TECHNICAL EVALUATION

&

PRELIMINARY DETERMINATION

APPLICANT

Solid Waste Authority of Palm Beach County
7501 North Jog Road
West Palm Beach, Florida 33412

PROJECT

DEP File No. 0990234-017-AC (PSD-FL-413)
Palm Beach Renewable Energy Facility No. 2

COUNTY

Palm Beach County, Florida

PERMITTING AUTHORITY

Florida Department of Environmental Protection
Division of Air Resource Management
Bureau of Air Regulation
2600 Blair Stone Road, MS#5505
Tallahassee, Florida 32399-2400

November 15, 2010

1. APPLICATION INFORMATION

1.1. Applicant Name and Address

Solid Waste Authority of Palm Beach County (the SWA)
7501 North Jog Road
West Palm Beach, Florida 33412

Authorized Representative: Mr. Mark Hammond, Executive Director

1.2. Key Dates

- May 17, 2010 — Received a Prevention of Significant Deterioration (PSD) air construction permit application from the SWA.
- June 16 — Department issued first request for additional information (RAI).
- August 9 & 23 — Received responses to first RAI.
- September 14 — Received further information in response to first RAI and modification of application to incorporate selective catalytic reduction (SCR).
- October 6 — Received ambient air quality modeling to demonstrate compliance with the 1-hour nitrogen dioxide (NO_2) and 1-hour sulfur dioxide (SO_2) National Ambient Air Quality Standards (NAAQS.
- November 15 — Department issued Draft Permit decision for SRF and posted documents.

1.3. Facility Location

Palm Beach County (PBC) owns the Palm Beach County Renewable Energy Park (PBREP), which is located at 7501 North Jog Road (immediately west of the Turnpike) in West Palm Beach. The PBREP consists of Class I and Class III landfills, a biosolids pelletizer facility, a compost facility and a waste-to-energy (WTE) plant known as the North County Resource Recovery Facility (NCRRF).

The existing NCRRP is operated by Palm Beach Resource Recovery Corporation, which is a subsidiary of Babcock and Wilcox Corporation (B&W). It consists of a municipal solid waste (MSW) tipping floor, a refuse derived fuel (RDF) processing plant, a RDF storage building, two RDF-fueled municipal waste combustors (MWC), a steam turbine-electric generator (STG), pollution control equipment, and associated facilities and equipment. The location of the PBREP is shown in Figure 1. The UTM coordinates are Zone 17; 585.3 kilometers (km) East and 2,961.7km North.

Figure 1 - Location of the Existing PBREP

Figure 2 - Aerial View from Northeast of the PBREP

The PBREP is located approximately 118 kilometers north northeast of the Everglades National Park (ENP), a Class I area with respect to the PSD rules and 123 km north of the Class II Biscayne Bay National Park. The landfill and waste unloading area at the PBREP are shown below.

Figure 3 – Existing SWA Landfill

Figure 4 – Waste Transfer Trucks

1.4. Project Description

The applicant proposes to construct a second WTE plant to be known as the Palm Beach Renewable Energy Facility No. 2 (PBREF-2) and will be located immediately north of the existing PBREP as shown in a preliminary rendition below. PBREF-2 will consist of:

Figure 5 – Existing NCRRF (left, south) and Artist Rendition of the new PBREF-2 (right, north)

- Three nominal 1,000 TPD mass burn MWC, each with an estimated maximum continuous rating (MCR) of 416.7 million Btu per hour heat input (mmBtu/hr) and a peak rating of 458.3 mmBtu/hr;
- A 100 megawatt (MW) STG with an air cooled condenser;
- One ash building and handling system;
- Three lime storage silos and one carbon storage silo; and
- Two 250 horsepower (hp) diesel fire pumps and one 250 kilowatt (kW) emergency generator.

Figure 6 - Northeast View of New PBREF-2 Figure 7 - View of Stacks from IronHorse – 17th Tee

The three MWC furnaces will be based on grate stoker technology. Each boiler will produce approximately 291,000 pounds per hour (lb/hr) of steam on a 24-hr basis and 320,100 lb/hr of steam on a 4-hr block average. Approximately 78 MW of electric power from the single STG will be delivered to the grid. Table 1 indicates the new emissions units (EUs) that will be added by this project.

Table 1. - New EUs for PBREF #2

Facility ID No. 0990234	
ID No.	**Emission Unit Description**
024	Municipal Waste Combustor #1
025	Municipal Waste Combustor #2
026	Municipal Waste Combustor #3
027	Lime Storage Silo A
028	Lime Storage Silo B
029	Lime Storage Silo C
030	Carbon Storage Silo
031	Diesel Fire Pump A
032	Diesel Fire Pump B
033	Emergency Generator
034	Ash Building and Handling System

1.5. Additional Project Features

Fuels

The SWA proposes to fuel the new mass-burn MWC stoker units primarily with MSW rather than RDF. A natural gas-fired auxiliary burner system will be used on a limited basis during periods of startup and shutdown and to maintain good combustion conditions. MSW includes the items and materials that fit within the definition of MSW contained in either 40 CFR 60.51b or Section 403.706(5), Florida Statutes (1995). The PBREF-2 will also process other solid wastes that are not strictly classified as MSW. Following is an example of a typical fuel slate for MWC in Florida. The actual fuel slate for the proposed project will be stated in the permit.

The facility shall not burn any of the following materials:

a) those materials that are prohibited by state or federal law;
b) those materials that are prohibited by this permit;
c) lead acid batteries;
d) hazardous waste;
e) nuclear waste;
f) radioactive waste;

g) sewage sludge;
h) explosives; and
i) beryllium-containing waste, as defined in 40 CFR 61, Subpart C.

Further, the facility shall not knowingly burn:

a) nickel-cadmium batteries pursuant to Section 403.7192 (3);
b) mercury containing devices and lamps pursuant to Sections 403.7186(2) & (3);
c) untreated biomedical waste from biomedical waste generators regulated pursuant to Chapter 64E-16, F.A.C., and from similar generators (or sources);
d) segregated loads of biological waste; and
e) chromated copper arsenate (CCA) treated wood.

The following other solid waste may be used as fuel at the facility:

a) confidential, proprietary or special documents (including but not limited to business records, lottery tickets, event tickets, coupons and microfilm);
b) contraband which is being destroyed at the request of appropriately authorized local, state or federal governmental agencies, provided that such material is not an explosive, a propellant, a hazardous waste, or otherwise prohibited at the facility. For the purposes of this determination, contraband includes but is not limited to drugs, narcotics, fruits, vegetables, plants, counterfeit money, and counterfeit consumer goods;
c) wood pallets, clean wood, and land clearing debris;
d) packaging materials and containers;
e) clothing, natural and synthetic fibers, fabric remnants, and similar debris, including but not limited to aprons and gloves;
f) rugs, carpets, and floor coverings, but not asbestos-containing materials or polyethylene or polyurethane vinyl floor coverings;
g) construction and demolition debris;
h) oil spill debris from aquatic, coastal, estuarine or river environments. Such items or materials include but are not limited to rags, wipes, and absorbents;
i) items suitable for human, plant or domesticated animal use, consumption or application where the item's shelf-life has expired or the generator wishes to remove the items from the market. Such items or materials include but are not limited to off-specification or expired consumer products, pharmaceuticals, medications, health and personal care products, cosmetics, foodstuffs, nutritional supplements, returned goods, and controlled substances;
j) consumer-packaged products intended for human or domesticated animal use or application but not consumption. Such items or materials include but are not limited to carpet cleaners, household or bathroom cleaners, polishes, waxes and detergents;
k) Waste materials that:
   i. are generated in the manufacture of items in categories (c) or (d) above and are functionally or commercially useless (expired, rejected or spent); or
   ii. are not yet formed or packaged for commercial distribution. Such items or materials must be substantially similar to other items or materials routinely found in MSW.
l) Waste materials that contain oil from:
   i. the routine cleanup of industrial or commercial establishments and machinery; or
   ii. spills of virgin or used petroleum products. Such items or materials include but are not limited to rags, wipes, and absorbents.
m) used oil and used oil filters. Used oil containing a PCB concentration equal or greater than 50 parts per million (ppm) shall not be burned, pursuant to the limitations of 40 CFR 761.20(e); and
n) waste materials generated by manufacturing, industrial or agricultural activities, provided that these items or materials are substantially similar to items or materials that are found routinely in MSW, subject to prior approval of the Department.

Air Pollution Controls

MWC

The exact design details of the proposed PBREF-2 will be available after a bidder is selected. However, the basic features of the MWC and associated air pollution control equipment are known. The typical pollution control measures and equipment for recently constructed mass burn units in the U.S. consist of Good Combustion Practices (GCP), Spray Dryer (SD) Absorber, Fabric Filter (FF) Baghouse, Activated Carbon Injection (CI) and Selective Non-Catalytic Reduction (SNCR). The shorthand notation for this arrangement is GCP/SD/FF/CI/SNCR. The PBREF-2 project is based on this arrangement, but will incorporate an advanced feature known as selective catalytic reduction (SCR) in lieu of or in addition to SNCR. Thus the PBREF-2 strategy is GCP/SD/FF/CI/SCR.

Figure 8 is a diagram of the typical Martin GmbH (a partner of Covanta) mass burn grate stoker MWC with the typical air pollution control equipment configuration of GCP/SD/FF/CI/SNCR. MSW is unloaded and then charged to grate stoker furnace where it is combusted. The ammonia (NH_3) tank and injection system shown in the figure are for the SNCR system that controls nitrogen oxides (NO_X) formed in the furnace. A possible location of a SCR unit is indicated as well.

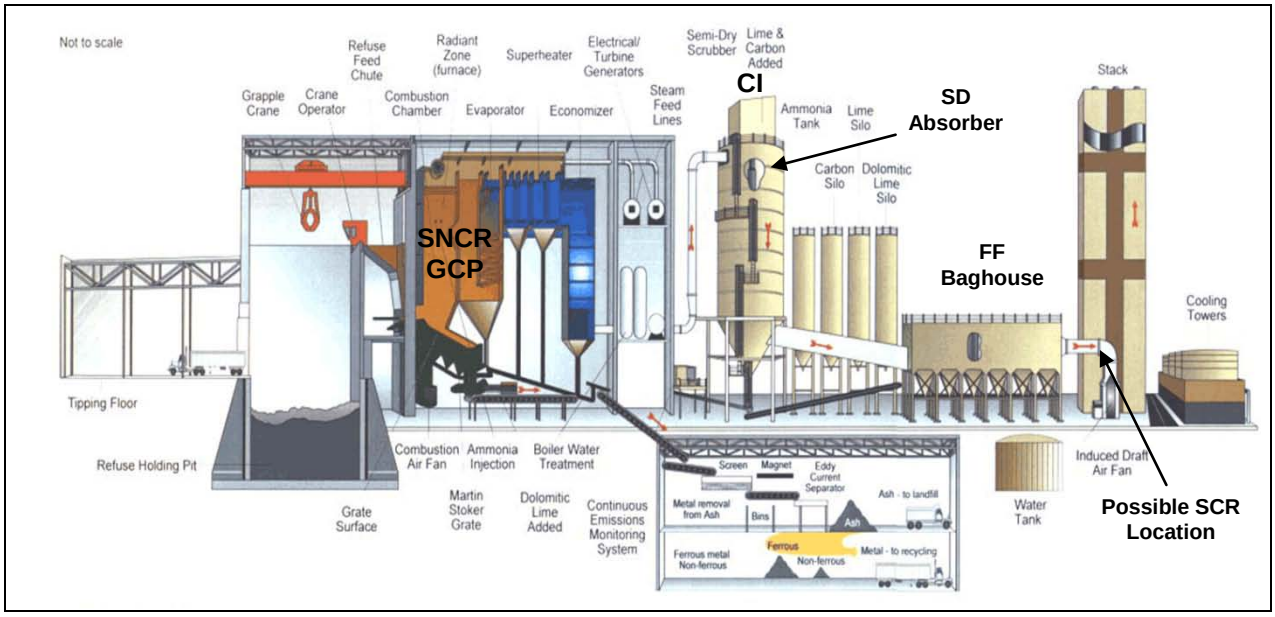


Figure 8 – Typical Martin GmbH Mass Burn MWC with GCP/SD/FF/CI/SNCR Configuration

The lime silos, lime addition point and semidry scrubber shown in the figure comprise the SD absorber system wherein acid gases in the furnace exhaust such as hydrogen chloride (HCl) and sulfur dioxide (SO_2) are neutralized and captured as particulate matter (PM). The carbon silo and addition point comprise the activated CI system which serves to capture (adsorb) certain metals such as mercury (Hg) and organic hazardous air pollutants (HAP) such as dioxin and furan (D/F) and then remove them in the FF baghouse. The baghouse contains the FF media that captures PM originating from the combustion, the acid gas reactions and the spent activated carbon. However it would be located between the FF baghouse and the stack and would (in conjunction with or in the absence of SNCR) destroy NO_X, react and reduce excess NH_3, and provide addition organic HAP and D/F control.

Storage

- PM Emissions from the carbon and limo silos will be controlled by a FF baghouses.

Emergency Support Equipment

- The emergency generator and fire pumps will be designed to meet the emission limits given in New Source Performance Standards (NSPS) Subpart IIII and National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart ZZZZ.
- Ultra low sulfur distillate (ULSD) fuel oil will be utilized, and operation of these units will be limited to 100 hours per year or less per unit.

1.6. Project Emissions

Tabulations of project emissions are given and discussed in conjunction with major source review applicability in Section 2.3.

2. APPLICABLE REGULATIONS

2.1. State Regulations

This project is subject to the applicable environmental laws specified in Chapter 403 of the Florida Statutes (F.S.). The F.S. authorize the Department of Environmental Protection (Department) to establish rules and regulations regarding air quality as part of the Florida Administrative Code (F.A.C.). This project is subject to the applicable rules and regulations defined in the following Chapters of the F.A.C. and summarized in Table 2.

Table 2 - Applicable Rules from the F.A.C.

F.A.C. Rule	Description
62-4	Permits
62-204	Air Pollution Control – General Provisions
62-210	Stationary Sources of Air Pollution – General Requirements
62-212	Stationary Sources – Preconstruction Review
62-213	Operation Permits for Major Sources (Title V) of Air Pollution
62-214	Requirements for Sources Subject to the Federal (Title IV) Acid Rain Program
62-296	Stationary Sources – Emission Standards
62-297	Stationary Sources – Emissions Monitoring

2.2. Federal Regulations

The U.S. Environmental Protection Agency (EPA) establishes air quality regulations in 40 CFR Part 60 that identifies New Source Performance Standards (NSPS) for a variety of industrial activities. 40 CFR Part 61 specifies National Emission Standards for Hazardous Air Pollutants (NESHAP). 40 CFR Part 63 specifies NESHAP provisions based on the Maximum Achievable Control Technology (MACT) for given source categories. Federal regulations adopted by reference are given in Rule 62-204.800, F.A.C. State regulations approved by EPA are given in 40 CFR Part 52, Subpart K – Florida, also known as the State Implementation Plan (SIP) for Florida.

2.3. PSD Major Stationary Source Applicability Determination

The Department regulates major stationary sources in accordance with Florida's PSD program pursuant to Rule 62-212.400, F.A.C. PSD preconstruction review is required in areas that are currently in attainment with the state and federal Ambient Air Quality Standards (AAQS) or areas designated as "unclassifiable" for these regulated pollutants.

As defined in Rule 62-210.200(189), F.A.C., a facility is considered a "major stationary source" if it emits or has the potential to emit (PTE) 5 tons per year (TPY) of lead (Pb), 250 TPY or more of any PSD pollutant, or 100 TPY or more of any PSD pollutant and the facility belongs to one of the 28 listed PSD major facility categories. The existing NCRRF (to which the PBREF-2 is an expansion) is a major stationary source because it contains: *"Municipal incinerators capable of charging more than 250 tons of refuse per day which emits, or has the PTE, 100 TPY or more of any PSD pollutant."*

PSD pollutants include: carbon monoxide (CO); NO_X; SO_2; PM; PM smaller than 10 micrometers (PM_{10}); VOC; Pb; fluorides (F); sulfuric acid mist (SAM); total reduced sulfur (TRS), including hydrogen sulfide (H_2S); MWC organics measured as total tetra- through octa-chlorinated dibenzo-p-dioxins and dibenzofurans (D/F); MWC metals measured as PM; MWC acid gases (MWC-AG) measured as SO_2 and hydrogen chloride (HCl); MSW landfill emissions as non-methane organic compounds (NMOC); and Hg.

Refer to Table 3. For existing major stationary sources (such as the existing NCRRF), PSD applicability is based on emissions thresholds known as the significant emission rates (SER) as defined in Rule 62-210.200, (Definitions) F.A.C. Emissions of PSD pollutants from the PBREF-2 project exceeding these SER are considered "significant" and BACT must be employed to minimize emissions of each pollutant.

Table 3 – List of SER by PSD-Pollutant

Pollutant	SER (TPY)	Pollutant	SER (TPY)
CO	100	NO_X	40
PM/PM_{10}	25/15	Ozone (VOC) [1]	40
Ozone (NO_X) [1]	40	SAM	7
SO_2	40	F	3
MWC organics as D/F	3.5×10^{-6}	MWC-AG as $HCl+SO_2$	40
MWC metals as PM	15	MSW Landfill Emissions as NMOC	50
Pb	0.6	TRS	10
H_2S	10	Hg	0.1

1. Ozone (O_3) is regulated by its precursors (VOC and NO_X).

Table 4 is a summary of the applicant's revised estimates of key regulated air pollutants from the proposed PBREF-2 and whether each pollutant exceeds the respective SER thus triggering PSD.

Table 4 – Applicant's Revised Estimated PTE of Key Pollutants (in TPY) for the PBREF-2

Pollutant and Emissions in TPY	3 MWC	Silos	Diesel Fire Pumps	Emergency Generator	Total	PSD?
NO_X	401.9		0.14	0.15	402.2	Yes
CO	434.9		0.07	0.09	435.1	Yes
SO_2	298.7		0.0003	0.0002	298.7	Yes
MWC-AG as HCl, SO_2	440.4				440.4	Yes
VOC	59.8		0.003	0.006	59.8	Yes
PM [1] and MWC metals as PM [1]	56.1	0.04	0.006	0.003	56.1	Yes
PM_{10} [1]	56.1	0.036	0.006	0.003	56.1	Yes
Pb	0.65				0.65	Yes
SAM	95.2				95.2	Yes
MWC organics as D/F	6.08×10^{-5}				6.08×10^{-5}	Yes
Hg	0.056				0.056	No
Fluorides (Estimated as HF) [3, 5]	13.6				13.6	No [5]
$PM_{2.5}$ [1]	56.1	0.036	0.006	0.003	56.1	Note 2
HCl	141.7				141.7	Note 3
HF	~13.6				~13.6	Note 3
Cadmium (Cd)	0.047				0.047	Note 3
NH_3	33.00				33.0	Note 4

1. PM, PM_{10}, and PM with a diameter less than 2.5 micrometers ($PM_{2.5}$) from the MWC are estimated as filterable (front-half sampling train) material measured by EPA Method 5.
2. $PM_{2.5}$ is also a PSD pollutant under federal rules, but an SER has not yet been defined in the Department's rules. It is regulated by its precursors and surrogates (e.g. PM/PM_{10} NH_3, SO_2, NO_X).
3. HCl, HF and Cd are HAP which are not regulated by the PSD program.
4. NH_3 is introduced as a pollution control reagent for the SCR system.
5. Applicant assumed that HF constitutes Fluorides. However, HF is regulated as a HAP (see Note 3). Non-HF Fluoride emissions will be much less than 13.6 TPY and less than 3 TPY based on tests conducted at existing NCRRF.

2.4. Regulatory Classification

Following is a summary of the applicability of key regulations to the PBREF-2 project.

