollutants.

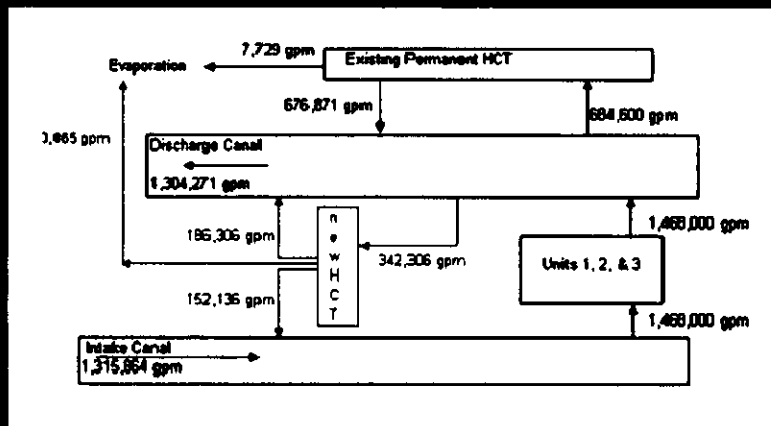
g/m³ = micrograms per cubic meter.

^a Short-term concentrations are not to be exceeded.

^b No *de minimis* concentration; an increase in VOC emissions of 100 TPY or more will require monitoring analysis for ozone.

^c Any emission rate of these pollutants.

Sources: 40 CFR 52.21.
Rule 62-212.400



PROJECT		PROGRESS ENERGY-FLORIDA CRYSTAL RIVER UNIT 3 POWER UPGRADE PROJECT CITRUS COUNTY, FLORIDA			
TITLE		CR3 UPRATE PROJECT SOUTH COOLING TOWER LAYOUT			
PROJECT No.		0738831		FILE No.	
DESIGN		HF	04/30/07	SCALE	
CADD		SH	05/18/07	NTS	
CHECK		MM	05/18/07	REV.	
REVIEW		MM	05/18/07	0	



FIGURE 2-1

APPENDIX A

PM₁₀ EMISSION CALCULATION

Calculating Realistic PM₁₀ Emissions from Cooling Towers

Abstract No. 216 Session No. AM-1b

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ABSTRACT

Particulate matter less than 10 micrometers in diameter (PM₁₀) emissions from wet cooling towers may be calculated using the methodology presented in EPA's AP-42¹, which assumes that all total dissolved solids (TDS) emitted in "drift" particles (liquid water entrained in the air stream and carried out of the tower through the induced draft fan stack.) are PM₁₀. However, for wet cooling towers with medium to high TDS levels, this method is overly conservative, and predicts significantly higher PM₁₀ emissions than would actually occur, even for towers equipped with very high efficiency drift eliminators (e.g., 0.0006% drift rate). Such over-prediction may result in unrealistically high PM₁₀ modeled concentrations and/or the need to purchase expensive Emission Reduction Credits (ERCs) in PM₁₀ non-attainment areas. Since these towers have fairly low emission points (10 to 15 m above ground), over-predicting PM₁₀ emission rates can easily result in exceeding federal Prevention of Significant Deterioration (PSD) significance levels at a project's fence line. This paper presents a method for computing realistic PM₁₀ emissions from cooling towers with medium to high TDS levels.

INTRODUCTION

Cooling towers are heat exchangers that are used to dissipate large heat loads to the atmosphere. Wet, or evaporative, cooling towers rely on the latent heat of water evaporation to exchange heat between the process and the air passing through the cooling tower. The cooling water may be an integral part of the process or may provide cooling via heat exchangers, for example, steam condensers. Wet cooling towers provide direct contact between the cooling water and air passing through the tower, and as part of normal operation, a very small amount of the circulating water may be entrained in the air stream and be carried out of the tower as "drift" droplets. Because the drift droplets contain the same chemical impurities as the water circulating through the tower, the particulate matter constituent of the drift droplets may be classified as an emission. The magnitude of the drift loss is influenced by the number and size of droplets produced within the tower, which are determined by the tower fill design, tower design, the air and water patterns, and design of the drift eliminators.

AP-42 METHOD OF CALCULATING DRIFT PARTICULATE

EPA's AP-42¹ provides available particulate emission factors for wet cooling towers, however, these values only have an emission factor rating of "E" (the lowest level of confidence acceptable). They are also rather high, compared to typical present-day manufacturers' guaranteed drift rates, which are on the order of 0.0006%. (Drift emissions are typically

expressed as a percentage of the cooling tower water circulation rate). AP-42 states that "a conservatively high PM₁₀ emission factor can be obtained by (a) multiplying the total liquid drift factor by the TDS fraction in the circulating water, and (b) assuming that once the water evaporates, all remaining solid particles are within the PM₁₀ range." (Italics per EPA).