Chapter 62-4, F.A.C. www.dep.state.fl.us/air/rules/fac/62-4.pdf

Rule 62-4.070(1), F.A.C., Standards for Issuing or Denying Permits; Issuance; Denial.

This rule applies to all permitting decisions:

- A permit shall be issued to the applicant upon such conditions as the Department may direct, only if the applicant affirmatively provides the Department with reasonable assurance based on plans, test results, installation of pollution control equipment, or other information, that the construction, expansion, modification, operation, or activity of the installation will not discharge, emit, or cause pollution in contravention of Department standards or rules.

Chapter 62-17, F.A.C. www.dep.state.fl.us/siting/files/rules_statutes/pps_rule.pdf

- The PBREF-2 project requires a modification of the previously issued conditions of certification for the NCRRF pursuant to the power plant siting provisions of this rule.

Chapter 62-204, F.A.C. www.dep.state.fl.us/air/rules/fac/62-204.pdf

Rule 62-204.220(1), F.A.C., Ambient Air Quality Protection.

This rule applies to all air permitting decisions.

- The Department shall not issue an air permit authorizing a person to build, erect, construct, or implant any new emissions unit; operate, modify, or rebuild any existing emissions unit; or by any other means release or take action which would result in the release of an air pollutant into the atmosphere which would cause or contribute to a violation of an ambient air quality standard established under Rule 62-204.240, F.A.C.

Rule 62-204.240, F.A.C., Ambient Air Quality Standards.

This rule applies to all air permitting decisions.

- Refer to list of pollutants and ambient air quality standards provided therein and discussed in the Ambient Air Quality Section of this evaluation.

Rule 62-204.800(8), F.A.C., 40 CFR 60, NSPS.

The following provisions incorporated into Rule 62-204.800(8), F.A.C. adopted from 40 CFR 60 and incorporated into this rule apply to this project:

- 40 CFR 60, Subpart A – General Provisions;
- 40 CFR 60, Subpart Eb – Standards of Performance for Large Municipal Waste Combustors for Which Construction is Commenced After September 20, 1994 or for Which Modification or Reconstruction is Commenced After June 19, 1996; and
- 40 CFR 60, Subpart IIII – Stationary Compression Ignition Internal Combustion Engines (ICE).

In accordance with Section 129 of the Clean Air Act (CAA), Subpart Eb accomplishes the purposes of both the NSPS and NESHAP MACT requirements for MWC.

Rule 62-204.800(11), F.A.C., 40 CFR 63, NESHAP.

The following provision incorporated into Rule 62-204.800(11), F.A.C. adopted from 40 CFR 63 and incorporated into this rule applies to this project:

- 40 CFR 63, Subpart ZZZZ – Stationary Reciprocating Internal Combustion Engines (RICE). This subpart requires all affected area source units to meet the applicable emission standards of 40 CFR 60, Subpart IIII.

Chapter 62-210, F.A.C. www.dep.state.fl.us/air/rules/fac/62-210.pdf

Rule 62-210.200, F.A.C., Definitions.

- The facility (including the PBREF-2) is a Title V or "Major Source" of air pollution because the PTE of at least one regulated pollutant will exceed 100 TPY.
- The facility (including the PBREF-2) is a major source of HAP because it emits or has a PTE of 10 TPY or more of any one HAP or 25 TPY or more of any combination of HAP.
- The facility (including the PBREF-2) is classified as a "Major Stationary Source" (PSD-source) because it emits 100 TPY or more of a PSD pollutant and is one of the 28 facility categories listed in the definition with the PSD applicability threshold of 100 TPY.

Rule 62-210.300, F.A.C., Permits Required.

- Unless exempted, the owner or operator of any facility or emissions unit which emits or can reasonably be expected to emit any air pollutant shall obtain appropriate authorization (i.e. a permit) from the Department prior to undertaking any activity at the facility or emissions unit for which such authorization is required.

Rule 62-210.350, F.A.C. Public Notice and Comment.

- A notice of proposed agency action on permit application, where the proposed agency action is to issue the permit, shall be published by any applicant.
- The rule details additional public notice requirements for emissions units subject to PSD. Examples include: the location and nature of the project; whether BACT has been determined; PSD increment consumption; and notification to the public of the opportunity to submit comments or request a public hearing (meeting).

Rule 62-210.700, F.A.C., Excess Emissions.

This rule applies to all air permitting decisions. Only the key provisions potentially affecting this project are listed.

- Excess emissions resulting from startup, shutdown or malfunction of any emissions unit shall be permitted providing (1) best operational practices to minimize emissions are adhered to and (2) the duration of excess emissions shall be minimized but in no case exceed two hours in any 24 hour period unless specifically authorized by the Department for longer duration.
- Excess emissions which are caused entirely or in part by poor maintenance, poor operation, or any other equipment or process failure which may reasonably be prevented during startup, shutdown, or malfunction shall be prohibited.
- Considering operational variations in types of industrial equipment operations affected by this rule, the Department may adjust maximum and minimum factors to provide reasonable and practical regulatory controls consistent with the public interest.

Chapter 62-212, F.A.C. www.dep.state.fl.us/air/rules/fac/62-212.pdf

Rule 62-212.300, F.A.C., General Preconstruction Review Requirements.

- This rule generally applies to the construction or modification of air pollutant emitting facilities in those parts of the state in which the state ambient air quality standards are being met.

Rule 62-212.400, F.A.C., PSD.

- The rule applies because the project is a major stationary (PSD) source and the project emissions exceed the SER.

Chapter 62-213, F.A.C. www.dep.state.fl.us/air/rules/fac/62-213.pdf

- Because the facility is a Title V source, the applicant will be required to apply for and obtain a Title V operation permit revision for the PBREF-2 project in the future.

Chapter 62-214, F.A.C. www.dep.state.fl.us/air/rules/fac/62-214.pdf

- The proposed plant will be a Title V source, will serve an electric generator capable of generating 25 MW or more of electricity and will sell the resultant electricity. At this time, the unit will burn less than 20% fossil fuels in the MWC units and will not be required to apply for and obtain a Title IV Acid Rain Part within its Title V operation permit. However, if increased fossil fuels are fired at the MWC units, the facility is subject to the requirements of Chapter 62-214.320(1)(h), F.A.C.

Chapter 62-296, F.A.C. www.dep.state.fl.us/air/rules/fac/62-296.pdf

Rule 62-296.320, F.A.C., General Pollutant Emission Limitation Standards.

- This rule prohibits the discharge of air pollutants which cause or contribute to an objectionable odor;
- This rule specifies a visible emissions (VE) standard of 20 percent (%) opacity; and
- The rule prohibits emissions of unconfined PM provisions without taking reasonable precautions to prevent such emissions.

Rules 62-296.401, F.A.C., Incinerators

- Incinerators and WTE facilities combust waste. The fuel slate authorized by this permit constitutes a waste or MSW according to the Department's rules, but the rule applies to permits charging 50 tons per year
- TPD or less. Therefore, this rule does not apply to this project.

Rule 62-296.416, F.A.C., WTE Facilities.

- Incinerators and waste to energy facilities combust waste. The fuel slate authorized by this permit constitutes a waste or MSW according to the Department's rules, and the rule applies to this permit since it authorizes charging is 50 TPD or greater.

Rule 62-296.406, F.A.C., Fossil Fuel Steam Generators with Less than 250 mmBtu Heat Input

- This rule applies only to the extent that fossil fuel is burned in the MWC unit. The fossil fuel heat input capability of the MWC unit will be less than 250 mmBtu/hr. This provision specifies a VE standard of 20 percent (%) opacity; and compliance with the Best Available Control Technology limits for NO_X and SO_2 (e.g., this permit BACT Determination).

Rule 62-296.470, F.A.C., Implementation of Federal Clean Air Interstate Rule (CAIR).

- The Palm Beach Renewable Energy Park is subject to CAIR.

3. BACT REVIEW

BACT determinations are required for the pollutants that are subject to PSD review, including NO_X, CO, SO_2, PM/PM_{10}, VOC, Pb, F, SAM, MWC organics as D/F, MWC metals as PM, and MWC-AG as SO_2 and HCl.

A BACT determination for $PM_{2.5}$ is not required primarily because the Department has not yet adopted a SER for $PM_{2.5}$ and identified it as a PSD-pollutant. Even without a SIP requirement and without approved test methods or accounting requirements, the Department nevertheless relies on precursors and surrogates to minimize direct emissions and subsequent formation of $PM_{2.5}$ per the rationale given below.

On September 16, 1997, EPA revised the NAAQS for particulate matter, which includes a new NAAQS for $PM_{2.5}$. Florida implemented an ambient monitoring program for $PM_{2.5}$. As EPA mentioned in its guidance dated October 23, 1997, there are significant technical difficulties with respect to $PM_{2.5}$ monitoring, emissions estimation and modeling.

This guidance recommended the use of PM_{10} as a surrogate for $PM_{2.5}$ in meeting New Source Review (NSR) requirements under the CAA, including the permit programs for PSD. Meeting these measures in the interim will serve as a surrogate approach for reducing $PM_{2.5}$ emissions and protecting air quality. Florida is in the process of revising its SIP to address the new $PM_{2.5}$, NAAQS, PSD SER and ambient air quality impact thresholds for modeling analyses as required by EPA for approved states by early 2011. Until state regulations support PSD preconstruction review for $PM_{2.5}$ emissions, the Department will rely on PM_{10} emission limits and $PM_{2.5}$ precursor limits (e.g., SAM, SO_2, VOC, NH_3, and NO_X). This approach is more robust than the EPA guidance memoranda.

3.1. Definition of BACT

Rule 62-210.200, F.A.C. defines "BACT" as:

An emission limitation, including a visible emissions standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account:

1. *Energy, environmental and economic impacts, and other costs;*
2. *All scientific, engineering, and technical material and other information available to the Department; and*
3. *The emission limiting standards or BACT determinations of Florida and any other state;*

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 each such pollutant.

If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of an emissions unit 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.

Each BACT determination shall include applicable test methods or shall provide for determining compliance with the standard(s) by means which achieve equivalent results.

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, 61, and 63.

3.2. BACT Review for the MWC (EU 024, 25, 26)

Generation of Pollutants from MWC

A very basic description of the mass burn process and planned air pollution control equipment was provided in Section 1.5 above. A WTE facility is a complete industrial installation containing most or all of the following features:

- Waste receiving and separation
- Waste storage and handling
- Waste feeding
- Furnace for combustion
- Heat recovery equipment followed by steam and electricity generation
- Air pollution control devices (flue gas treatment)
- Residue (ash and wastewater) handling installations

A schematic of a mass-burn MWC with steam electrical power production is shown in the following figure. Some of the points where pollutants can be removed or formation prevented are shown.

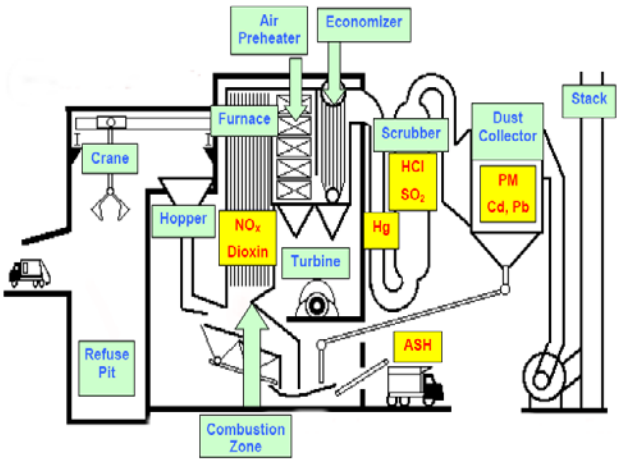


Figure 9. Pollutant Generation/Control Points

Figure 10 - Refuse pit at Brescia facility, Italy

Waste is delivered, weighed, sorted/separated if necessary, and tipped into the refuse pit, such as the one shown in Figure 10, where it is temporarily stored. The tipping hall and refuse pit are closed buildings to minimize dust and odor releases. The waste is mixed in the refuse pit which is designed to hold sufficient fuel for several days of combustion as waste is typically delivered during normal working hours while the plant operates "24/7". Air is continually extracted from the pit to maintain a negative pressure and serves as combustion air for the furnace.

A crane system lifts the waste from the refuse pit and transports it to the feed chute, which consists of a hopper and chute. Hydraulic-driven feed rams push the waste onto the horizontal combustion grate. Refer to Figures 11 and 12.

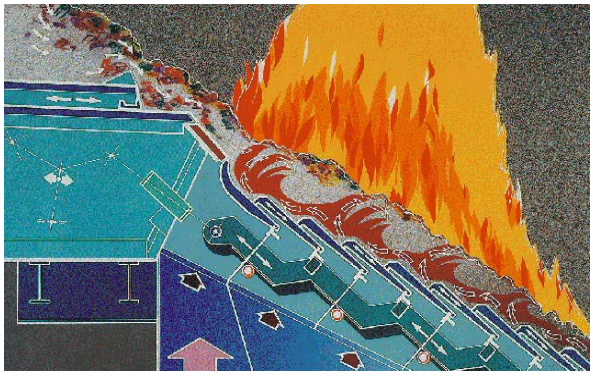


Figure 11 - Martin GmbH Grate System

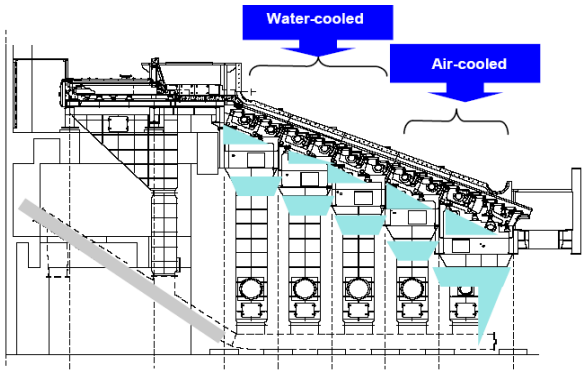


Figure 12 - Seghers Water and Air Cooled Grate

GCP Concepts.

The grate system and furnace comprise the core of a MWC and provide the opportunities to implement the GCP. Most NO_X is released from combustion of fuel nitrogen, with the exception of thermal NO_X formed in "hot spots". Martin GmbH (partner of Covanta) designs can be horizontal or reverse-acting grates. Options exist regarding the manner by which the waste is mixed on the grates, number of zones, the way underfire air is introduced and the manner by which grate cooling is accomplished. The waste begins to burn at the grate front end and the fuel bed temperatures reach over 1,000°C. The waste is combusted to inert mineral bottom ash through the slow and uniform mixing and agitating motion of the fuel bed.

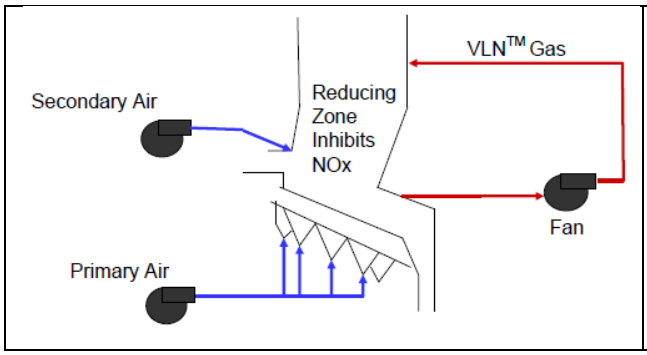
Rows of water-cooled tiles can be added to rows of air cooled tiles in a hybrid grate arrangement based on the characteristics of the waste (i.e. high calorific value, or wet, etc.). These last longer than air cooled grates, allow more efficient use of primary air for combustion rather than cooling, and can aid in NO_X minimization. The heat absorbed by the water within the grates is recovered.

Additional GCP options include the overfire air (OFA) arrangement, flue gas recirculation (FGR) or other sophisticated combustion techniques. Basically, the temperature is maintained high enough to destroy hazardous organic compounds such as D/F but low enough to reduce the potential for refractory damage and minimize thermal NO_X emissions. OFA is injected into the furnace above the fuel bed via nozzles arranged opposite each other in the front and rear furnace walls. The flue gases are thus subject to turbulence, mixed in an extremely efficient manner, and char and CO effectively burn out.

In response to the Department's aggressive NO_X requirement for the Hillsborough County WTE Facility Unit 4 in 2006, Covanta and Martin GmbH embarked on an effort to improve the profile of the Martin Grate stoker design by employing more advanced GCP concepts. They call their designs low NO_X (LN™) and very low NO_X (VLN™) [1].

The technology, known as VLN™, employs combustion system design, which in addition to conventional primary and secondary air streams, also features a new internal stream of gas called "VLN™ gas," which is drawn from the combustor and re-injected into the furnace. The gas flow distribution between the primary and secondary air, as well as the VLN™ gas, is controlled to yield the optimal flue gas composition and furnace temperature profile to minimize NO_X formation and optimize combustion.

Figure 13 is a simplified diagram of the VLN™ process. Figure 14 demonstrates that operation of the VLN™ system reduces NO_X concentration by roughly half.



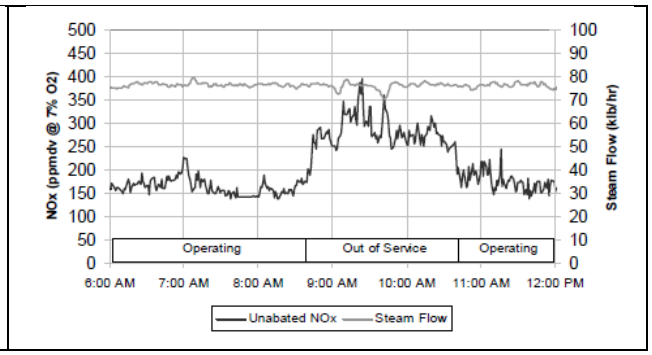


Figure 13 – Diagram of the VLN™ Process **Figure 14 – Operation with/without VLN™ System**

The basic principle of the VLN™ and similar processes is to maintain a reducing zone to destroy or inhibit the formation of NO_X. The theoretical approach of these types of arrangement is as follows:

Equation 1. The material fuel immediately above and on the grate is heated and pyrolyzed releasing hydrocarbon radicals (CHi*). These, in turn, catalytically or otherwise react with nitrogen oxide (NO) to form hydrogen cyanide (HCN) according to:

$$CHi^* + NO \rightarrow HCN + ... \qquad \text{Eq. 1}$$

Where:

$i = 1, 2, 3$

Equation 2. HCN in turn destroys more NO_X in the reducing environment according to:

$$HCN + NO \rightarrow N_2 + CO + CO_2 + H_2O + ... \qquad \text{Eq. 2}$$

[1] Covanta and Martin GmbH. New Process for Achieving Very Low NO_X. Proceedings of the 17th Annual North American Waste-to-Energy Conference. May 2009.

Equation 3. Ammonia-like radicals (NHi*) are also released during pyrolysis. Under reducing conditions these radicals destroy NO according to:

$$NHi^* + NO \rightarrow N_2 + ... \quad \text{Eq. 3}$$

This mechanism suppresses formation of NO by the pyrolyzed fuel nitrogen and recruits that nitrogen to combat NO_X in reactions that at first glance look much like SNCR or SCR discussed further below.

Reactions 2 and 3 can be catalytically enhanced based on the presence of various species within such an environment. Also, they can be accelerated by attaining a relatively high temperature within the reducing atmosphere but well below that which would promote thermal NO_X formation. Other reactions involving CO or hydrogen (H_2) also destroy NO_X in this reducing atmosphere and can be to varying degrees catalytically enhanced. Additional volatile and char combustion occurs in the higher temperature free board region above the bed. CharC denotes char carbon and CharN denotes char nitrogen.

Equation 4 and 5. Under the reducing conditions, even the char can assist on NO_X destruction as follows:

$$CharC + NO \rightarrow N_2 + CO + CO_2 + ... \quad \text{Eq. 4}$$

$$CharN + O_2 \rightarrow N_2 + O_2 + ... \quad \text{Eq. 5}$$

Eventually the NO_X destruction reactions will proceed much more slowly and some of the remaining fuel nitrogen forms additional NO_X.

Equations 6, 7, 8 and 9. In the presence of the progressively oxidizing environment effected by the two OFA levels, NO_X formation rather than destruction predominates.

$$NH_3 + O_2 \rightarrow NO + ... \quad \text{Eq. 6}$$

$$HCN + O_2 \rightarrow NO + ... \quad \text{Eq. 7}$$

$$CharC + O_2 \rightarrow NO + ... \quad \text{Eq. 8}$$

$$CharN + O_2 \rightarrow NO + ... \quad \text{Eq. 9}$$

The management of NO_X formation and destruction involves promotion of Eq. 1 through 5 to form nitrogen (N_2) before the inevitable and progressive addition of OFA causes Eq. 6 through 9 to dominate. This can be accomplished to the greatest degree by delaying and then adding the OFA in stages.

Peak flame temperatures will increase when lower moisture content materials are combusted and during low load boiler operations. During these periods, FGR can be employed to lower the peak flame temperatures thus avoiding the tendency to form thermal NO_X.

There are numerous approaches which are marketed under names like Mobotec, EcoJet, EcoTube, Prizm, etc. that incorporate innovations such that emissions from grate stokers can be minimized by modern GCP and then achieve very low emissions with add-on controls.

Besides NO_X, other pollutants released in the furnace include: CO, $PM/PM_{10}/PM_{2.5}$ including MWC metals such as Pb and Cd; MWC-AG including SO_2 and HCl; MWC organics including D/F, VOC and Hg.

The following figure includes a picture of the Tampa MacKay Bay RRF and a side view diagram of one of their Riley boilers. Each boiler includes a furnace, two empty passes and several superheater and economizers in the final passes. Radiant and calorific energy released in the combustion chamber and furnace is recovered by the furnace waterwall, convective zone, superheater and economizer. The steam that is produced is used to run a STG.

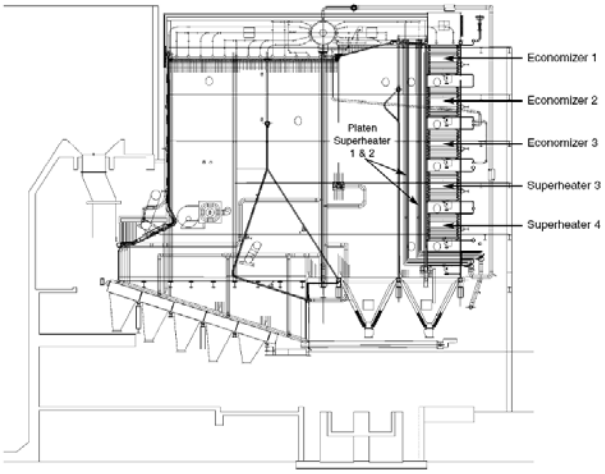


Figure 15 - Aerial View, Tampa MacKay Bay RRF and Side Elevation of a Riley Furnace/Boiler

Table 5 is a summary of the basic MWC boiler characteristics for the PBREF-2 project.

Table 5 – MWC Characteristics for the PBREF-2 Project

Parameter	Description
MWC Type	Grate stoker technology with waterwall, superheaters, fans, economizers, air heaters, soot blowers
Primary Fuel	MSW
Supplemental Fuel	Additional specified solid waste fuel slate and pipeline natural gas
Ash Removal	From baghouse and MWC to ash storage silo via an enclosed conveyor
Condenser	Air cooled condenser to provide dry cooling of exhaust steam
Heat Input Rate	Maximum capacity is 458 mmBtu/hr of which a maximum of 246 mmBtu/hr is from natural gas
Steam Production	291,000 lb/hr (24-hr average), 320,100 lb/hour (4-hr block average)
Stack Parameters	8.1 feet (ft) diameter (maximum); 310 ft tall (minimum) with three independent flues
Flue Gas	184,310 actual cubic feet per minute (acfm) at 315 °F
Pollution Control System	GCP/SD/FF/CI/SCR (with or without SNCR)

The collected ash will be transferred from the boiler and the air pollution control buildings to the ash management building via enclosed conveyor. The collected ash will be combined and quenched with water. The ash management building will contain ash processing equipment including ferrous and non-ferrous recovery systems. Since the ash will be wetted to a moisture content level in the approximate range of 20 to 25 percent, fugitive particulate matter emissions for the ash handling building are expected to be negligible.

To further minimize PM emissions from the ash management building ventilation air will be routed to a fabric filter control device prior to discharge to the atmosphere. The residual ash will be transferred from the ash management building in covered, leak resistant vehicles for disposal at the onsite landfill. All loading and preparation for ash transport will occur within the enclosed ash management building. Because the ash is moist, dust will not be generated during transportation and disposal.

<u>Requirements of NSPS for Large MWC</u>

In no event shall the application of BACT result in emissions of any pollutant from the PBREF-2 project which would exceed the emissions allowed by 40 CFR 60, Subpart Eb; the NSPS and MACT for Large MWC.

Table 6 is a comparison of the SWA BACT proposal with the Subpart Eb Large MWC MACT promulgated by EPA in May 2006.[2]

Table 6 – Comparison of PBREF-2 BACT Proposal with Subpart Eb MACT Limits

Pollutant		Subpart Eb MACT	PBREF-2 BACT Proposal	
NO_X		180 ppmvd [1] (1st year) 150 ppmvd (thereafter) (24 hr mean)	50 ppmvd (24-hr mean) 45 ppmvd (Annual)	GCP/SCR with or w/o SNCR
CO		100 ppmvd (4-hr block mean)	100 ppmvd (4-hr block mean) 80 ppmvd (30-day)	GCP
MWC-AG	SO_2	30 ppmvd or 80 percent (%) reduction [5] (24-hr geometric mean)	24 ppmvd or 80% reduction [5] (24-hr geometric mean)	SD/FF/CI
	HCl	25 ppmvd or 95% reduction [5]	20 ppmvd or 95% reduction [5]	SD/FF
PM, MWC metals as PM		20 mg/dscm [2] (filterable)	12 mg/dscm (filterable)	GCP/SD/FF/CI/SCR
Pb		140 µg/dscm [3]	125 µg/dscm	SD/FF/CI
Cd		10 µg/dscm	10 µg/dscm	
Hg		50 µg/dscm or 85% reduction [5]	25 µg/dscm or 85% reduction [5] 113 lb/yr (12-month) [6]	
MWC organics as D/F		13 ng total/dscm [4]	13 ng total/dscm	GCP/SD/FF/CI/SCR
VE (opacity)		10% (6 minute average)	10% (6 minute average)	GCP/SD/FF/CI/SCR
PM_{10} and $PM_{2.5}$		No Standard	12 mg/dscm (filterable)	GCP/SD/FF/CI/SCR
VOC		No Standard	7 ppmvd	GCP/CI/SCR
Fluoride		No Standard	3.5 ppmvd as HF	SD/FF
SAM		No Standard	5 ppmvd	SD/FF/CI
NH_3 Slip		No Standard	10 ppmvd	SCR

1. ppmvd means parts per million by volume, dry at 7 percent oxygen (@ 7% O_2).
2. mg/dscm means milligrams dry standard cubic meter @ 7% O_2.
3. µg/dscm means micrograms/dscm @ 7% O_2.
4. ng/dscm means nanograms/dscm @ 7% O_2. D/F is measured as total and not as the toxic equivalent (TEQ).
5. The least stringent of the two values.
6. Equivalent to approximately 12 µg/dscm.

The SWA proposed BACT limits for the PBREF-2 are at least as stringent as the Subpart Eb MACT requirements for the pollutants subject to both BACT and MACT. The central role of GCP and the integration of all of the techniques is also clear. The use of SCR in lieu of or in addition to SNCR makes it possible to meet a much lower NO_X BACT limit than required by the MACT which relies primarily on SNCR.

Reduction of Annual Emissions from Large and Small MWC

The implementation of MACT in accordance with 40 CFR Part 60 at existing and new units for large and small MWC resulted in very significant reductions in emissions nation-wide by 2005 compared with emissions in 1990. The reductions were estimated by EPA and are summarized in Table 7.[3]

[2] Final Rule. 40 CFR 60 – Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources; Large MWC; Final Rule. Federal Register / Vol 71, No. 90 / May 10, 2006. Pages 27324-332.

[3] Memorandum. Stevenson, Walt of EPA to Docket EPA-HQ-OAR-2005-0117. August 10, 2007.

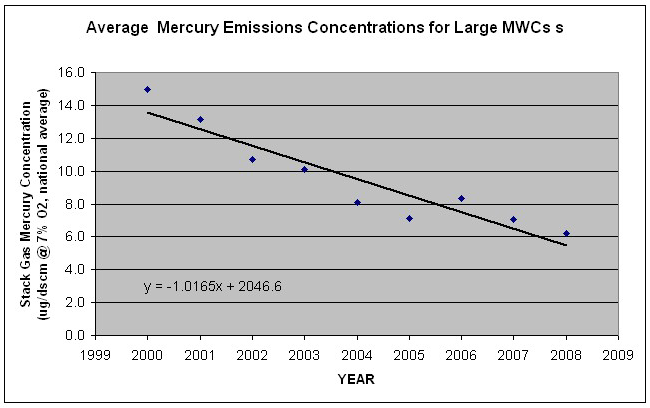
Table 7 – Total Emissions from All Large and Small MWC in the U.S. in 1990 and 2005

Pollutant	1990 Emissions	2005 Emissions	Reduction (%)
NO_X	64,900	49,500	24
SO_2	38,300	4,600	88
HCl	57,400	3,200	94
PM	18,600	780	96
Pb	170	5.5	97
Hg	57	2.3	96
Cd	9.6	0.4	96
D/F (total, not TEQ)	4.85×10^{-3}	1.65×10^{-5}	99+

Most, though not all MWC, installed the GCP/SD/FF/CI/SNCR configuration. Some did not install SNCR for NO_X control or did not install CI for Hg and D/F. Some rely on electrostatic precipitators (ESP) instead of FF baghouses for PM control. Some have wet scrubbers instead of SD to eliminate acid gases.

The nation-wide reductions are based on actual measurements rather than emission limits which are greater and based on the applicable MACT regulations such as 40 CFR 60, Subpart Eb or Cb. The actual reductions are very impressive for all pollutants except for NO_X. The major focus of Department reviews has been to concentrate on NO_X reduction as it is clear that the standard design of GCP/SD/FF/CI/SNCR has not resulted in reductions commensurate with those in other industries, such as coal-fueled power plants.

Figures 16 and 17 indicate the average performance of large MWC in the U.S. with respect to Hg and D/F. While Hg reductions continue on average, there have not been commensurate reductions in D/F.



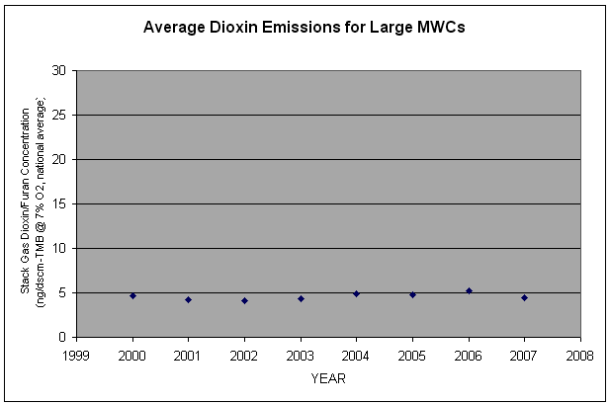


Figure 16 – Average Hg Concentrations (µg/dscm) Figure 17 – Average D/F Concentrations (ng/dscm)

Total Hg emissions have been considerably reduced at MWC in Florida as indicated in Figure 18. Emissions in 1991 were more than 5 tons and by 2007 had been reduced to approximately 0.275 tons or 550 lb. Recent values, while greatly improved, are still significant and the Department continues to focus on Hg control. D/F is subject to BACT and is also a focus of the Department's project review.

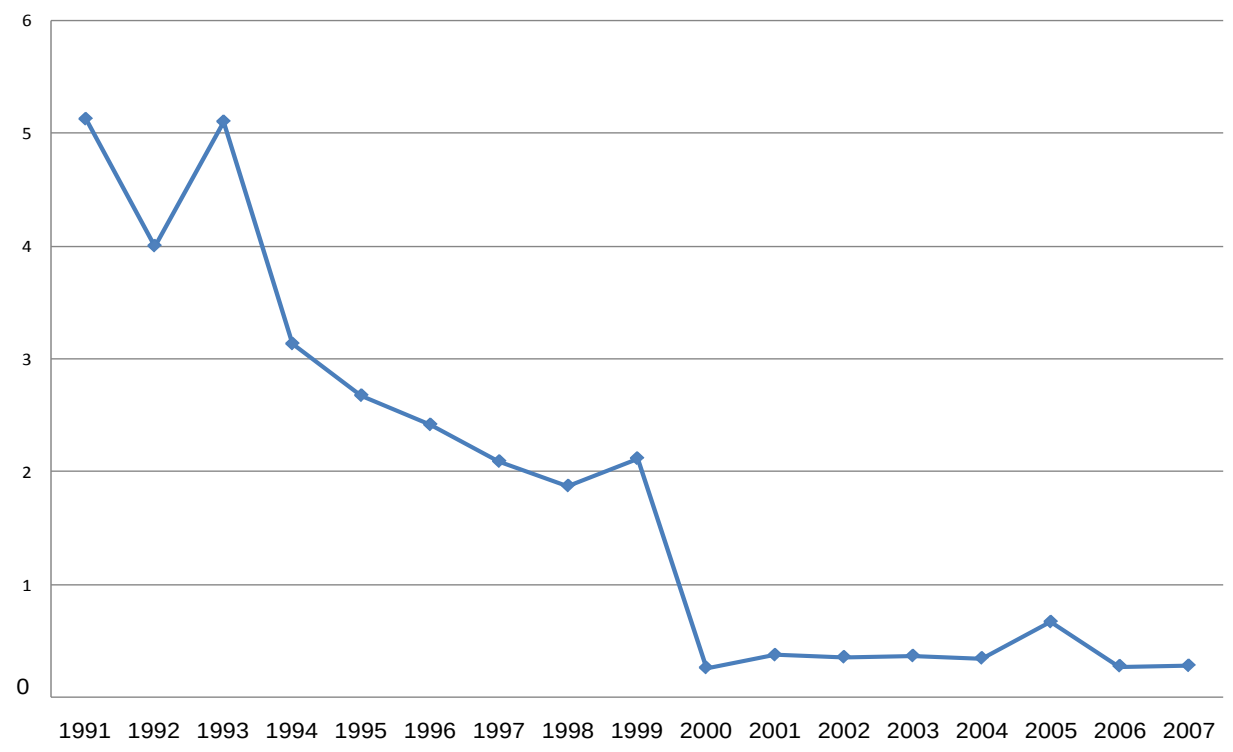


Figure 18 – Total Hg Emissions from MWC in Florida from 1991 to 2007 in TPY

Actual Performance of Large MWC Compared with Subpart Eb

Table 8 is a comparison of the performance of large MWC with the Subpart Eb MACT limits.

Table 8 – Comparison of Performance of Large MWC with Subpart Eb MACT Limits

Pollutant	Subpart Eb (2006)	Large MWC (mean/99%UCL) [1]	Hillsborough 4 [2]
NO_X	150 ppmvd	173 / 215 ppmvd	109 ppmvd (SNCR) ~ 70 ppmvd (SNCR+LN)
CO	100 ppmvd	Not Available	26 ppmvd
SO_2	30 ppmvd or 80 percent (%) reduction [5]	6.4 / 21.8 ppmvd	0.56 ppmvd and 99.1% reduction
HCl	25 ppmvd or 95% reduction [5]	8.5 / 23.5 ppmvd	11.5 ppmvd and 98.2% reduction
MWC metals as PM	20 mg/dscm [2]	3.2 / 9.5 mg/dscm	1.0 mg/dscm
Pb	140 µg/dscm	11.3 / 35.6 µg/dscm	18.3 µg/dscm
Hg	50 µg/dscm or 85% reduction [5]	7.9 / 26.7 µg/dscm	1.5 µg/dscm and 97.8% reduction
Cd	10 µg/dscm	0.77 / 2.2 µg/dscm	0.2 µg/dscm
MWC organics as D/F	13 ng total/dscm [4]	2.4 / 9.5 ng total/dscm	0.26 ng/dscm
VE (opacity)	10% (6 minute average)	Not Available	0%

1. Mean and 99% upper confidence limit (UCL) values from summary statistics developed in 2005 and used in development of the Subpart Eb MACT limits for the GCP/SD/FF/CI/SNCR arrangement.
2. Initial compliance test results from newest MWC with GCP/SD/FF/CI/SNCR in the U.S. NO_X was further reduced after tuning of Covanta LN™ system.

The values in the third column represent the statistical average and the statistical 99% UCL concentrations based on tests conducted at numerous MWC with the GCP/SD/FF/CI/SNCR configuration. The summary is based on a 2005 compilation by EPA's contractor and was used when determining the limits in Subpart Eb for new MWC with the GCP/SD/FF/CI/SNCR configuration. [4]

It is clear that EPA relied on the 99% UCL when setting the Subpart Eb limits so it is not surprising that any large MWC with the standard configuration of GCP/SD/FF/CI/SNCR will readily meet these limits with the possible exception of NO_X. The Department has commented to EPA that the approach when used in other industries (such as cement and coal power plants) does not comport with the CAA requirement that MACT for existing sources is based on the average of the best performing 12% of existing sources. Adherence to the 99% UCL is contrary to the notion of the average of the best performing 12%.

More importantly, the approach used by EPA for MACT on new sources makes it difficult for the regions and state programs to explain to applicants the feasibility and requirement for more stringent limits through the PSD/BACT process.

The final column represents the results of the performance tests conducted at the recently commissioned Hillsborough County WTE Unit 4. [5] Unit 4 was the first MWC constructed after promulgation of the 2006 Subpart Eb MACT and was based on GCP/SD/FF/CI/SNCR control strategy and BACT. Unit 4 performed well within the Subpart Eb requirements as expected and, on balance, much better than the average large MWC upon which Subpart Eb was based.

Notably, Unit 4 performed much better than the Subpart Eb limitation for NO_X (which was not revised in the 2006 Rule). The main reason was that the Department set BACT limits of 110 and 90 ppmvd on 24-hour and 12-month bases, respectively. As mentioned, this led to improvements by Covanta of its grate and furnace GCP to insure that the limit could be met without excessive use of NH_3 in the SNCR system.

<u>NO_X BACT Analysis</u>

Add-on Controls for NO_X Control.

Initial add-on NO_X controls for MWC consisted of SNCR whereby NH_3 or urea is injected at a point in the process characterized by a suitable temperature window between about 1,500 and 1,900 °F depending on residence time, turbulence, oxygen content, and a number of other factors specific to the given gas stream. The reaction products are N_2 and water vapor (H_2O). SNCR destroys NO_X by a multi-step process as described in the simplified equations below.

Equation 10. NH_3 reacts with available hydroxyl radicals (OH*) to form amine radicals (NH_2*) and water per the following theoretical equation:

$$NH_3 + OH^* \rightarrow NH_2^* + H_2O \qquad \text{Eq. 10}$$

Equation 11. Amine radicals combine with NO to form nitrogen and water as follows:

$$NH_2^* + NO \rightarrow N_2 + H_2O \qquad \text{Eq. 11}$$

Equation 12. The two steps are typically expressed as a single "global reaction".

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O \qquad \text{Eq. 12}$$

Similar simplified reactions describe the destruction of NO_2.

[4] Memorandum. Huckaby, Jason of Eastern Research Group (ERG) to Stevenson, Walt of EPA. Large MWC 5-Year Review/Stack Test Pollutants. October 27, 2005.

[5] Initial Compliance Report. Transmitted from Boldissar, B. of Hillsborounty Solid Waste Management Department to Henry, Danielle of the Florida Department of Environmental Protection. MWC No. 4 Initial Compliance Test Report. October 8, 2009.