If TDS data for the cooling tower are not available, a source-specific TDS content can be estimated by obtaining the TDS for the make-up water and multiplying it by the cooling tower cycles of concentration. [The cycles of concentration is the ratio of a measured parameter for the cooling tower water (such as conductivity, calcium, chlorides, or phosphate) to that parameter for the make-up water.]

Using AP-42 guidance, the total particulate emissions (PM) (after the pure water has evaporated) can be expressed as:

$$PM = \text{Water Circulation Rate} \times \text{Drift Rate} \times \text{TDS} \quad [1]$$

For example, for a typical power plant wet cooling tower with a water circulation rate of 146,000 gallons per minute (gpm), drift rate of 0.0006%, and TDS of 7,700 parts per million by weight (ppmw):

$$PM = 146,000 \text{ gpm} \times 8.34 \text{ lb water/gal} \times 0.0006/100 \times 7,700 \text{ lb solids}/10^6 \text{ lb water} \times 60 \text{ min/hr} = \underline{3.38 \text{ lb/hr}}$$

On an annual basis, this is equivalent to almost 15 tons per year (tpy). Even for a state-of-the-art drift eliminator system, this is not a small number, especially if assumed to all be equal to PM₁₀, a regulated criteria pollutant. However, as the following analysis demonstrates, only a very small fraction is actually PM₁₀.

COMPUTING THE PM₁₀ FRACTION

Based on a representative drift droplet size distribution and TDS in the water, the amount of solid mass in each drop size can be calculated. That is, for a given initial droplet size, assuming that the mass of dissolved solids condenses to a spherical particle after all the water evaporates, and assuming the density of the TDS is equivalent to a representative salt (e.g., sodium chloride), the diameter of the final solid particle can be calculated. Thus, using the drift droplet size distribution, the percentage of drift mass containing particles small enough to produce PM₁₀ can be calculated. This method is conservative as the final particle is assumed to be perfectly spherical; hence as small a particle as can exist.

The droplet size distribution of the drift emitted from the tower is critical to performing the analysis. Brentwood Industries, a drift eliminator manufacturer, was contacted and agreed to provide drift eliminator test data from a test conducted by Environmental Systems Corporation (ESC) at the Electric Power Research Institute (EPRI) test facility in Houston, Texas in 1988 (Aull², 1999). The data consist of water droplet size distributions for a drift eliminator that achieved a tested drift rate of 0.0003 percent. As we are using a 0.0006 percent drift rate, it is reasonable to expect that the 0.0003 percent drift rate would produce smaller droplets, therefore,

this size distribution data can be assumed to be conservative for predicting the fraction of PM₁₀ in the total cooling tower PM emissions.

In calculating PM₁₀ emissions the following assumptions were made:

- Each water droplet was assumed to evaporate shortly after being emitted into ambient air, into a single, solid, spherical particle.
- Drift water droplets have a density (ρ_w) of water, 1.0 g/cm³ or 1.0 * 10⁻⁶ $\mu\text{g} / \mu\text{m}^3$.
- The solid particles were assumed to have the same density (ρ_{TDS}) as sodium chloride, (i.e., 2.2 g/cm³).

Using the formula for the volume of a sphere, $V = 4\pi^3 / 3$, and the density of pure water, $\rho_w = 1.0 \text{ g/cm}^3$, the following equations can be used to derive the solid particulate diameter, D_p , as a function of the TDS, the density of the solids, and the initial drift droplet diameter, D_d :

$$\text{Volume of drift droplet} = (4/3)\pi(D_d/2)^3 \quad [2]$$

$$\text{Mass of solids in drift droplet} = (\text{TDS})(\rho_w)(\text{Volume of drift droplet}) \quad [3]$$

substituting,

$$\text{Mass of solids in drift} = (\text{TDS})(\rho_w)(4/3)\pi(D_d/2)^3 \quad [4]$$

Assuming the solids remain and coalesce after the water evaporates, the mass of solids can also be expressed as:

$$\text{Mass of solids} = (\rho_{\text{TDS}})(\text{solid particle volume}) = (\rho_{\text{TDS}})(4/3)\pi(D_p/2)^3 \quad [5]$$