One drawback with SNCR is that some of the NH_3 can be converted to NO_X and excessive NH_3 injection is occasionally required to effect good reduction. Excess NH_3 (called slip) can combine with chloride and sulfate species in the exhaust and cause visible emissions. Additionally, good CO control is necessary when employing SNCR due to interference with the reaction as described.

Equation 13. CO competes with NH_3 for available OH radicals needed to effect Eq. 10.

$$CO + OH^* \rightarrow CO_2 + H^* \qquad \text{Eq. 13}$$

In the case of SCR technology, the NH_3 is injected in the presence of catalyst and at a lower temperature than encountered in the furnace. The reactions are more complete and efficient and NH_3 slip is minimized. Minimization of NH_3 emissions reduces the formation of ammoniated chlorides and sulfates, plume opacity and condensable PM including condensable PM_{10} and $PM_{2.5}$.

Advanced techniques have been developed to minimize the use of excessive reagent while using SNCR. Examples include smart systems such as DyNOR shown in Figure 19.[6] Basically reagent NH_3 is directed most precisely to the instantaneous points within the furnace that have the highest NO_X concentrations or correct temperature window to provide best NO_X destruction and least temperature window. This is accomplished through the use of sophisticated instrumention such as: infrared (IR) pyrometers to detect temperature distributions; multilevel injection levels, computerized feedback and individual injector control; and tunable diode laser (TDL) to measure NH_3 in the furnace. This approach not only avoids excessive NH_3 use for the NO_X present, it also minimizes conversion (combustion) of NH_3 into additional NO_X which would otherwise require even more NH_3 reagent to destroy.

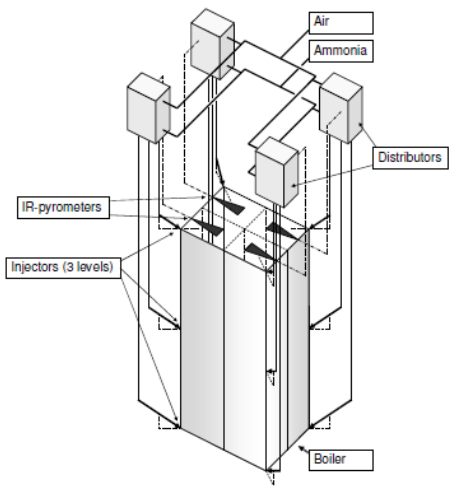


Figure 19 – VonRoll DyNOR SNCR System

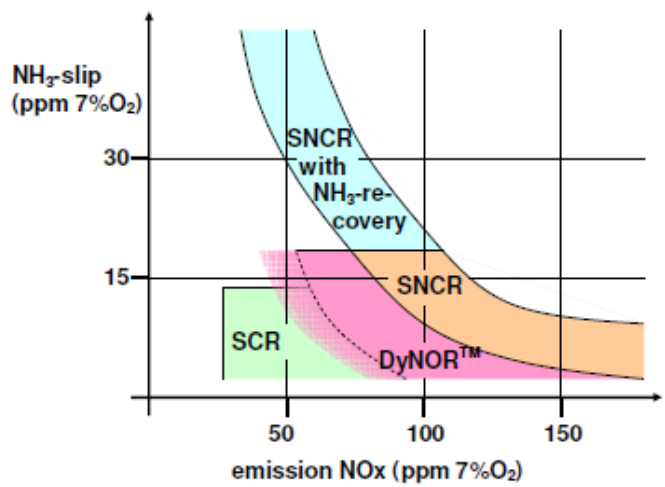


Figure 20 – Comparison of Slip for SCR and SNCR

The basic shapes of curves describing NO_X emissions versus NH_3 slip are shown in Figure 20. The blue area relates to the option of injecting excessive NH_3 to achieve low NO_X and removing/recovering the excess NH_3 in a wet scrubber. The Department concurs with the trends implied by the curves, but not necessarily the numerical NH_3 slip values associated with the given NO_X reduction objectives. For example, a well designed SCR yields closer to 1 ppmvd of NH_3 slip versus the range given (2-14 ppmvd).

A combination of SCR and SNCR would involve injection of urea or NH_3 in the furnace and reliance on a smaller reactor and less catalyst than required by SCR alone. The issue is an economic one and will be determined by the selected supplier.

[6] Paper. Zigg et al, VonRoll. DyNOR™ DeNOx Performance Confirmed in Further MSW Plants. Proceedings of the 18th Annual North American WTE Conference. Orlando. May 2010.

Applicant's NO_X BACT Proposal

Per Table 6, the applicant proposes to meet a NO_X limit of 50 ppmvd on a 24-hour basis and 45 ppmvd on a 12-month rolling basis as demonstrated by the continuous emissions monitoring system (CEMS) required by Subpart Eb. The SWA proposes to rely on GCP and SCR or a combination of GCP, SNCR and SCR. Following is a short discussion of SNCR and SCR.

The SWA estimates the cost of three SCR installations will be $61.5 million and $6,585/ton NO_X removed whereas the cost of three SNCR installations to meet a higher NO_X limit would have been approximately $4 million and $1,449/ton NO_X removed.

The Department believes costs for the SCR systems and cost per ton NO_X removed will be much less if provided as part of an integrated bid. SNCR and SCR would likely be less expensive than SCR alone. The Department agrees that the cost will be significant (but nevertheless cost-effective) with respect to the overall estimated cost of the entire project.

Department's NO_X BACT Determination

The NO_X proposal is equivalent to 0.085 pounds per million Btu heat input (lb/mmBtu) short-term and 0.77 lb/mmBtu long-term. The Department accepts the SWA BACT proposal for NO_X from the PBREF-2 based on the following rationale:

- The proposal is much more stringent than the requirement in Subpart Eb;
- The proposed values are less than any permitted WTE facility in the U.S.;
- The proposed values are in-line with most of the recent NO_X BACT determinations for renewable energy facilities;
- The SCR technology provides the freedom to optimize operation of the grate and furnace so that low CO, VOC and organic HAP emissions can be achieved without installation of oxidation catalyst (ox-cat as discussed below);
- The SCR technology has several co-benefits including direct reductions of $PM/PM_{10}/PM_{2.5}$, NH_3, VE, VOC, organic HAP including and as D/F; and
- SCR technology is cost-effective.

<u>MWC organics as D/F BACT Analysis</u>

Mechanism of D/F Formation and Control

D/F constitute a class of cyclic halogenated hydrocarbons with halogen atoms (such as chlorine) substituting some of the points in the ringed carbon structures normally occupied by hydrogen. Furthermore, two ringed halogenated hydrocarbons are joined to each other in such a manner that includes one or two oxygen atoms. Figure 21 includes generalized diagrams of dioxin and of furan.

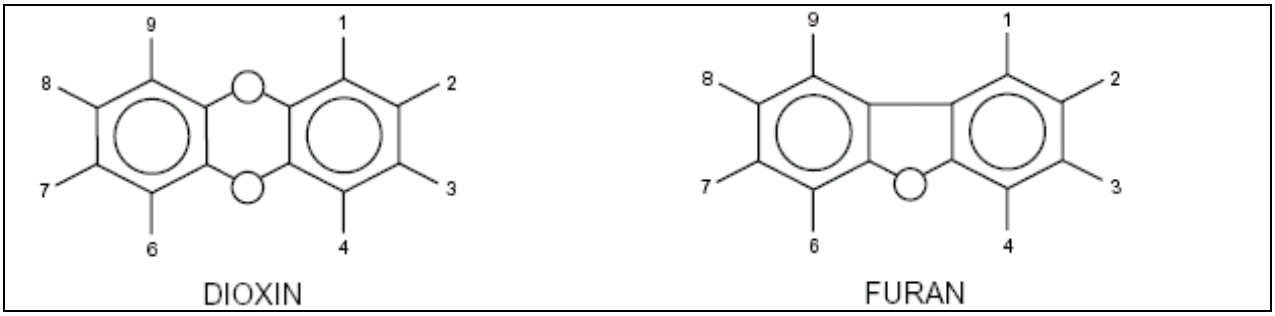


Figure 21. Skeletal Diagrams of Generalized Dioxin and Furan Molecules

The compound 2,3,7,8 tetrachlorinated dibenzo-p-dioxin (TCDD) has chlorine atoms substituting for hydrogen atoms at the lateral positions. It is considered the most toxic congener of dioxin. In the U.S., the regulations and reporting requirements for MWC are specified as the total mass of all D/F compounds with four (tetra) through eight (octa) chloride substitutions for hydrogen.

There is an alternative quantification scheme used in other industries and internationally to the total mass known as toxic equivalent (TEQ). The congener 2,3,7,8 TCDD is assigned a weighting factor of 1.0 and its contribution is simply its mass. The contribution of each of the other congeners is multiplied by a weighting factor less than 1.0 (based on its toxicity relative to 2,3,7,8 TCDD) prior to its addition when calculating the TEQ value. This is relevant in the discussion below when comparing U.S. limits and test results with those in other countries.

The potential for D/F formation is inherently high in MWC because of the presence of aromatic hydrocarbons, chlorides, metals and fly ash. However with sufficient residence time and temperature, D/F can be almost completely destroyed. Figure 22 is a diagram showing the relative concentration of D/F remaining after exposure to varying temperatures for 0.5 and 2 seconds.[7]

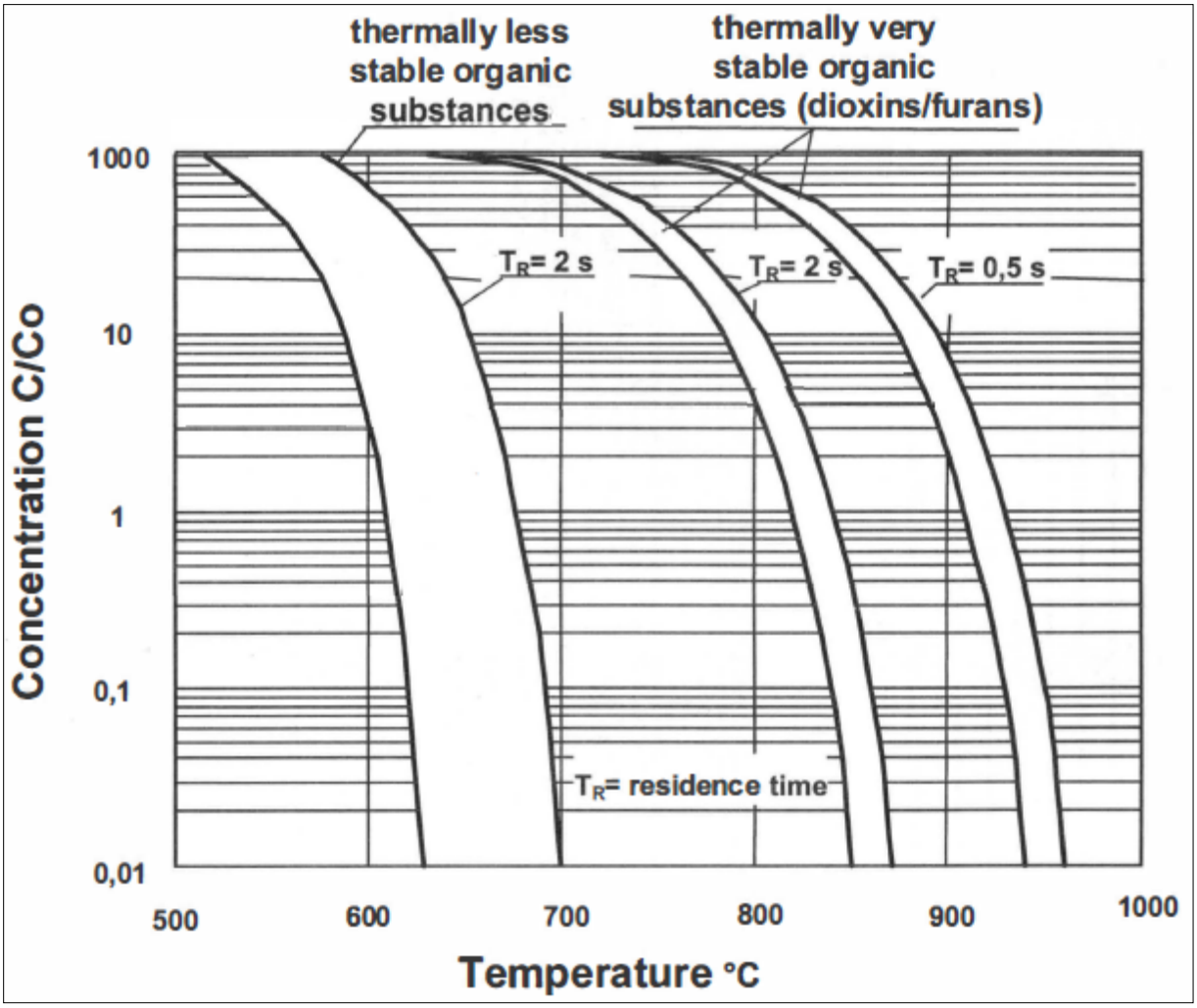


Figure 22. Relative D/F Concentrations with respect to Furnace Temperature and Residence Time

[7] Paper. Licata, A. and Hartenstein, H. Modern Technologies to Reduce Emissions of Dioxins and Furans from Waste Incineration. Proceedings of the 16th Annual North American WTE Conference. Philadelphia, May 2008.

D/F can reform from precursors (and catalyzed by fly ash and metals) in the heat recovery sections as the temperature drops. The first mechanism occurs in the range of 300-800° C and is a homogenous gas phase reaction whereby D/F formed from precursors such as polychlorinated benzenes, phenols and biphenyls.

The second mechanism is the so called *de novo* synthesis of D/F in a temperature window of 200-500° C as a heterogeneous gas-solid phase reaction on the surface of fly ash particles.

Equation 13. Inorganic chlorides such as NaCl or HCl in the presence of with catalytic active metallic chlorides like $CuCl_2$ or $FeCl_3$ will form elemental chlorine (Cl_2) in the presence of O_2 according to the Deacon reaction:

$$2HCl + 0.5O_2 \rightarrow Cl_2 + H_2O \qquad \text{Eq. 14}$$

Subsequently, Cl_2 reacts with aromatic components in flue gas or carbon in the fly ash to form chlorinated organic compounds and fragments, which combine to become D/F via complicated theoretical mechanisms.

Various temperature management options (again GCP) are possible to rapidly cool (quench) the gases in order to minimize D/F formation. The FF baghouse will catch much of the D/F that adheres onto fly ash particles and the capture can be enhanced by addition of sorbents such as activated carbon (i.e. by CI).

Application of such control strategies to existing and new units since 1990 lead to the significant reduction of D/F from MWC in the U.S. as documented in Table 7. However, per Figure 17 there has been no reduction in D/F concentrations from MWC on average in the past 10 years, notwithstanding the excellent performance of the Hillsborough County WTE Unit 4.

According the 2008 paper (by Licata and Hartenstein) from which Figure 22 was taken, *"honeycomb catalysts similar to those familiar from the well known SCR DeNOx process are* ***commonly*** *employed for this residue free D/F control technology."* The paper further states: *"Most Central European and Scandinavian Countries have decided to reduce their D/F emissions drastically. This led to the development and installation of extremely efficient air pollution control equipment such as activated carbon reactors and catalytic DeDiox reactors. Other countries such as the U.S. take a somewhat less stringent approach and define adsorbent injection as the BACT".*

The analysis by Licata and Hartenstein is further buttressed by vendors such as CRI (a vendor) who states that SCR catalyst is also an effective system to reduce D/F [8]. This benefit is elsewhere corroborated in the literature as well as the destruction of VOC by SCR (though possibly not quite as efficiently as by oxidation catalyst). [9, 10]

Equations 15 and 16. The theoretical equations for the proven oxidation of D/F on the SCR catalyst at a cement plant are shown below:

$$C_{12}H_nCl_{8-n}O_2 + (9+0.5n)O_2 \rightarrow (n-4)H_2O + 12CO_2 + (8-n)HCl \qquad \text{Eq. 15}$$

$$C_{12}H_xCl_{8-n}O + (9.5+0.5n)O_2 \rightarrow (n-4)H_2O + 12CO_2 + (8-n)HCl \qquad \text{Eq. 16}$$

According to one publication, SCR catalyst reduced D/F emissions by approximately a factor of 100 at the IVAGO WTE plant in Ghent, Belgium. The measured D/F emissions were less than 0.050 ng

[8] Paper. Tang, H.S. The Shell Dioxin Destruction System. Solid & Hazardous Waste Management Conference, Singapore, February 2003. www.cricatalyst.com/products/pdfs/sporeconference.pdf

[9] E.g. Tzimas, E., and Peteves, S.D. NO_X and Dioxin Emissions from Waste Incineration Plants. Joint Research Center, European Commission. Circa 2001.

[10] E.g. Leibacher, U., Bellin, C., and Linero, A. High Dust SCR Solutions. International Cement Review. December 2006. www.cementeriadimonselice.it/pdf/HD_SCR_solutions.pdf

total/dscm (value estimated from TEQ by the Department).[11] Similar experience was documented at the MVA WTE plant in Spittelau, Austria (a 20-year old installation) where D/F emissions are between roughly 0.1 to 0.3 ng total/dscm.[12]

SCR was installed at the Algonquin Power WTE facility in Ontario, Canada for the dual purpose of NO_X and D/F reduction. A paper prepared by the government and the operator states: [13]

"In evaluating the technology options, it was suggested that the operating costs for SNCR would be lower than for SCR. However, the SCR system had the potential advantage of dioxin and furan destruction. Thermal oxidation of PCDD/F in the presence of a catalyst produces water, carbon dioxide (CO_2) and HCl. Therefore, SCR was the chosen technology after the evaluation of pollution control options was complete".

According to a report prepared for the Canadian Council of Ministers of the Environment (CCME), *"during commissioning testing (of the SCR system) in November 2001 the facility recorded three D/F emission concentration values well below the Environment Canada Level of Quantification (LOQ) of 32 picograms toxic equivalent (TEQ) per normal cubic meter at 11% oxygen (pg TEQ/Nm^3) @11% O_2".*[14] This equates to 0.045 ng TEQ/Nm^3 @7% O_2 and roughly 2 ng total/dscm. For reference, subsequent installation of activated carbon further reduced D/F at Algonquin by at least another order of magnitude and less than 0.2 total ng/dscm.

Applicant's MWC Organics as D/F BACT Proposal

The SWA proposed to meet the Subpart Eb MACT limit for D/F of 13 ng total/dscm as BACT for MWC organics as D/F. SWA's consultants advised that they are either not able to confirm the efficacy of SCR to achieve low D/F values or that their installation will be optimized for NO_X reduction and the benefits on D/F reduction cannot be estimated.

For reference, the most recent BACT determinations and proposals for D/F (the 2009 permit for the Mahoning, Ohio project and the 2010 draft permit for the Fairfield, Maryland project) are both 13 ng D/F total/dscm. Clearly the permit reviewers were not aware of the potential for further reduction by SCR catalyst or considered the MACT from Eb to be adequate for the purposes of BACT.

Department's MWC Organics as D/F BACT Determination

In view of the foregoing discussion and the performance of the Hillsborough County WTE Unit 4 (0.26 ng D/F total/dscm without SCR), the Department believes that BACT for D/F can and should be lower than proposed by the applicant.

The Department will include an initial limit of 10 ng D/F total/dscm and will specify the inclusion SCR within the GCP/SD/FF/CI/SCR strategy as BACT for D/F rather than fix a very low limit. It is clear that a very low level will actually be achieved as evidenced by the European and Canadian experience. Also, other states and EPA regions will be able to note from the entries in the control equipment Clearinghouse (known as the RACT/BACT/LAER Clearinghouse) that BACT is the SCR technology.

The Department will include a requirement that the SWA conduct additional testing to measure the effectiveness of the SCR system in destroying D/F after startup after which the Department will set a final BACT limitation between 0.75 and 10 ng D/F total/dscm (inclusive). At a level less than 0.75 ng D/F

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[11] Paper. IVAGO and Seghers. Seghers deDlnOX: Catalytic Reduction with Simultaneous Dioxin Destruction in a Municiapl Waste Incinerator in Belgium. Paris NO_X Conference. 2001.

[12] Paper. Fernwaerme Wien GmbH and Integral Umwelt. Latest Developments and the State of the Art of Catalytic DeNOx Plants after 15 years of Experience. Paris NO_X Conference. 2001.

[13] Paper. A Case Study of the SCR System at the Algonquin Power WTE Facility. Annual NA WTE Conference. NAWTEC 16-1903. 2008. www.seas.columbia.edu/earth/wtert/sofos/nawtec/nawtec16/nawtec16-1903.pdf

[14] Report. Review of Dioxins and Furans from Incineration in Support of a Canada-wide Standard Review. CCME Project #390-2007. December 15, 2006. www.ccme.ca/assets/pdf/1395_d_f_review_chandler_e.pdf

total/dscm PSD is avoided. If it is clear based on the tests that emissions will consistently be much less than 0.75 ng D/F total/dscm, the Department will set a non-BACT limit of 0.74 ng D/F total/dscm.

The rationale for this determination as BACT is that:

- The determination is more stringent than the requirement in Subpart Eb;
- The D/F limit is the lowest to-date in the U.S. for a MWC; and
- This is the first specification of SCR to be included as part of a D/F BACT determination in the U.S.

CO and VOC BACT Analysis

CO and VOC Discussion

Refer to the previous discussion of GCP concepts and descriptions of the grate stoker/furnace. CO and VOC (including organic HAP) are products of incomplete combustion. Initial combustion occurs on the grate and lower furnace in substoichiometric conditions. As a result, a great deal of CO is evolved as well as VOC (including hydrocarbon radicals and other species). The CO, hydrocarbon radicals and reduced nitrogen compounds (as previously mentioned) participate in reactions that assist in primary NO_X control.

Sufficient OFA, temperature and turbulence is necessary to complete the burnout of CO, fine char and VOC. Clearly, throttling NO_X formation by staging combustion using the OFA ports affects CO and VOC formation in the furnace. Basically, the manner by which the boiler is operated (e.g. favoring NO_X over CO/VOC control) is part of an overall source emission strategy that considers the emissions limits and costs of add-on controls.

This fact can be appreciated in Figure 23 from a Babcock and Wilcox (B&W) publication that demonstrates the modeled relative effects upon CO when switching to a low NO_X control strategy. Under the low NO_X strategy (newly designed air system including higher OFA ports) moderate levels of CO (and presumably VOC) persist at greater heights within the furnace compared with the previous combustion strategy. [15]

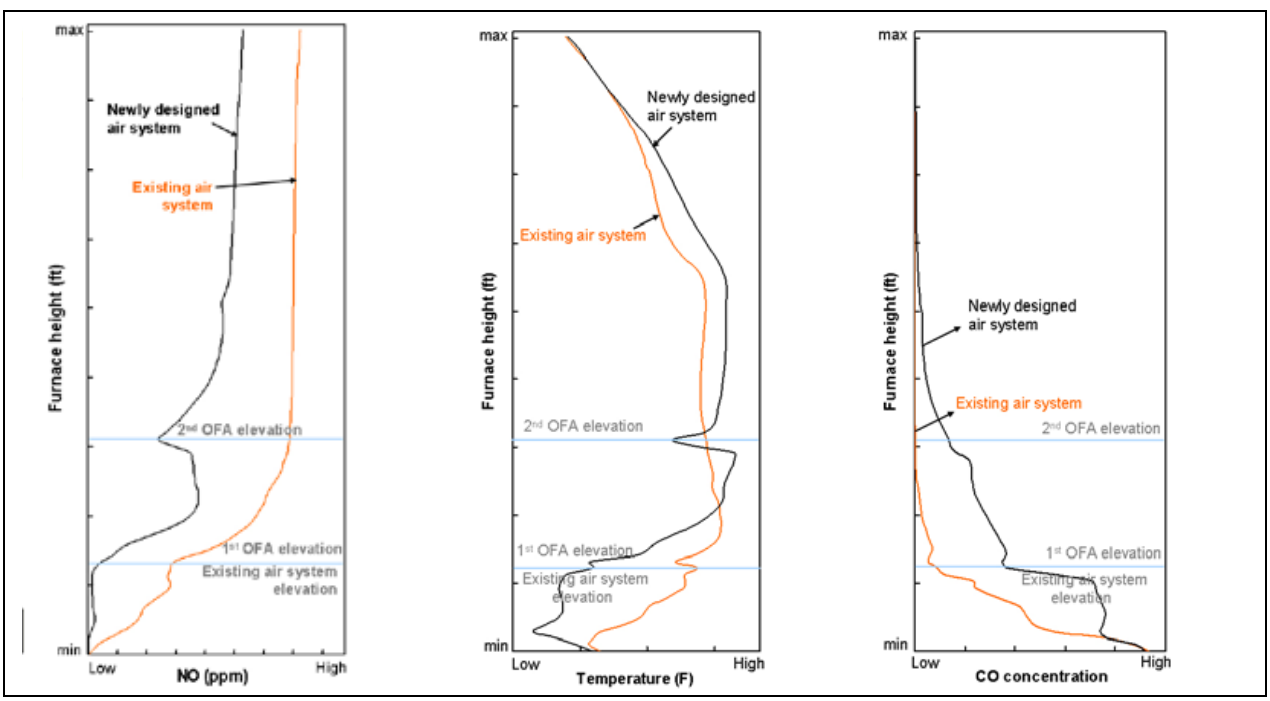

Figure 23. Modeled NO_X, Temperature and CO after Switching to Low NO_X strategy.

[15] Dessam et al, B&W. Use of Numerical Modeling for Designing a Biomass-fired BFB Boiler Air System for Low NO_X Emissions. 2009 Power-Gen International Conference. Las Vegas. December 2009.

According to the article, *"in favor of achieving low NO_X emissions, higher CO values were accepted in the Precision Jet air system. However, these CO emissions were well within the acceptable range to meet state and federal requirements"*.

Conversely, in favor of achieving low CO and VOC emissions, greater NO_X formation in the furnace will occur and can be abated by the add-on NO_X control equipment as described above. The inclusion of SCR (with or without SNCR) will make it easier to pursue such a strategy. As discussed above, SCR is effective in the reduction of MWC organic HAP as D/F and VOC in general.

If GCP are not sufficient to achieve low CO and VOC emissions, an ox-cat is an option. The preferred location of an ox-cat system is after the FF baghouse proposed for the PBREF-2 if the temperature regime is acceptable.

Refer to Figure 24. The information in the curves suggests that ox-cat is effective for CO removal at temperatures as low as 300 °F.[16] Clearly this allows installation downstream of the PM device and obviates the claimed necessity of reheat. The exit stack temperature from the PBREF-2 stacks is estimated at 315 °F.

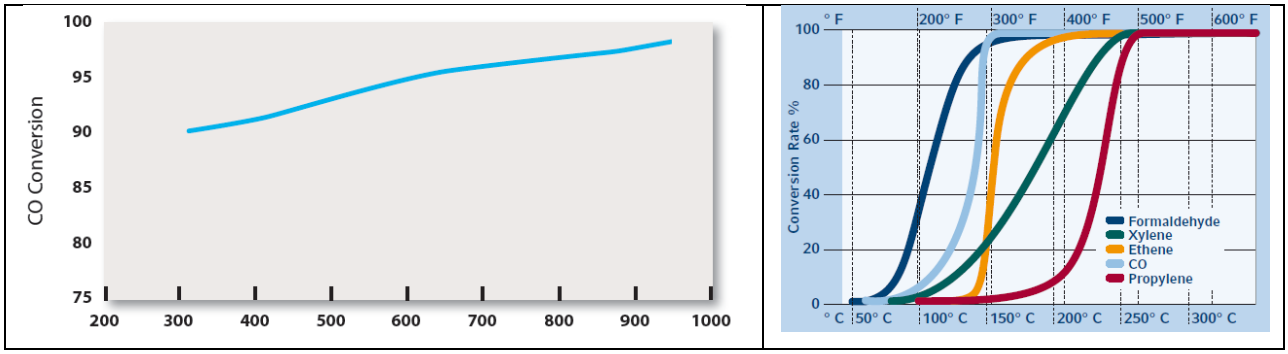

Figure 24. Ox-cat Performance vs. Temperature (^oF) Ox-cat Performance vs. Temperature (^oC)

Applicant's CO and VOC BACT Proposals

The applicant proposed BACT CO emission limits of 100 ppmvd (4-hour basis and equal to the Subpart Eb MACT requirement) and 80 ppmvd (24 hour rolling average). The applicant also proposed a BACT VOC emission limit of 7 ppmvd. These limits will be achieved by GCP as discussed above.

Department's CO BACT Determination

The CO proposal is equivalent to 0.105 lb/mmBtu (4-hour) and 0.084 lb/mmBtu (24-hour basis). For reference, the new Hillsborough County WTE Unit 4 achieved 26 ppmvd of CO (~ 0.027 lb/mmBtu) which by comparison with typical grate stoker applications is excellent performance. Unit 4 relies on SNCR for NO_X control and GCP for CO (specificially the Covanta LN^{TM} technology). The additional challenge of a lower NO_X limit is not likely to cause greater CO emissions given the use of SCR for the future PBREF-2 and flexibility for more aggressive CO GCP control measures.

The Department accepts the SWA proposal for CO from the PBREF-2 and is including the installation of SCR as part of this determination because it destroys VOC and provides for the opportunity of lower CO strategies in the furnace. The Department accepts the proposed value of 7 ppmvd as BACT for VOC but expects much lower emissions given the GCP for CO and the presence of the SCR catalyst.

Compliance will be demonstrated using the CO-CEMS required by Subpart Eb and by initial and annual tests for VOC. The overall rationale of the BACT determinations is as follows:

- The short-term CO proposal is as stringent as the requirement in Subpart Eb;
- The 24-hour CO value is an additional requirement beyond those of Subpart Eb;

[16] Brochures. Sud-Chemie and Johnson-Matthey.

- The proposed CO values are in-line with most of the recent CO BACT determinations for renewable energy facilities;
- The SCR technology for NO_X provides the freedom to optimize operation of the grate and furnace so that low CO, VOC and organic HAP emissions can be achieved without installation of ox-cat; and
- The CI prior to the FF baghouse and the SCR system directly reduce VOC.

MWC-AG BACT Analysis

Discussion

SO_2 is a PSD-pollutant by itself as well as in conjunction with HCl as MWC-AG. Emissions of SO_2 from MWC are generally low before control except when burning higher sulfur materials such as tires.

After excluding "outliers", EPA's consultant evaluated SO_2 data for the GCP/SD/FF/CI/SNCR configuration during the development of the 2006 Subpart Eb MACT. The mean of the data retained was 6.4 ppmvd. EPA's consultant estimated that 95 and 99% of data are less than 17 and 22 ppmvd respectively when assuming a "normal distribution". The 2006 Subpart Eb MACT did not change the SO_2 limit of 30 ppmvd promulgated under the 1995 Subpart Eb MACT.

In 2006 the Department set a limit of 26 ppmvd for the new Hillsborough County WTE Unit 4 project using the strategy of GCP/SD/FF/ACI/SNCR (in particular the SD/FF part). In the technical evaluation, the Department stated "that typical emissions will likely be less than 10 ppmvd".[17] In fact, per Table 8, Hillsborough County WTE Unit 4 achieved 0.56 ppmvd of SO_2 and 99% removal across the control equipment.

HCl is not a PSD pollutant except in conjunction with SO_2 as MWC-AG. Emissions of HCl from MWC are generally very high in the absence of control due to the presence in MSW of chlorinated plastics and othe compounds, salts, yard waste, etc.

After excluding "outliers", EPA's consultant evaluated HCl data for the GCP/SD/FF/ACI/SNCR configuration during the development of the 2006 Subpart Eb MACT. The mean of the data retained was 8.5 ppmvd. EPA's consultant estimated that 95 and 99% of data are less than 19 and 24 ppmvd respectively when assuming a "normal distribution". The 2006 Subpart Eb MACT did not change the SO_2 limit of 25 ppmvd promulgated under the 1995 Subpart Eb MACT.

In 2006 the Department set a HCl limit of 20 ppmvd for the new Hillsborough County WTE Unit 4 project using the strategy of GCP/SD/FF/CI/SNCR (in particular the SD/FF part). In the technical evaluation, the Department stated "it is likely the sum of the two pollutants (SO_2+HCl) will actually be on the order of 15 ppmvd". In fact, per Table 8, Hillsborough County WTE Unit 4 achieved 11.5 ppmvd of HCl and 98.2% removal across the control equipment. The sum of the two pollutants was measured at 12.1 ppmvd (SO_2+HCl).

HF is not a PSD pollutant and is a HAP. It was not specifically regulated in Subpart Eb because SO_2 and HCl were directly regulated and designated as surrogates for other AG such as HF.

Applicant's MWC-AG BACT Proposal

The applicant proposes the same values as BACT for MWC-AG that were determined for the Hillsborough County WTE Unit 4. These are the least stringent of 26 ppmvd of SO_2 or 80% reduction and the least stringent of 20 ppmvd of HCl or 95% reduction. The technology is the GCP/SD/FF/CI/SCR arrangement (specifically the SD/FF portion).

[17] Report. Technical Evaluation and Preliminary Determination. Hillsborough County WTE Unit 4. May 24, 2006. www.dep.state.fl.us/Air/emission/construction/hillsborough/369TEBACT.pdf Page 27.

Department's MWC-AG BACT Determination

It is possible to conduct a "co-incident analysis" of (SO_2 + HCl) to set a BACT for MWC-AG that is less than the sum of the individual limits for SO_2 and HCl. However, the Department has determined that the individual limits for SO_2 and for HCl proposed by the applicant are adequate as BACT for SO_2 and MWC-AG and will not include a separate limit to track as MWC-AG. Furthermore, the Department notes that the inclusion of CI within the GCP/SD/FF/CI/SCR arrangement will further reduce SO_2 although this fact is not typically highlighted.

By now, it is clear based on the results at Hillsborough Unit 4, that it is not necessary to include an alternative control efficiency standard of 80% for SO_2. Otherwise, the Department accepts the rest of the applicant's proposal of 24 ppmvd of SO_2 on a 24-hour basis as BACT for SO_2. Compliance shall be determined by the SO_2-CEMS required by Subpart Eb.

HCl is probably the pollutant governing the actual design of the SD/FF part of the control technology. Based on the results at the Hillsborough County WTE Unit 4 (11.5 ppmvd and 98.1% reduction), the Department believes that 20 ppmvd is an appropriate limit for HCl. Although the 95% alternative limit is adequate as well, it would not provide an actual limit on emissions and will not be included. Compliance will be based on the annual test required by Subpart Eb. The overall rationale of the BACT determinations is as follows:

- The requirements are more stringent than the requirement in Subpart Eb; and
- Overall, the MWC-AG emission limits are more stringent than those determined as BACT for the most recent large projects in Ohio and Maryland.

<u>Fluoride (F) BACT Analyses</u>

Discussion

The applicant <u>originally</u> estimated annual fluoride emissions of 13.6 TPY, a value that exceeds the PSD significant emission rate threshold of 3 TPY. However, the applicant actually estimated F emissions as HF, which is HAP and not a PSD-pollutant.

The Department reviewed data from the existing NCRRF from 2005 to 2009 which indicated less than 2 TPY of F (non-HF) for a 2,000 TPD refuse-derived fuel facility with ESP particulate control. The future PBREF-2 will rely on FF baghouse which will be more effective in controlling PM/PM_{10} of which F is a constituent.

The Department also reviewed F data (non-HF) from 2001 through 2005 from the Hillsborough County WTE facility which uses FF baghouses. Most if not all of the measured values were in the "non-detect" range using the standard EPA methods. The operator reported the values in a conservative manner such that the "limit of detectability" was used to estimate emissions. Assuming fulltime operation, the sum of emissions from the three units is less than 0.4 TPY of F.

There is no fluoride-limiting standard in the recent Subpart Eb update. The Department believes that the SD/FF/CI/SCR configuration as a work practice and the emission limitations for MWC Acid gases, and PM/PM_{10}, provides reasonable assurance that the proposed PBREF-2 project will not emit 3 or more TPY of F. It is unnecessary to set a BACT based limit for this pollutant or testing requirements given the history at the NCRRF or the testing at the Hillsborough County WTE facility.

<u>SAM BACT Analyses</u>

SAM is formed by the oxidation of SO_2 to sulfur trioxide (SO_3), which is rapidly converted to SAM. The proposed concentration limit of 5 ppmvd for SAM appears high in view of the fact that the limit for SO_2 is 24 ppmvd. Furthermore, the recently constructed Hillsborough WTE Unit 4 achieved only 0.56 ppmvd of SO_2. It is reasonable to expect that SAM emissions will be much less than SO_2 emissions.

There will be a small amount of additional SAM formed due to the inclusion of SCR. The Department believes that SAM emissions will not exceed 1 ppmvd and that annual emissions will be much less than the 95.2 TPY value estimated by the applicant. Furthermore, inclusion of CI within the control technology arrangement will further suppress SAM.

Rather than specifying limits for SAM, the Department believes that the GCP/SD/FF/ACI/SCR configuration (specifically the SD/FF/CI portion) is appropriate as a work practice and that the emission limitations for MWC-AG, and PM/PM_{10}, provide reasonable assurance that emissions of SAM will be controlled to BACT levels and to levels less than the PSD threshold of 7 TPY.

The Department will require initial tests to quantify SAM.

PM/PM_{10}/$PM_{2.5}$, MWC metals and VE BACT Analyses

Discussion

For the purposes of this descriptive discussion, PM means all PM including PM_{10}, $PM_{2.5}$ and MWC metals. MSW is a heterogeneous fuel that contains both combustible and non-combustible fractions. Heavier residual material forms slag and bottom ash that is removed from the bottom of the furnace grate.

The PM of interest is therefore the light ash that travels with the flue exhaust gas. Such PM consists of both the products of complete combustion and incomplete combustion. Vaporized inorganic material can condense on other particles and be carried out of the furnace. Organic material can be pyrolized and emitted as char if insufficient time is provided to insure complete burnout.

Additionally, reagents such as the lime, NH_3 and activate carbon used in the pollution control equipment contribute to PM. Acid gases and other fine PM and VE precursors react with various species to form alkali and ammoniated chlorides, sulfates, nitrates and other such species.

MWC metals as PM is a PSD category and requires a BACT determination. PM is the measured surrogate for MWC metals and has a greater PSD threshold of 25 TPY. PM limits are often set after determining BACT for PM_{10}. Typically applicants agree to lower values than BACT for PM to avoid conducting more difficult PM_{10} fractionation and measurement. The Department will address the two components of MWC metals separately.

Applicant's PM/PM_{10}/$PM_{2.5}$, MWC metals and VE BACT Proposals

The applicant proposes a single limit of 12 mg/dscm for filterable PM, PM_{10}, $PM_{2.5}$ and MWC metals as PM. The technology is the GCP/SD/FF/ACI/SCR arrangement. The applicant proposes a VE limit of 10% opacity. All features of the arrangement are involved whether by minimizing PM formation, reacting with fine PM precursors, adsorbing certain species, directly filtering PM and catalytically destroying fine PM precursors.

Department's PM/PM_{10}/$PM_{2.5}$, MWC metals and VE BACT Determinations

For reference, after excluding "outliers", EPA's consultant evaluated filterable PM data for the GCP/SD/FF/CI/SNCR configuration during the development of the new Subpart Eb. The mean of the data retained was 3.2 mg PM/dscm. EPA estimated that 95 and 99% of data are less than 7.6 and 9.5 mg/dscm respectively when assuming a normal distribution. The new Hillsborough County WTE Unit 4 achieved 1 mg/dscm of filterable PM which was much less than the BACT established for that project of 12 mg/dscm.