Equations [4] and [5] are equivalent:

$$(\rho_{\text{TDS}})(4/3)\pi(D_p/2)^3 = (\text{TDS})(\rho_w)(4/3)\pi(D_d/2)^3 \quad [6]$$

Solving for D_p :

$$D_p = D_d [(\text{TDS})(\rho_w / \rho_{\text{TDS}})]^{1/3} \quad [7]$$

Where,

TDS is in units of ppmw

D_p = diameter of solid particle, micrometers (μm)

D_d = diameter of drift droplet, μm

Using formulas [2] – [7] and the particle size distribution test data, Table 1 can be constructed for drift from a wet cooling tower having the same characteristics as our example; 7,700 ppmw TDS and a 0.0006% drift rate. The first and last columns of this table are the particle size distribution derived from test results provided by Brentwood Industries. Using straight-line interpolation for a solid particle size 10 μm in diameter, we conclude that approximately 14.9 percent of the mass emissions are equal to or smaller than PM₁₀. The balance of the solid

particulate are particulate greater than 10 μm . Hence, PM_{10} emissions from this tower would be equal to PM emissions $\times 0.149$, or $3.38 \text{ lb/hr} \times 0.149 = 0.50 \text{ lb/hr}$. The process is repeated in Table 2, with all parameters equal except that the TDS is 11,000 ppmw. The result is that approximately 5.11 percent are smaller at 11,000 ppm. Thus, while total PM emissions are larger by virtue of a higher TDS, overall PM_{10} emissions are actually lower, because more of the solid particles are larger than 10 μm .

Table 1. Resultant Solid Particulate Size Distribution (TDS = 7700 ppmw)

EPRI Droplet Diameter (μm)	Droplet Volume (μm^3) [2]	Droplet Mass (μg) [3]	Particle Mass (Solids) (μg) [4]	Solid Particle Volume (μm^3)	Solid Particle Diameter (μm) [7]	EPRI % Mass Smaller
10	524	5.24E-04	4.03E-06	1.83	1.516	0.000
20	4189	4.19E-03	3.23E-05	14.66	3.037	0.198
30	14137	1.41E-02	1.09E-04	49.48	4.553	0.228
40	33510	3.35E-02	2.68E-04	117.29	6.073	0.514
50	65450	6.54E-02	5.04E-04	229.07	7.591	1.518
60	113067	1.13E-01	8.71E-04	395.84	9.110	5.702
70	179594	1.80E-01	1.38E-03	628.58	10.628	21.348
80	261704	2.62E-01	2.94E-03	1135.66	13.685	49.512
90	369910	3.69E-01	5.37E-03	2438.16	16.701	70.509
100	505347	5.05E-01	9.86E-03	4026.21	19.738	82.023
150	1767148	1.77E+00	1.36E-02	6185.01	22.774	88.012
180	3053628	3.05E+00	2.35E-02	10887.70	27.329	91.032
210	4849048	4.85E+00	3.73E-02	16971.67	31.884	92.468
240	7238229	7.24E+00	5.57E-02	25333.60	36.439	94.001
270	10305995	1.03E+01	7.94E-02	36070.98	40.994	94.889
300	14137187	1.41E+01	1.09E-01	49480.08	45.549	95.288
350	22449298	2.24E+01	1.73E-01	78572.54	53.140	97.011
400	33510322	3.35E+01	2.58E-01	117296.13	60.732	98.340
450	47712938	4.77E+01	3.67E-01	166995.28	68.323	99.071
500	65449847	6.54E+01	5.04E-01	226074.46	75.915	99.071
600	113067336	1.13E+02	8.71E-01	395840.67	91.068	100.000

Bracketed numbers refer to equation number in text.

The percentage of PM_{10}/PM was calculated for cooling tower TDS values from 1000 to 12000 ppmw and the results are plotted in Figure 1. Using these data, Figure 2 presents predicted PM_{10} emission rates for the 146,000 gpm example tower. As shown in this figure, the PM emission rate increases in a straight line as TDS increases, however, the PM_{10} emission rate increases to a maximum at around a TDS of 4000 ppmw, and then begins to decline. The reason is that at higher TDS, the drift droplets contain more solids and therefore, upon evaporation, result in larger solid particles for any given initial droplet size.

CONCLUSION

The emission factors and methodology given in EPA's AP-42¹ Chapter 13.4 *Wet Cooling Towers*, do not account for the droplet size distribution of the drift exiting the tower. This is a critical factor, as more than 85% of the mass of particulate in the drift from most cooling towers will result in solid particles larger than PM_{10} once the water has evaporated. Particles larger than PM_{10} are no longer a regulated air pollutant, because their impact on human health has been shown to be insignificant. Using reasonable, conservative assumptions and a realistic drift

droplet size distribution, a method is now available for calculating realistic PM₁₀ emission rates from wet mechanical draft cooling towers equipped with modern, high-efficiency drift eliminators and operating at medium to high levels of TDS in the circulating water.