By now it is clear that a lower filterable PM limit than proposed is readily achievable. The value for the proposed Fairfield Maryland project is 10 mg/dscm of filterable PM.[18] The Department will set a limit of 10 mg/dscm and believes this provides a wide margin of safety for the proposed project. The same value will be set for PM_{10} and MWC metals as PM.

[18] Initial Licensing Conditions. Energy Answers International, Inc. – Fairfield Renewable Energy Project. PSC Case No. 9199. May 10, 2010.

The overall rationale for the PM/PM_{10} and MWC metals as PM limit is as follows:

- The limit of 10 mg/dscm is more stringent than the standard of 20 mg/dscm in Subpart Eb MACT; and
- The limit is as stringent as the lowest known PM/PM_{10} and MWC metals as PM limit for a WTE unit.

No $PM_{2.5}$ limit will be set for this project since it is not a PSD-pollutant and there is no defined $PM_{2.5}$ SER within Department rules. Also, condensable $PM/PM_{10}/PM_{2.5}$ limits will not be set because the Department does not yet define such species and has not yet adopted associated test methods.

The Department will establish a NH_3 limit of 10 parts per million (ppm) at 7% O_2 to minimize direct NH_3 emissions that can form PM (including filterable and condensable PM_{10} and $PM_{2.5)}$ as ammoniated chlorides, sulfates and nitrates in the exhaust stream and in the environment. The limit will also provide reasonable assurance of proper control equipment operation. The NH_3 emission limit will be readily controlled by the SCR system. Compliance shall be demonstrated by initial and annual tests using EPA Method CTM-027.

The Department has reviewed $PM_{2.5}$ and believes that measures have been incorporated into the overall BACT for the project that will adequately address this pollutant even though there is not a SER for $PM_{2.5}$. These measures include:

- BACT emission limits for surrogate PM/PM_{10};
- BACT emission limits and add-on controls for precursors SO_2 and NO_X that tend to form $PM_{2.5}$ in the environment;
- The VE limit that directly controls the fraction of $PM_{2.5}$ that interferes with light transmission; and
- Limits on NH_3 and HCl.

<u>Pb Analyses</u>

Discussion

Pb is a semi-volatile metal and a PSD pollutant that is released in the furnace, manifested as $PM/PM_{10}/PM_{2.5}$ and captured in the FF baghouse. The applicant estimates Pb emissions to be 0.65 TPY for the MWC units which is slightly greater than the SER of 0.6 TPY.

Applicant's Pb BACT Proposal

The SWA proposed to meet the Subpart Eb MACT limit for Pb of 140 µg/dscm as BACT for Pb. For reference, after excluding "outliers", EPA's consultant evaluated Pb data for the GCP/SD/FF/CI/SNCR configuration during the development of the new Subpart Eb. The mean of the data retained was 11.3 µg Pb/dscm. EPA estimated that 95 and 99% of data are less than 28.5 and 35.6 µg Pb/dscm respectively when assuming a normal distribution. The new Hillsborough County WTE Unit 4 achieved 18.3 µg Pb/dscm which was much less than the MACT (non-BACT) limit established for that project of 140 µg Pb/dscm.

Department's Pb Emission Limit Determination

The Department would set a limit for BACT that is much less than 140 µg Pb/dscm MACT limit and would result in annual emissions much less than the 0.6 TPY SER or the applicants estimate of 0.65 TPY. The Department will set a limit of 125 µg Pb/dscm that is sufficient to avoid PSD and with the expectation that actual emissions will be much less than the established Subpart Eb MACT limit for Pb.

The control strategy of GCP/SD/FF/CI/SCR (specifically the SD/FF/CI components) will provide reasonable assurance that the limit will be achieved. The initial stack test requirements are sufficient for the purposes of compliance. Annual tests will be required thereafter.

Cd Analyses

Discussion

Cd is a semi-volatile metal but is not a PSD pollutant. It is released in the furnace, manifested as $PM/PM_{10}/PM_{2.5}$ and captured in the FF baghouse.

Applicant's Cd Proposal

The SWA proposes to meet the Subpart Eb MACT limit for Cd of 10 µg/dscm. For reference, after excluding "outliers", EPA's consultant evaluated Cd data for the GCP/SD/FF/CI/SNCR configuration during the development of the new Subpart Eb. The mean of the data retained was 0.77 µg Pb/dscm. EPA estimated that 95 and 99% of data are less than 1.75 and 2.16 µg Cd/dscm respectively when assuming a normal distribution. The new Hillsborough County WTE Unit 4 achieved 0.2 µg Cd/dscm which was much less than the MACT (non-BACT) limit established for that project of 10 µg Cd/dscm.

Department's Cd Emission Limit Determination

The Department will set a limit of 10 µg Cb/dscm with the expectation that actual emissions will be much less than the established Subpart Eb MACT limit for Cd.

The control strategy of GCP/SD/FF/CI/SCR (specifically the SD/FF/CI components) will provide reasonable assurance that the limit will be achieved. The initial stack test requirements are sufficient for the purposes of compliance. Annual tests will be required thereafter.

Hg Analysis

Discussion

Hg is a volatile metal and a PSD pollutant that is released in the furnace, manifested as $PM/PM_{10}/PM_{2.5}$ and captured in the FF baghouse. The applicant estimates that Hg emissions will be approximately 0.056 TPY or 113 lb/yr which is less than the applicable SER of 0.1 TPY (200 lb/yr).

Refer back to Figure 16. Average emissions of Hg from large MWC in the U.S. have been reduced from approximately 15 µg/dscm in 1999 (by which time most MWC in the U.S. had been upgraded to comply with the original Subpart Eb) to 6 µg/dscm. This downward trend is likely from the addition of CI at some facilities where it had not been previously installed and by the modernization of others.

After excluding "outliers" EPA's consultant evaluated Hg data for the SD/FF/CI/SNCR configuration in 2005 during the development of the new Subpart Eb. The mean of the data retained was 8 µg/dscm consistent with Figure 16. EPA's consultant estimated that 95 and 99% of data are less than 22 and 27 µg Hg/dscm respectively when assuming a "normal distribution".

Table 9 is a summary of the average emissions from a group of MWC in Florida representative of much of the installed capacity. The new Hillsborough County WTE Unit 4 achieved 1.5 µg Hg/dscm and 97.8% reduction which was superior to the limit established for that project of 28 µg Hg/dscm or 85% reduction.

Table 9 – Average of Hg Emissions Concentrations from MWC in Florida 1999 – 2010 (µg/dscm) [1]

Year	2007	2008	2009	2010
Average Emissions	12.34	9.69	6.17	5.41

1. Facilities included in the emission calculations are Broward County South, Bay County, Pasco County, Lee County, Lake County, Hillsborough County, and Tampa McKay Bay

Applicant's Hg Proposal

The SWA proposes to meet a value of 25 µg/dscm which is half of the Subpart Eb MACT limit for Hg of 50 µg/dscm. However, 25 µg/dscm would actually trigger PSD and require a BACT determination because it equates to approximately 233 lb/yr. The SWA requested the option of 85% reduction if emissions are greater than 25 µg/dscm. This would further increase the annual emissions and make an annual limit difficult to enforce.

The SWA also proposes an annual limit of 113 lb/yr to be determined based on four stack tests per year, which would require that the average stack test result be much less than 25 µg/dscm. Finally, the SWA proposes to install and eventually rely upon Hg-CEMS to insure compliance with an annualized limit of 12 µg/dscm on a 12-month rolling basis.

Department's Hg Emission Limit Determination

The Department accepts the proposal by the SWA to comply with a limit of 25 µg Hg/dscm demonstrated by stack test. This value is less than the 50 µg Hg/dscm limitation per the Subpart Eb MACT. Quarterly testing is required for each flue stream. The Department also accepts the proposal by the SWA to limit annual emissions to 113 lb Hg/yr, which is less than the SER for Hg. This value is equivalent to 12 µg Hg/dscm.

To insure compliance with the annual limit such that the SER is not triggered, the Department will incorporate a requirement to conduct four tests per year per flue for the 25 µg Hg/dscm and 113 lb/yr based upon Hg-CEMS for compliance as described in the draft permit. During the first 12 months of testing, and emission factors shall be established for pounds of mercury per million tons of steam (lb-Hg/MTS) to account for missing data if and when the CEMS is not operational. The CEMS data shall have 80% availability in the first year and 85% every year thereafter.

3.3. BACT Review for Storage Silos (EU 027, 28, 29, 30)

Lime and carbon will be used in the air pollution control systems for the MWC and stored at the facility in three lime silos and one carbon silo. The lime will be utilized in the control of SO_2 emissions (spray dryer absorber) and the carbon will be used to control mercury emissions. The silos will be filled on an intermittent basis and PM emissions will be limited to the periods when the silos are being filled. Each silo will be equipped with a fabric filter system mounted on the roof of the silo to control PM emissions. The fabric filter system will be designed to discharge collected dust back into the silos. Emissions are estimated to be very low (less than 0.05 tons per year) due to the operation of the fabric filter system and limited number of filling events.

3.4. BACT Review for Emergency Equipment (EU 031, 32, 33)

Emergency Support Equipment

The proposed plant will also require:

- One 250 kW emergency electrical generator (or smaller); and
- Two 250 hp emergency fire water pumps (or smaller).

3.5. Applicable Standards under 40 CFR 60 and 63

The applicable standards pursuant to 40 CFR 60 and 63 were identified above and are summarized in the following three tables for the MWC units, the emergency generator and the emergency fire pump engines. By meeting the requirements of NSPS Subpart IIII, the requirements of NESHAP Subpart ZZZZ which is applicable to reciprocating internal combustion engines (RICE) are fulfilled.

Table 10 - NSPS Applicable to the Emergency Generator (40 CFR 60, Subpart IIII)

Emergency Generator (225 kW ≤ and < 450 kW)	**CO** (g/kW-hr)[1]	**PM** (g/kW-hr)	**SO_2**[2] **(% S)**	**NMHC**[3]**+NO_X** (g/kW-hr)
Subpart IIII (2007 and later)	3.5	0.20	0.0015	4.0

1. g/kW-hr means grams per kilowatt-hour.
2. SO_2 emission standard will be met by using ULSD fuel oil in the emergency generator with fuel sulfur (S) content of 0.0015% by weight.
3. NMHC means Non-Methane Hydrocarbons.

Table 11 - NSPS Applicable to the Emergency Fire Pump Engine (40 CFR 60, Subpart IIII)

Emergency Pump (175 ≤ hp and < 300 hp)	**CO** (g/hp-hr)[1]	**PM** (g/hp-hr)	**SO_2**[2] (% S)	**NMHC+NO_X** (g/hp-hr)
Subpart IIII (2009 and later)	2.6	0.15	0.0015	3.0

1. g/hp-hr means grams per horsepower-hour.
2. SO_2 emission standard will be met by using ULSD fuel oil in the emergency fire pump engine with a fuel sulfur content of 0.0015% by weight.
3. NMHC means Non-Methane Hydrocarbons.

The Department is adopting the requirements of 40 CFR 60, Subpart IIII as the minimum requirements emission standards for the emergency generator and emergency fire pumps. Each unit will be limited to 100 hours of operation annually for testing and maintenance. Subpart IIII will be considered BACT for each unit, and the manufacturer's certification will meet or exceed the requirements of Subpart IIII.

3.6. BACT Review for the Ash Handling System and Building (EU 034)

The collected ash will be transferred from the boiler and the air pollution control buildings to the ash management building via enclosed conveyor. The collected ash will be combined and quenched with water. The ash management building will contain ash processing equipment including ferrous and non-ferrous recovery systems. Since the ash will be wetted to a moisture content level in the approximate range of 20 to 25 percent, fugitive particulate matter emissions for the ash handling building are expected to be negligible.

To further minimize PM emissions from the ash management building ventilation air will be routed to a fabric filter control device prior to discharge to the atmosphere. These emissions will also be expected to be minimal due to moisture content. The residual ash will be transferred from the ash management building in covered, leak resistant vehicles for disposal at the onsite landfill. All loading and preparation for ash transport will occur within the enclosed ash management building. Because the ash is moist, dust will not be generated during transportation and disposal.

4. AMBIENT AIR QUALITY

4.1. Introduction

Table 4 above lists the PSD-pollutants which according to the applicant will be emitted in excess of their respective SER. Of those pollutants, only the following have associated Florida ambient air quality standards (AAQS): SO_2, PM_{10}, (the inhalable component of PM) nitrogen dioxide (NO_2 – a component of NO_X), O_3 (formed by its precursors – VOC and NO_X) and Pb. Except for Pb (which will be limited to less that its respective SER) these pollutants require an ambient air impact analyses.

4.2. Major Stationary Sources in Palm Beach County

Tables 12 through 16 list the largest sources of the pollutants in PBC per annual operating reports (AOR) filed with the Department. The pollutants listed are those most directly related to the criteria pollutants for which there are AAQS. The summaries include the future contributions of the PBREF-2. The maximum expected future emissions in TPY from the proposed project expansion are also shown for comparison. The locations of the key facilities are shown in Figures 25 and 26.

Table 12. Major Sources of NO_X in Palm Beach County (2009)

Owner	Site Name	TPY
SWA of PBC	NCRRF (i.e. the existing facility)	1,330
New Hope Power Partnership (NHPP)	Okeelanta Cogeneration (CoGen)	801
Sugar Cane Growers Co-Op (SCGC)	SCGC	475
SWA of PBC	**PBREF-2 (proposed)**	**402**
Osceola Farms	Osceola Farms	364
Florida Power & Light (FP&L)	West County Energy Center (WCEC)	170
United Technologies Corp.	Pratt & Whitney Aircraft	155
FP&L	Riviera Power Plant	100

Table 13. Largest Sources of SO_2 in Palm Beach County (2009)

Owner	Site Name	TPY
FP&L	Riviera Power Plant	445
SCGC	SCGC	441
SWA of PBC	**PBREF-2 (proposed)**	**299**
SWA of PBC	NCRRF	252
NHPP	Okeelanta CoGeneration	202
PBC Water Utilities Department (WUD)	PBC S. Region Water Reclamation (SRWR)	108
Osceola Farms	Osceola Farms	28

Table 14. Largest Sources of PM_{10} in Palm Beach County (2009)

Owner	Site Name	TPY
Osceola Farms	Osceola Farms	245
SCGC	SCGC	218
FP&L	WCEC	98
NHPP	Okeelanta CoGen	85
SWA of PBC	NCRRF	79
SWA of PBC	**PBREF-2 (proposed)**	**56**

Table 15. Largest Sources of CO in Palm Beach County (2009)

Owner	Site Name	TPY
Osceola Farms	Osceola Farms	9,926
SCGC	SCGC	9,533
NHPP	Okeelanta CoGen	1,598
SWA of PBC	NCRRF	786
SWA of PBC	**PBREF-2 (proposed)**	**435**
FP&L	WCEC	24
FP&L	Riviera Power Plant	14

Table 16. Largest Sources of VOC in Palm Beach County (2009)

Owner	Site Name	TPY
Osceola Farms	Osceola Farms	574
Sugar Cane Growers Co-Op	Sugar Cane Growers Co-Op	414
SWA of PBC	**PBREF-2 (proposed)**	**60**
NHPP	Okeelanta CoGen	52
PBC WUD	PBC SRWR	36
SWA of PBC	NCRRF	23
FP&L	WCEC	11

Figure 25 – SWA Site including PBREF-2

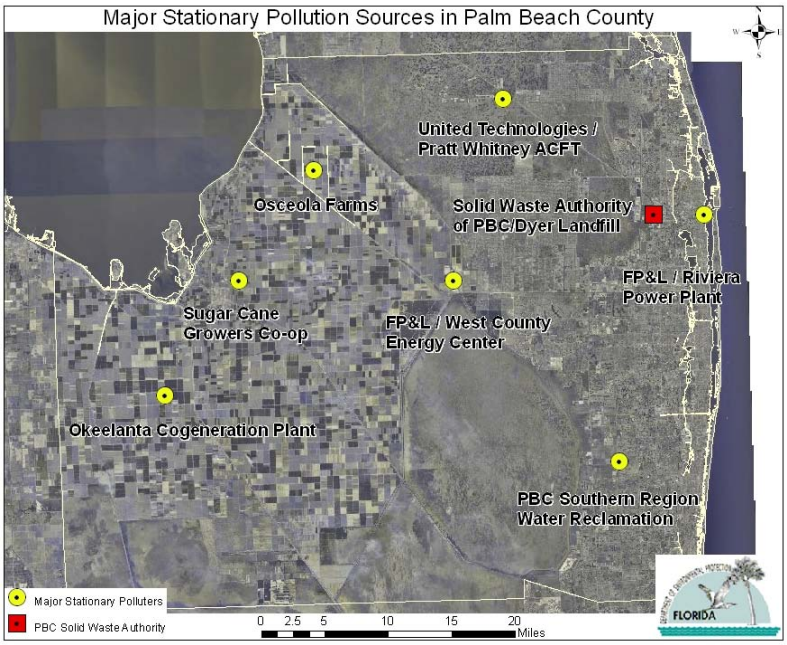

Figure 26 – Major Stationary Sources in PBC

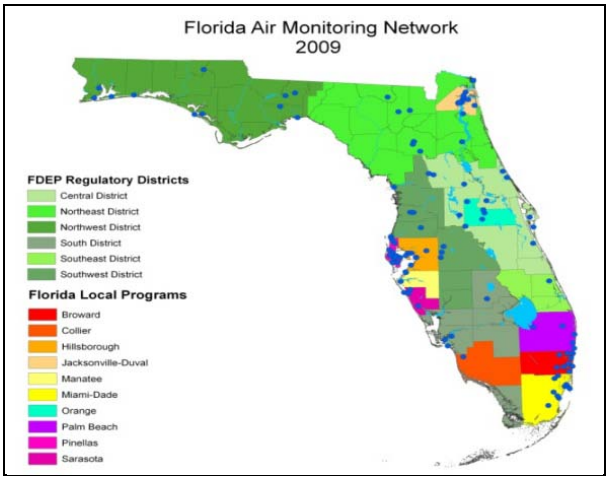

Figure 27 – Air Monitoring Network

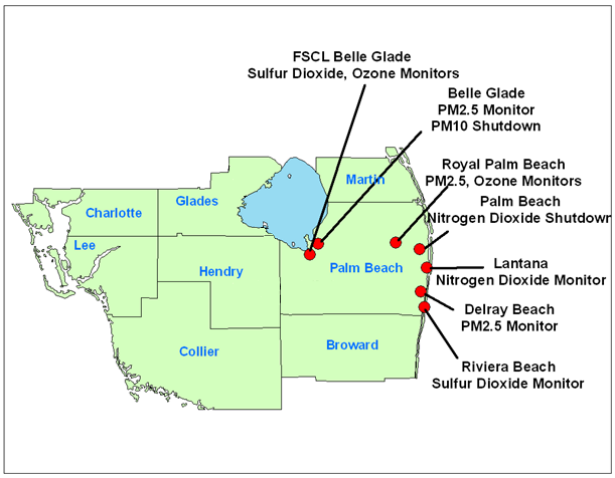

Figure 28. Monitors in Palm Beach County

4.3. Air Quality and Monitoring in the Palm Beach County

The State ambient air monitoring network operated by the Department and its partners (local air pollution control programs) includes monitors in counties containing over 90% of the population. As Figure 27 above indicates, the ambient air monitoring sites are concentrated in areas of high population density, along the coasts and near major highways in the interior portion of the state. The Florida Sugar Cane League (FSCL) operates SO_2 and O_3 instruments in Belle Glade, Palm Beach County. The Palm Beach County Public Health Unit operates six monitoring sites for the measurement of SO_2, NO_2, PM_{10}, $PM_{2.5}$ and ozone as shown in Figure 28.

These monitors are used to estimate the existing air quality in the area of the proposed facility. The monitors in Palm Beach and Royal Palm Beach are nearest and most representative of the proposed site. Air quality measurements from these monitors are summarized in Table 17 and compared with the applicable Department as well as National AAQS.

Table 17- Ambient Air Quality Measurements Nearest to the Project Site (2006-2009)

Pollutant	Location (Site Number)	Averaging Period	Ambient Concentration			
			Compliance Period	Value	Standard	Units [a]
PM_{10}	Belle Glade (0990008)	24-hour [b]	2008	49	150	$\mu g/m^3$
		Annual [c]	2008	18.9	50	$\mu g/m^3$
$PM_{2.5}$	Royal Palm Beach (0990009)	24-hour [d]	2007-2009	15	35	$\mu g/m^3$
		Annual [e]	2007-2009	6.3	15	$\mu g/m^3$
SO_2	FSCL Belle Glade (0992101)	1-hour [i]	2009	3	75	ppb
		3-hour [f]	2009	5.5	1300	$\mu g/m^3$
		24-hour [f]	2009	5.5	260	$\mu g/m^3$
		Annual [c]	2007-2009	2.6	60	$\mu g/m^3$
NO_2	Palm Beach (0991004)	Annual [c]	2006-2008	8	53	ppb
		1-hour [h]	2006-2008	41	100	ppb
CO	West Palm Bch. Lantana (0991004)	1-hour [f]	2007	2	35	ppm
		8-hour [f]	2009	1	9	ppm
Ozone	Royal Palm Beach (0990009)	8-hour [g]	2009	0.065	0.075	ppm

a. Units are in: micrograms per cubic meter ($\mu g/m^3$); parts per billion (ppb); or parts per million (ppm).
b. Not to be exceeded on more than an average of one day per year over a three-year period.
c. Arithmetic mean.
d. Three year average of the 98th percentile of maximum daily 24-hour concentrations with exceptional events excluded (as approved by EPA).
e. Three year average of the arithmetic annual means with exceptional events excluded (per EPA).
f. Not to be exceeded more than once per year.
g. Three year average of the annual 4th highest daily 8-hour maximum.
h. Three-year average of the annual 98th percentile maximum daily 1-hour value (design value).
i. Three-year average of the annual 99th percentile maximum daily 1-hour value.

4.4. Existing Ambient Air Quality – $PM_{2.5}$ and Ozone

O_3 is a key indicator of the overall state of regional air quality. It is not emitted directly from combustion processes. Rather it is formed from VOC and NO_X emitted primarily from regional industrial and transportation sources. VOC is also emitted from fires and vegetation (e.g. isoprene). These two precursors participate in photochemical reactions that occur on an area-wide basis and are highly dependent on meteorological factors.

O_3 limits and measurements are summarized on three year blocks, rolled annually. The reported ozone value was calculated by taking the maximum 8-hour readings recorded each day during the three years. The fourth highest of the recorded maxima were identified for each year and then the average of those three values was reported as the compliance value. These values are shown for each county in Figure 29.

$PM_{2.5}$ (also known as PM_{fine}) is another key indicator of the overall state of regional air quality. The Department is in the process of adopting the AAQS and SER for this pollutant (but had not yet completed the process by the time this technical evaluation was prepared). Some $PM_{2.5}$ is directly emitted as a product of combustion from transportation and industrial sources as well as fires. Much of it consists of particulate nitrates and sulfates formed through chemical reactions between gaseous precursors such as SO_2 and NO_X from combustion sources and NH_3 naturally present in the air or added by other industrial sources.

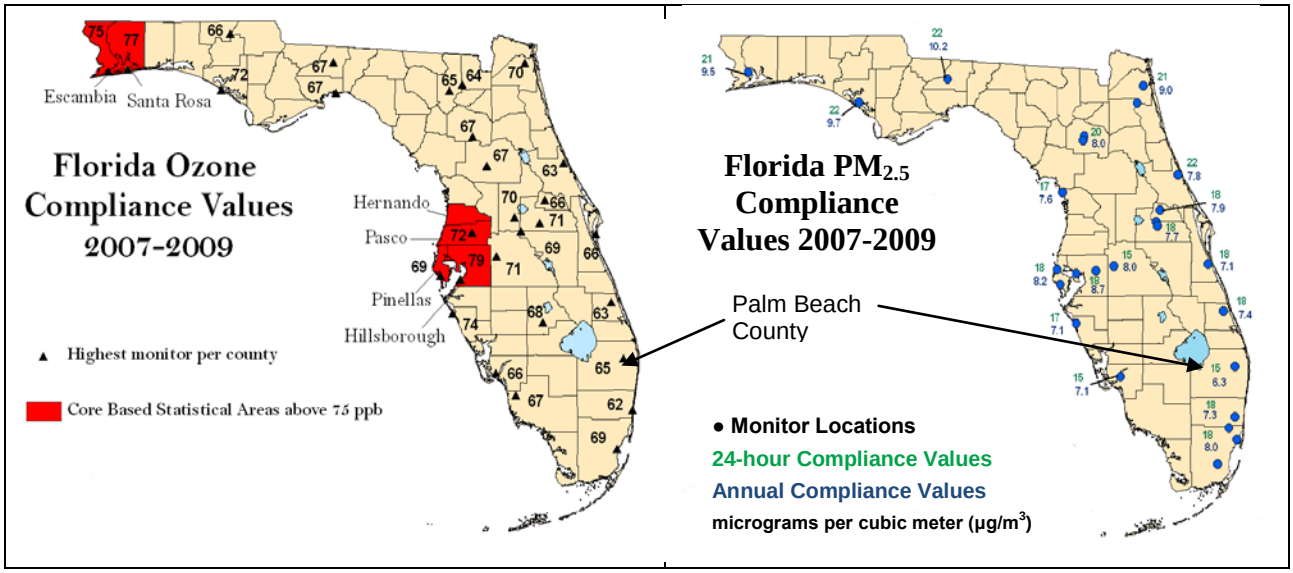

Figure 29 – Florida Ozone Compliance Values **Figure 30 – Florida $PM_{2.5}$ Compliance Values**

Federal $PM_{2.5}$ limits and ambient measurements are summarized on three year blocks, rolled annually. The reported 24-hour compliance value for $PM_{2.5}$ is 15 $\mu g/m^3$, shown in Figure 30 for the Royal Palm Beach site, and was calculated by taking the average 24-hour readings recorded each day during the three years (2007-2009). The value for each year that exceeds 98% of all daily measurements within each given year was identified and then the average of those three numbers was reported as the 24-hour compliance value and compared with the standard of 35 $\mu g/m^3$.

4.5. $PM_{2.5}$ and O_3 Precursor Emissions from Power Plants in the Southeastern U.S.

There is a regional effort underway through the CAIR and other regulatory programs to reduce emissions of $PM_{2.5}$ precursors including NO_X (also an O_3 precursor) and SO_2. Power plant VOC emissions are not as significant as NO_X as a precursor of O_3. Regional SO_2 emission reductions from existing power plants between 2007 and 2009 are listed in Table 18. SO_2 emissions from power plants in Florida were reduced by nearly 120,000 TPY and regional SO_2 emissions were reduced by over 1.25 million TPY.

Table 18 - SO_2 Emission Reductions from Power Plants in the Southeast between 2007 and 2009

State	2007 (TPY)	2009 (TPY)	Reduction (TPY)	Reduction (%)
Alabama	447,189	277,971	169,218	38
Florida	317,582	197,682	119,900	38
Georgia	635,484	262,258	373,226	59
Kentucky	379,837	252,001	127,836	34
Mississippi	69,796	40,160	29,636	43
North Carolina	370,826	110,948	259,878	70
South Carolina	172,726	97,940	74,786	43
Tennessee	237,231	108,042	129,189	12
Total	**2,630,671**	**1,347,002**	**1,283,669**	**49**

The simple average of all $PM_{2.5}$ measurements within each three years (2007-2009) was also calculated and then the mean of the three averages (6.3 $\mu g/m^3$) was reported as the annual compliance value and compared with the standard of 15 $\mu g/m^3$. The results indicate that PBC is in attainment with the applicable O_3 and national $PM_{2.5}$ AAQS.

The state and regional SO_2 reduction trends will continue as coal-fueled power plants continue to install scrubbers to control SO_2 emissions. Regional NO_X emission reductions from existing power plants between 2007 and 2009 are listed in Table 19.

Table 19 - NO_X Emission Reductions from Power Plants in the Southeast between 2007 and 2009

State	2007 (TPY)	2009 (TPY)	Reduction (TPY)	Reduction (%)
Alabama	122,374	49,610	72,764	59
Florida	184,171	84,252	99,919	54
Georgia	107,471	57,566	49,905	46
Kentucky	174,840	78,767	96,073	55
Mississippi	48,546	26,601	21,945	45
North Carolina	59,417	38,782	20,635	35
South Carolina	46,062	21,213	24,849	54
Tennessee	102,886	27,911	74,975	73
Total	**845,767**	**384,702**	**461,065**	**55**

In just two years, NO_X emissions from power plants in Florida were reduced by nearly 100,000 TPY and regional NO_X emissions were reduced by over 460,000 TPY. The state and regional NO_X reduction trends will continue as coal-fueled power plant operators throughout the southeastern states continue to install SCR systems to control NO_X.

4.6. SO_2 and NO_X Emission Trends from FPL Peninsular Facilities

FP&L facilities are among the largest sources of SO_2 and NO_X (precursors of $PM_{2.5}$ and/or O_3) nearest to the proposed PBREF-2 site. To put emissions from the existing FP&L facilities and the future PBREF-2 into another perspective, the Department graphed the SO_2 and NO_X emission trends during the period 1998-2009 from FPL fossil-fueled plants located in the Florida peninsula. Most of the plants are in South Florida. The data source is the EPA Clean Markets Acid Rain database. The results are summarized in Figure 31.

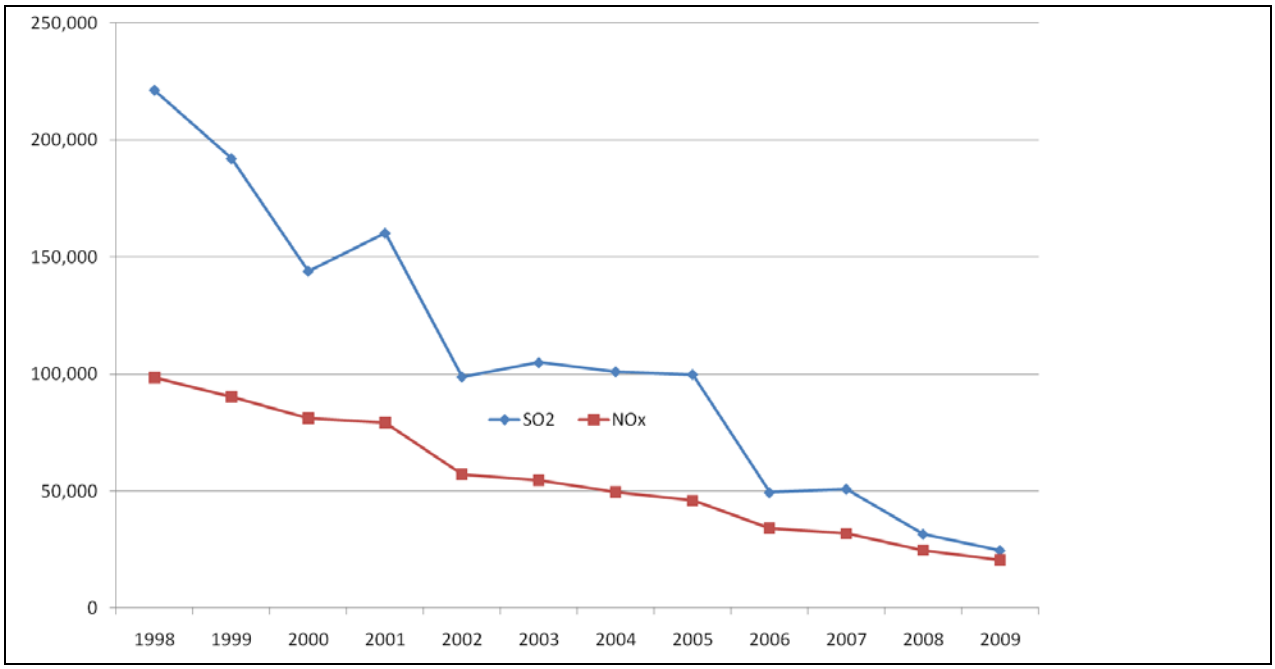

Figure 31 – SO_2 and NO_X reductions in TPY at FPL Peninsular Facilities (1998-2009)

During the period 1998-2009 there was a *decrease* from 221,400 to 24,700 TPY (89%) in SO_2 emissions from the FP&L fossil fueled plants in peninsular Florida. Similarly, there was a *decrease* from 98,500 to 20,500 TPY (79%) in NO_X emissions. For comparison purposes, the future PBREF-2 expansion will emit 299 TPY of SO_2 and 402 TPY of NO_X.

The contribution of 299 TPY of SO_2 and 402 TPY of NO_X from the PBREF2 will not affect the general, overwhelming and continuing downward trends in $PM_{2.5}$ and O_3 precursors. Similarly, it will not have an appreciable effect on local or regional $PM_{2.5}$ and O_3 concentrations.

4.7. Ambient $PM_{2.5}$ Trends in South Florida

The overall reduction in $PM_{2.5}$ precursor emissions from stationary sources and the transportation sources (due to use of cleaner fuels) has contributed to the clear decline in ambient $PM_{2.5}$ levels in South Florida during the same period as shown in Figure 32.

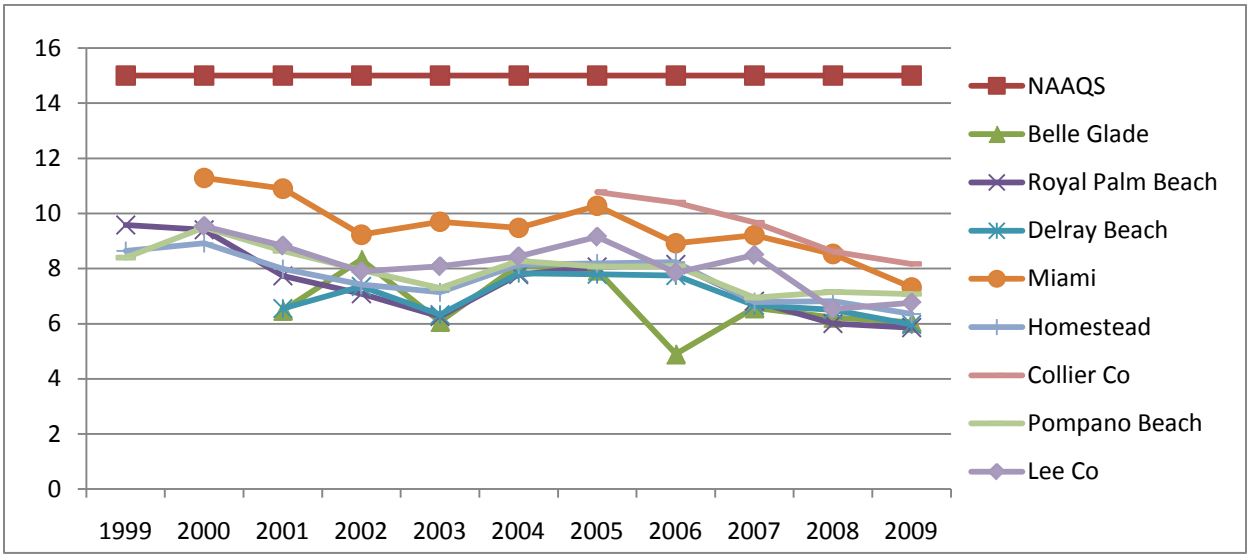

Figure 32 - South Florida Annual Average $PM_{2.5}$ Trends in $\mu g/m^3$ (1999 – 2009)

Basically the pronounced reductions in Miami are consistent with the above mentioned reductions in emissions from stationary and transportation sources. By and large, the values in Belle Glade (within the rural sugar cane growing area) have been the lowest. However, they have been more resistant to further declines most likely due to the nature of the sugar industry which is based on periodic burning followed by harvesting of sugar cane.

4.8. Air Quality Impact Analysis

Significant Impact Analysis

The first step in conducting an air quality impact analysis is to determine whether the emissions from the source of interest can contribute significantly to ground level concentrations of the given pollutant(s) of interest. Rule 62-210.200(275), F.A.C. defines "significant impact" as an impact of emissions on ambient air quality in excess of any of pollutant-specific concentration values listed therein. The levels are known as the significant impact levels (SIL) and are defined for SO_2 (3 and 24-hr), NO_2 (annual), PM_{10} (24-hr and annual), CO (1 and 8-hr) and Pb (quarterly). Separate SIL are defined for Class I areas such as the Everglades National Park (ENP) and Class II areas; basically all other areas in the proximity of the project.

A significant impact analysis (SIA) is performed on each of these pollutants and associated averaging times (except for Pb in the case of the present project) to determine if the project can cause an increase in ground level concentration greater than the respective SIL for each pollutant.

The EPA-approved AERMOD modeling system was used by the applicant to address the significant impact on the PSD Class II area.

Although the Department has not yet adopted SER, AAQS or SIL for $PM_{2.5}$, the applicant modeled $PM_{2.5}$ with respect to the federal maximum 24-hour and annual impacts as discussed further below. In conducting this analysis, the applicant conservatively assumed that all PM_{10} is actually $PM_{2.5}$, and scaled the SIL for PM_{10} in proportion to the ratio of the respective NAAQS to develop SIL applicable to $PM_{2.5}$. The rationale for the SIL used for $PM_{2.5}$ is as follows:

- The promulgated annual SIL for PM_{10} is 2.0% of the corresponding state/national AAQS;
- The project-specific annual SIL for $PM_{2.5}$ is also 2.0% of the corresponding NAAQS;
- The promulgated 24-hour SIL for PM_{10} is 3.3% of the state/national AAQS; and
- The project-specific SIL for $PM_{2.5}$ is also 3.3% of the NAAQS.

The applicant believes this approach encompasses all meaningful $PM_{2.5}$ sources capable of interacting with PBREF-2 for the purposes of determining impacts with respect to the 24-hour and annual $PM_{2.5}$ NAAQS.

Although the Department has not yet adopted the NAAQS for 1-hour NO_2 and SO_2, the applicant modeled both parameters. To conduct that modeling applicant proposed project-specific SIL equal to 4% of the respective NAAQS for these two pollutants based on the fact that the 4% SIL is more conservative (less than) the 5% SIL applicable to the only other pollutant (CO) that has a 1-hour averaging time (Rule 62-204.200(29), F.A.C.).

In addition, for the 1-hour NO_2 multisource analysis:

- The applicant evaluated all facilities within 70 km of PBREF-2;
- The applicant included all sources (regardless of size) within the significant impact distance (SID) (2.7 km) of PBREF-2; and
- The applicant included all facilities greater than 500 TPY within 52.7 km of PBREF-2 (SID plus 50 km)

The applicant believes this approach encompasses all meaningful SO_2 and NO_X sources capable of interacting with PBREF-2 for the purposes of determining impacts with respect to the 1-hour SO_2 and NO_2 NAAQS.

In addition to the Class II SIL, the applicant conducted a modeling analysis for nearby Class I areas. Class I SIL have been proposed by EPA for SO_2, NO_2, and PM_{10}, and most recently promulgated for $PM_{2.5}$. In order to conduct a significant impact analysis, the applicant uses the proposed project's emissions at worst load conditions as inputs to the models. The models used in this analysis and any required subsequent modeling analyses are described below. The highest predicted short-term concentrations and highest predicted annual averages predicted by this modeling are compared to the appropriate SIL for the PSD Class I Everglades National Park (ENP) and the PSD Class II Area (everywhere except the ENP). Further, the Class II area analysis also includes a separate analysis for the Biscayne National Park (BNP).