Table 2. Resultant Solid Particulate Size Distribution (TDS = 11000 ppmw)

EPRI Droplet Diameter (μm)	Droplet Volume (μm ³) [2]	Droplet Mass (μg) [3]	Particle Mass (Solids) (μg) [4]	Solid Particle Volume (μm ³) [5]	Solid Particle Diameter (μm) [7]	EPRI % Mass Smaller
10	524	5.24E-04	5.76E-06	2.62	1.710	0.000
20	4189	4.18E-03	4.61E-05	20.94	3.420	0.196
30	14137	1.41E-02	1.56E-04	70.69	5.130	0.228
40	33510	3.35E-02	3.69E-04	167.55	6.640	0.514
50	65450	6.54E-02	7.20E-04	327.25	8.650	1.616
60	113097	1.13E-01	1.24E-03	585.49	10.260	5.702
70	179594	1.80E-01	1.98E-03	897.97	11.970	21.348
90	381704	3.82E-01	4.20E-03	1908.52	15.390	49.612
110	696910	6.97E-01	7.67E-03	3484.55	18.810	70.509
130	1150347	1.15E+00	1.27E-02	5751.73	22.230	82.523
150	1767146	1.77E+00	1.94E-02	8835.73	25.660	88.012
180	3053628	3.05E+00	3.38E-02	15268.14	30.780	91.032
210	4849048	4.85E+00	5.33E-02	24245.24	35.909	92.468
240	7238229	7.24E+00	7.98E-02	36191.15	41.039	94.091
270	10305695	1.03E+01	1.13E-01	51529.97	46.168	94.689
300	14137167	1.41E+01	1.58E-01	70685.83	51.299	96.268
350	22449298	2.24E+01	2.47E-01	112346.49	59.649	97.011
400	33510322	3.35E+01	3.69E-01	167551.51	66.399	98.340
450	47712938	4.77E+01	5.25E-01	238584.69	76.949	99.071
500	65449847	6.54E+01	7.20E-01	327249.23	85.499	99.071
600	113097336	1.13E+02	1.24E+00	565486.68	102.699	100.000

Figure 1: Percentage of Drift PM that Evaporates to PM₁₀

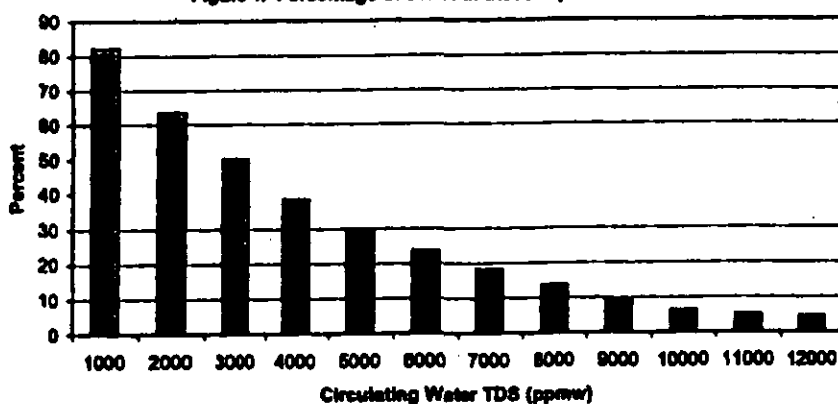
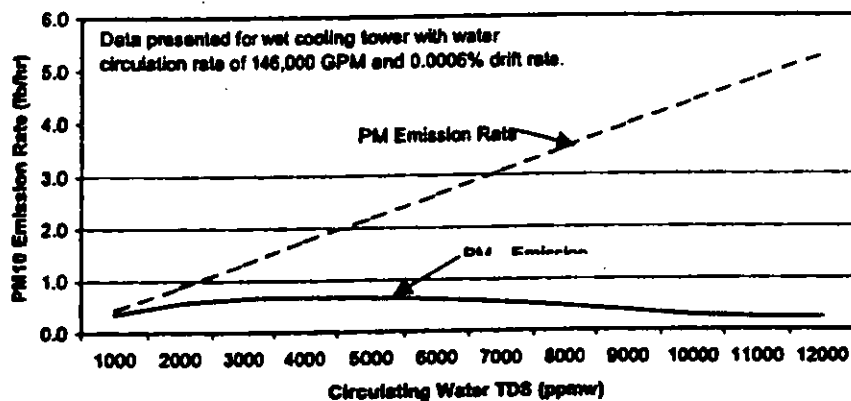