For the Class II analysis, a combination of fence line, near-field and far-field receptors were chosen for predicting maximum concentrations in the vicinity of the project. The fence line receptors consisted of discrete Cartesian receptors spaced at 50-meter intervals around the facility fence line. The remaining receptor grid consisted of densely spaced Cartesian receptors at 100 meters apart extending to 3 kilometers. From 3 to 10 kilometers, Cartesian receptors with a spacing of 500 meters were used from the facility, followed by a coarser, 1000 meter spaced grid from 10 kilometers out to 30 kilometers.

Because the public will have limited access within the fence lines of both the existing PBREP and the proposed facility, (for example, at drop off areas and at visitor centers), grid receptors within the fence line were also included in the model.

If this modeling at worst-load conditions shows ground-level increases less than the SIL, the applicant is exempted from conducting any further modeling. If the modeled concentrations from the project equal or exceed the SIL for a pollutant, then additional modeling including emissions from all major facilities or projects in the region (multi-source modeling) is required to determine the proposed project’s impacts compared to the AAQS and PSD increments.

The nearest PSD Class I area is the Everglades National Park (ENP) located about 118 km to the south of the project site. Maximum air quality impacts from the proposed project are summarized in the Table 21. The results of the initial PM/PM_{10}, NO_2 and SO_2 air quality impact analyses for this project indicated that maximum predicted impacts from SO_2, PM_{10}, and NO_2 are less than the applicable SIL for the Class I area. Therefore, no further detailed modeling efforts are required for these pollutants.

The results of applicant’s SO_2, PM_{10}, NO_2, and CO air quality Class II significant impact analysis for this project are shown below in Table 20. The applicant used Tier 2 75% NO_X to NO_2 ambient ratio method (ARM) conversion for the 1-hour NO_2 modeling analysis. Maximum predicted impacts are greater than the applicable SIL for the Class II area for 1-hour NO_2 averaging times. Consequently, a full AAQS of NO_2 in which the PSD Increment analysis considering all sources of this pollutant in the area is required.

Preconstruction Ambient Monitoring Requirements

PSD regulations require up to one year of continuous ambient air monitoring prior to construction of any new PSD source. A preconstruction monitoring analysis is performed for those pollutants with listed de minimis impact levels. These are levels, which, if exceeded, would require pre-construction ambient monitoring. However, the regulations allow an exemption from this requirement for those sources whose air quality impacts fall below de minimis levels and where representative ambient monitoring data is available. For this analysis, AERMOD was used to identify if potential emissions from the site exceed de minimis levels using worst load conditions as inputs to the model. As shown in Table 22, all maximum predicted impact levels for PSD sources were below de minimis impact levels.

Table 20 - Maximum Predicted Air Quality Impacts from Palm Beach County Facility Renewable Energy Facility No. 2 for Comparison to the PSD Class II SIL

Pollutant	Averaging Time	Max Predicted Impact ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)	Ambient Air Standards ($\mu g/m^3$)	Significant Impact?
SO_2	Annual	0.35	1	60	NO
	24-hour	3.61	5	260	NO
	3-hour	7.21	25	1300	NO
	1-hour	7.73	7.8[a]	195	NO
$PM_{10\ (2.5)}$	Annual	0.065	1 (0.3)	50 (15)	NO
	24-hour	0.68	5 (1.16)	150 (35)	NO
NO_2 [b]	Annual	0.88	1	100	NO
	1-hour	8.67	7.6[a]	189	YES
CO	1-hour	14.81	2,000	40,000	NO
	8-hour	12.04	500	10,000	NO

a. Applicant's proposed SIL for this project.
b. The annual NO_2 predicted impacts are based on the use of SNCR as a control technology. The proposed facility now incorporates SCR to control the NO_X emissions, and therefore, the predicted annual impacts are expected to be lower. The 1-hour NO_2 impacts incorporates the switch to SCR. Assumes 75% conversion of NO_X to NO_2, i.e., tier 2 modeling approach for the 1 hour average.

Table 21 - Maximum Predicted Air Quality Impacts from the Palm Beach County Renewable-Energy Facility No. 2 for Comparison to the PSD Class I SIL at ENP [a]

Pollutant	Averaging Time	Max. Predicted Impact at Class I Area ($\mu g/m^3$)	Class I Significant Impact Level ($\mu g/m^3$)	Significant Impact?
$PM_{10\ (2.5)}$	Annual	0.0007	0.2 (0.06)	NO
	24-hour	0.018	0.3 (0.07)	NO
NO_2	Annual	0.0079	0.1	NO
SO_2	Annual	0.0031	0.1	NO
	24-hour	0.091	0.2	NO
	3-hour	0.246	1	NO

a. Using originally proposed emissions (since reduced) from the SNCR control technology scenario.

Table 22. - Maximum Air Quality Impacts for Comparison to the De Minimis Concentration Levels

Pollutant	Averaging Time	Max Predicted Impact ($\mu g/m^3$)	De Minimis Level ($\mu g/m^3$)	Impact Greater Than De Minimis?
NO_2	Annual	0.88	14	NO
SO_2	24-hour	3.6	13	NO
PM_{10}	24-hour	0.68	10	NO
CO	8-hour	12.0	575	NO
Lead	3-month	0.009	0.1	NO
Fluorides	24-hour	0.06	0.25	NO

Based on the preceding discussions, the only additional detailed air quality analyses required by the PSD regulations for this project are the following:

- A preliminary analysis to determine if facility emissions will result in a significant impact on ambient air quality.
- A full impact, or multisource analysis of any pollutants that will result in a significant impact, including modeling emissions from the proposed source, other existing facilities, and the emissions due to the planned growth that accompanies the new source.
- An analysis of impacts on soils, vegetation, visibility, and of growth-related air quality modeling impacts.

Models and Meteorological Data Used in the Foregoing Air Quality Analysis

PSD Class II Area: The AERMOD modeling system was used to evaluate the pollutant emissions from the proposed project in the surrounding Class II Area. AERMOD was approved by the EPA in November 2005. The AERMOD modeling system incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including the treatment of both surface and elevated sources, and both simple and complex terrain. AERMOD contains two input data processors, AERMET and AERMAP. AERMAP is the terrain processor and AERMET is the meteorological data processor.

A series of specific model features, recommended by the EPA, are referred to as the regulatory options. The applicant used the EPA recommended regulatory options. Direction specific downwash parameters were used for all sources for which downwash was considered. The stacks associated with this project all satisfied the good engineering practice (GEP) stack height criteria.

The AERMOD-ready meteorological data used for this analysis consisted of a concurrent 5-year period of hourly surface weather observations from the National Weather Service at the Palm Beach International Airport and upper air data from Florida International University, Miami. The 5-year period of meteorological data was from 2001 through 2005. The nearest National Weather Service (NWS) station at the Palm Beach International Airport is approximately 6.9 miles southeast of the site.

In reviewing this permit application, the Department has determined that the application complies with the applicable provisions of the stack height regulations as revised by EPA on July 8, 1985 (50 FR 27892). Portions of the regulations have been remanded by a panel of the U.S. Court of Appeals for the D.C. Circuit in NRDC v. Thomas, 838 F. 2d 1224 (D.C. Cir. 1988). Consequently, this permit may be subject to modification should EPA revise the regulation in response to the court decision. This may

result in revised emission limitations or may affect other actions taken by the source owners or operators. A more detailed discussion of the required analyses follows.

PSD Class I Area: The California Puff (CALPUFF) dispersion model was used to evaluate the pollutant emissions from the proposed project in the Class I ENP beyond 50 km from the proposed project. Meteorological MM4 and MM5 data used in this model was from 2001 to 2003.

CALPUFF is a non-steady state, Lagrangian, long-range transport model that incorporates Gaussian puff dispersion algorithms. This model determines ground-level concentrations of inert gases or small particles emitted into the atmosphere by point, line, area, and volume sources.

The CALPUFF model has the capability to treat time-varying sources, is suitable for modeling domains from tens of meters to hundreds of kilometers, and has mechanisms to handle rough or complex terrain situations. Finally, the CALPUFF model is applicable for inert pollutants as well as pollutants that are subject to linear removal and chemical conversion mechanism.

Multi-source PSD Class II Increment Analysis

The PSD increment represents the amount that new sources in an area may increase ambient ground level concentrations of a pollutant from a baseline concentration. Since the predicted impacts were below the SIL for all NAAQS with increments, a PSD increment analysis was not required for NO_2, SO_2 and PM_{10}, but have also been included by the applicant for informational purposes. The maximum predicted annual and maximum predicted high, second high short-term average PSD Class II area impacts from this project are shown in Table 23 below.

Table 23 - PSD Class II Increment Analysis

Pollutant	Averaging Time	Max Predicted Impact ($\mu g/m^3$)	Allowable Increment ($\mu g/m^3$)	Impact Greater Than Allowable Increment?
NO_2	Annual	0.88	25	NO
SO_2	Annual	0.34	20	NO
	24-hour	3.1	91	NO
	3-hour	6.8	512	NO
PM_{10}	Annual	0.06	17	NO
	24-hour	0.59	30	NO
Note: These results are based on the highest, second-high annual values over the five modeling years for the 3-hour and 24-hour SO_2 and PM_{10} averaging periods. The annual averages are based on the maximum of the five years for NO_2, SO_2 and PM_{10}.				

AAQS Analysis

For pollutants subject to an AAQS review, the total impact on ambient air quality is obtained by adding a "background" concentration to the modeled concentration based on the averaging time for the standard. This "background" concentration is based on existing monitoring data for each pollutant and representative of the area of the proposed source. This background is intended to account for sources of a particular pollutant that are not explicitly modeled. Since no attempt is typically made to subtract out the impacts due to the explicitly modeled sources on these monitored values, there is some amount of double-counting reflected in the total concentration (modeled + background) used to compare with the appropriate AAQS.

The sources that are explicitly modeled include the subject facility and nearby sources that are judged to potentially have a significant interaction with the proposed facility. The appropriate calculations for the modeled and background values are different for each pollutant, but generally follow the form for

compliance with the AAQS. Table 24 shows the results of this analysis. The metrics used for the modeled impacts and the background concentrations are provided in the footnotes. As shown in this table, emissions from the proposed facility are not expected to cause or contribute to a violation of an AAQS.

Table 24 - Ambient Air Quality Impacts

Pollutant	Averaging Time	Major Sources Impact ($\mu g/m^3$)	Background Conc. ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	Total Impact Greater Than AAQS?	Florida AAQS ($\mu g/m^3$)
NO_2	1-hour	32.4[a]	108	140.4	NO	189
	Annual	0.88	18	18.9	NO	100
SO_2	Annual	0.34	4	4.3	NO	60
	24-hour	3.1	5.5	8.6	NO	260
	3-hour	6.8	5.5	12.3	NO	1300
PM_{10}	Annual	0.06	18.9	19.0	NO	50
	24-hour	0.45	49	49.5	NO	150
$PM_{2.5}$	Annual	0.06	6.3	6.4	NO	15
	24-hour	0.68	15	15.7	NO	35
CO	8-hour	9.2	2061	2070	NO	10,000
	1-hour	14.4	3206	3220	NO	40,000
Lead	Quarterly	0.009	0.01	0.019	NO	1.5
	3-month rolling	0.009	0.01	0.019	NO	0.15

a. Assumes 75% conversion of NO_X to NO_2, i.e., the Tier 2 modeling approach, for the 1-hour average.

An AAQS review was only required for the 1-hour NO_2 averaging period, but modeled impacts for SO_2, $PM_{10}/PM_{2.5}$, CO and Pb have also been included for informational purposes. Based on the results of the air quality modeling analysis, the operation of the new Palm Beach Renewable Energy Facility No. 2 will not cause or contribute to a violation of an ambient air quality standard or maximum allowable concentration increase (PSD increment).

O_3 Modeling

Projects with VOC and NO_X emissions greater than 100 TPY are required to perform an ambient impact analysis for ozone including the gathering of preconstruction ambient air quality data. The applicant estimated annual potential VOC and NO_X emissions from the project to be 60 and 402 TPY respectively. The applicant's potential NO_X emissions were originally estimated to be 760 TPY under the SNCR system, but with the switch to the more efficient SCR system, estimated NO_X emissions have fallen more than 300 TPY or by 51% of the original proposal.

The O_3 monitoring data at Royal Palm Beach are sufficient for the purposes of background values at the PBREF-2 site. O_3 site-specific modeling is not typically completed for single source permitting because of its complexity. O_3 is a secondarily formed pollutant that is known to be caused by the regional emissions of VOC and NO_X in combination with meteorological parameters (temperature, rainfall, solar insolation, etc.).

To conclusively prove whether or not the 402 TPY of NO_X will not cause or contribute to a violation, a very sophisticated and expensive model would need to be run for the entire region. The key inputs to the model would be traffic, power plants throughout the region, other industrial sources, and meteorology. As previously discussed, the NO_X emission reductions in South Florida from FP&L projects alone have declined by nearly 80,000 TPY. The effects of the PBREF-2 on O_3 would not be measurable considering the overwhelming effects of the FP&L reductions and the climatological variability. The uncertainty in any regional ozone model would be greater than the contribution from this project.

4.9. Additional Impacts Analysis

Impact on Soils, Vegetation, and Wildlife

PSD regulations require an analysis of air quality impacts on sensitive vegetation types, with significant commercial or recreational value, and sensitive types of soil. According to the applicant, within Palm Beach County, the soils surface layer typically consists of very loose to medium dense, relatively clean to slightly silty, and occasionally silty fine to medium sands. The subsurface (depths less than about 125 feet) material consists predominantly of sand, shell, sandstone, and limestone while the materials within several thousand feet of the land surface are sedimentary rocks. The USEPA secondary NAAQS were used to evaluate whether soils and vegetation will experience any adverse effects from air pollution. The secondary NAAQS were developed to prevent unacceptable effects on the public welfare, including unacceptable damage to crops and vegetation. Table 25 presents a comparison of the proposed project's impacts to the secondary NAAQS. As shown, the highest predicted impacts (including the existing background concentration) are all well below the secondary NAAQS for all pollutants and averaging times. Therefore, the proposed PBREF-2 will not have an adverse impact on soil and vegetation.

Table 25: Soils and Vegetation Impact Analysis

Pollutant	Averaging Time	NAAQS Secondary Standard $\mu g/m^3$	Modeled Impact[a] $\mu g/m^3$	% of Secondary NAAQS	Background Concentration $\mu g/m^3$	Total Impact $\mu g/m^3$
NO_2	Annual	100	0.88[b]	0.9%	18	18.9
SO_2	Annual	80	0.34	0.4%	4	4.3
	24-hour	365	3.1	0.8%	5.5	8.1
	3-hour	1,300	6.8	0.5%	5.5	12.3
PM_{10}	24-hour[c]	150	0.45	0.3%	49	49.5
$PM_{2.5}$	Annual	15	0.06	0.4%	6.3	6.4
	24-hour[d]	35	0.68	1.9%	15	15.7
Pb[e]	3-month rolling	0.15	0.009	6.0%	0.01	0.019
	Quarterly	1.5	0.009	0.6%	0.01	0.019

a. Based on the modeled impact for the PBREF-2.
b. Impact based on the SNCR NO_X control scenario.
c. The 24-hour PM_{10} modeled impacts are based on the highest sixth-highest concentration over five years to compare with the secondary standard.
d. Maximum 24-hour modeled $PM_{2.5}$ concentration was used to conservatively determine compliance with the secondary standard.
e. Maximum 24-hour modeled concentrations were used to conservatively determine compliance with the lead standard.

Class I Area Impacts - Air Quality Related Values (AQRV)

Everglades National Park is the nearest Class I area to the proposed project and is located 118 kilometers south of the project site. Sulfur and nitrogen deposition analyses and a visibility impairment analysis was performed by the applicant to determine if the proposed facility would have an adverse impact on the specific AQRVs and visibility for the Everglades National Park.

Table 26 shows the results of the visibility analysis under the SNCR NO_X control scenario. Visibility impacts are less than criterion of 5% with the more recent Method 8 (mode 5) calculation approach, but slightly exceeded the threshold with the more conservative "Method 2" at one single day at a single receptor location.

Table 26 - Maximum 24-hour Visibility Impairment Predicted from the Proposed Facility at the Everglades National Park Class I Area

Background Extinction Calculation	Visibility Impairment (%) [a]	Visibility Impairment Criterion (%)
Method 2	6.26[b]	5.0
Method 8 (mode 5)	2.77	5.0

a. Concentrations are highest predicted using CALPUFF V5.8, 4-km domain for 2001-2003.
b. A single day at a single receptor location was predicted to exceed the threshold using Method 2 and proposed emissions from SNCR control technology scenario.

However, with the expected reduction of NO_X emissions under the current SCR controls scenario along with the fact that these reported impacts using the conservative Method 2 approach will be of the limited duration, frequency, and occurrence and combined with the fact that predicted impacts are well below SIL support the conclusion that proposed PBREF-2 emissions will not cause or contribute to an adverse impact to visibility at Everglades National Park. The proposed use of SCR is expected to reduce the nitrate portion of the change of visibility impairment found using Method 2. The federal land manager concurs that no adverse impacts on visibility are predicted to occur. There were no visibility concerns for the Class II areas.

Total nitrogen (N) and sulfur (S) deposition rates were predicted using the CALPUFF model. Deposition thresholds were developed by the Federal Land Managers that represent the additional amount of N or S deposition within a Class I area below which impacts from a new or modified source are considered insignificant. Table 27 provides the results of this analysis. Total deposition of both N and S are both an order of magnitude below the threshold of 0.01 kilograms per hectare per year (kg/ha/yr).

Table 27 - Maximum Annual Nitrogen and Sulfur Deposition from the Proposed Facility at the Everglades National Park Class I Area

Species	Total Deposition	Deposition Analysis Threshold
	kg/ha/yr	kg/ha/yr
Nitrogen (N) Deposition [a]	0.0031	0.01
Sulfur (S) Deposition	0.0028	0.01

a. Using proposed emissions from the SNCR control technology scenario.

Industrial and Commercial Growth-Related Impacts

Between 1998 and 2008, there was an approximate 21 percent increase in the labor force, from more than 519,000 persons in 1998 to over 628,000 by 2008. Of the 20 major employers in the County, at least six lie within 5 miles of the proposed PBREF-2, but not closer than 4 miles to the proposed PBREF-2. The projected employment in Palm Beach County from 2008 to 2016 is anticipated to increase by 16 percent.

A number of industrial parks exist within 5 miles of the proposed PBREF-2 which is indicative of potential and planned industrial growth near the project site. The expected commercial and industrial growth due to the new facility will be negligible. The majority of the operations associated with the PBREF-2 are relatively self-contained. Therefore, no significant air quality impacts due to associated industrial/commercial growth are expected.

Residential Growth Impact Analysis

Palm Beach County's population (including Palm Beach County cities and the unincorporated areas of the County), according to the 2000 US Census Bureau, was approximately 1,131,191 permanent residents with an estimated additional seasonal population of 123,725 residents. There are approximately 474,175 occupied households. Based on data from the US Census Bureau, the average population density for the county is 635 people per square mile.

Palm Beach County's population grew 31 percent between 1990 and 2000. The state population grew nearly 19 percent from 2000 to 2008. The municipality of West Palm Beach is the largest among the County's 37 municipalities, both in population and area. West Palm Beach has a population of 82,103 permanent residents with an estimated additional seasonal population of 4,652 residents. Based on data from the US Census Bureau, the average population density for the municipality of West Palm Beach is 1,564 people per square mile.

According to the University of Florida's Bureau of Economic and Business Research, the population as of 2008 for towns and cities at least partially within 5 miles of the proposed PBREF-2 was 212,960. Since the proposed facility will divert existing MSW from the landfill, residential growth as a direct result of the proposed PBREF-2 is expected to be negligible.

5. CONCLUSION

The Department makes a preliminary determination that the proposed project will comply with all applicable state and federal air pollution control regulations as conditioned by the Draft Permit.