Figure 2: PM₁₀ Emission Rate vs. TDS

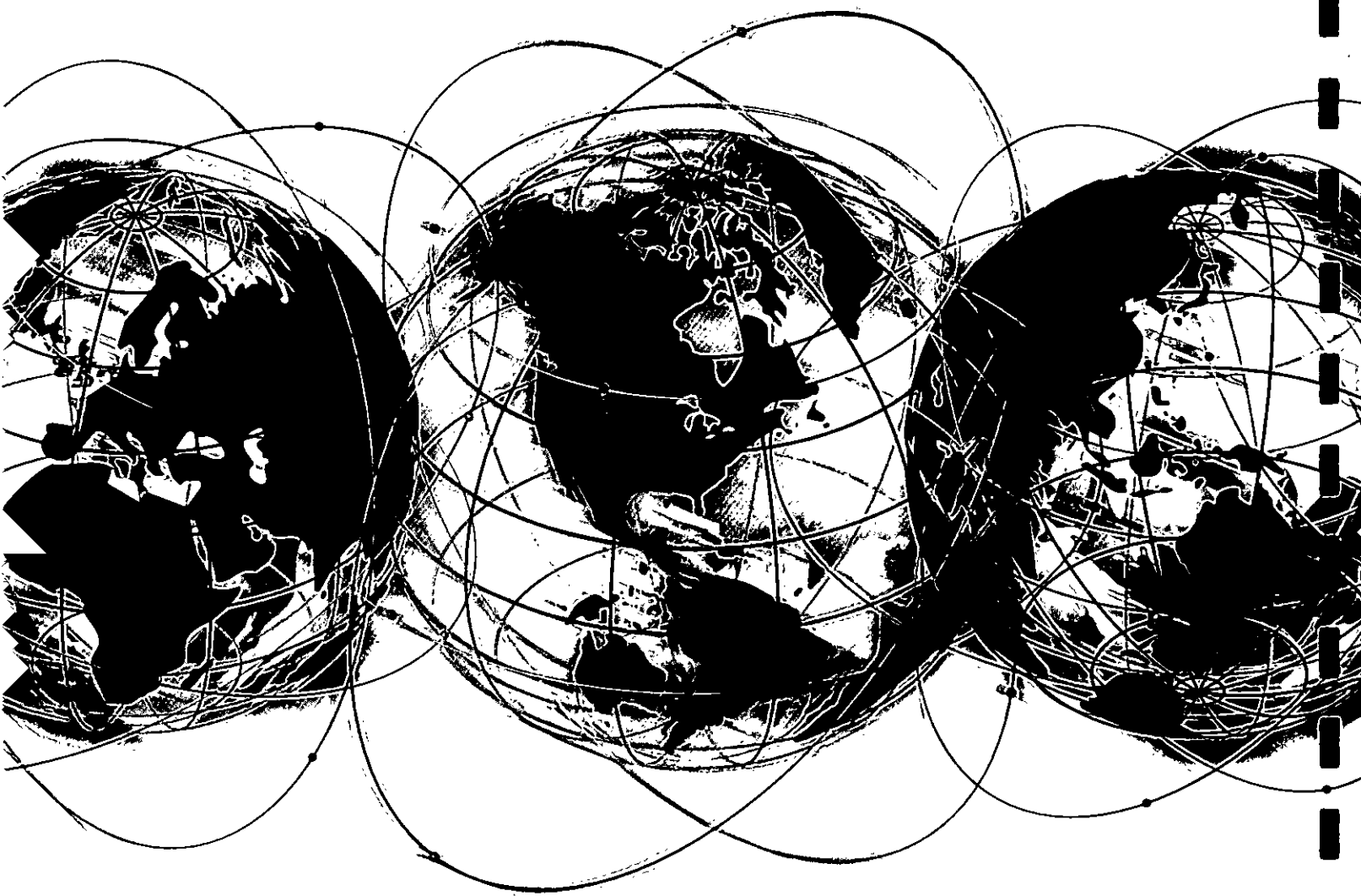


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2. Aull, 1999. Memorandum from R. Aull, Brentwood Industries to J. Reisman, Greystone, December 7, 1999.

KEY WORDS

Drift
Drift eliminators
Cooling tower
PM₁₀ emissions
TDS



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