SWA
SOLID WASTE AUTHORITY
YOUR PARTNER FOR
SOLID WASTE SOLUTIONS



September 9, 2010

Mr. A.A. Linero, P.E.
Program Administrator – Special Projects Section
Florida Department of Environmental Protection
Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Re: Request for Additional Information
Air Permit Application for Palm Beach Renewable Energy Facility No. 2
DEP File No. 0990234-017-AC (PSD-FL-413)

Dear Mr. Linero:

The Solid Waste Authority of Palm Beach County (the Authority) is providing additional information regarding the air permit application for the proposed Palm Beach Renewable Energy Facility No. 2 (PBREF2). On August 9, 2010, the Authority submitted information in response to the Florida Department of Environmental Protection's request for additional information (RAI) dated June 15, 2010. As indicated in our August 9th submittal, RAI items 2 and 3 related to $NO_x$ emissions were not addressed as a decision from the Authority's Governing Board (Board) was pending regarding the use of selective catalytic reduction (SCR). At the Board meeting held on August 25, 2010, a formal decision was made to specify SCR for this project. As such, we are now responding to RAI items 2 and 3. As part of this submittal we are also revising the proposed annual mercury emission limit as requested by the Department. With this submittal, responses to all of the RAI items have been provided except for the 1-hour $NO_2$ and $SO_2$ modeling analyses. These analyses are being completed and we expect to submit the modeling results and associated files later this month.

**<u>Selection of SCR for $NO_x$ Control & Response to RAI items 2 & 3</u>**

Items 2 and 3 from the Department's June 15th RAI are as follows:

2. *<u>BACT Analysis for $NO_x$.</u> The application indicates 85 ppmvd as the lowest nitrogen oxides ($NO_x$) emission limit based on the RACT/BACT/LAER Clearinghouse database. Please consider some of the well-known applications, draft and final permits including the 2,200 tons per day (TPD) Jefferson Renewables in Ohio and the 4,000 TPD stoker-based Fairfield, Maryland facility. Both will include regenerative selective catalytic reduction (RSCR) to achieve emission limitations of 75 and 45 parts per million (ppm) respectively.*

3. *<u>BACT Cost Analysis for $NO_x$.</u> Please re-evaluate the $NO_x$ BACT analysis with RSCR as an option and provide costs associated with the RSCR comparison with SNCR and SCR. In addition, review of the submitted cost analysis is requested by the Department. Please justify the need for both operating labor and maintenance labor. The catalyst replacement number appears to be annualized. Was the initial cost of the catalyst backed out of the original product cost? Provide additional justification and basis for the additional energy for flue gas heating prior to the SCR. Please review and re-evaluate the incremental cost difference between the three technologies based upon maximum emission reductions for SCR, SNCR, and RSCR technologies.*

   In response to the August 25th decision from the Board to use SCR for reducing $NO_x$ emissions, the Authority is proceeding with implementing SCR in the design process for the new facility. A "clean-side" SCR design will be used with the SCR unit located downstream of the acid gas and particulate control systems. The SCR system will be specified to meet $NO_x$ emission limits (corrected to 7 percent oxygen, dry basis) of 50 $ppm_v$ as a short-term 24-hour block average and 45 $ppm_v$ as a 12-month rolling average. Additionally, a maximum ammonia slip concentration of 10 $ppm_v$ is proposed for the SCR system. In recognition that SCR is the top control option for reducing $NO_x$ emissions, additional comparative cost information is not being provided.

   As requested by the Department, several portions of the Authority's May 2010 Prevention of Significant Deterioration (PSD) Permit Application for PBREF2 have been revised to reflect the change in the $NO_x$ control system and corresponding emission rates. The revised application sections/pages are enclosed.

**Annual Mercury Emission Limit**

In the August 9th response to the RAI, we provided additional information to support the proposed mercury emission limits of 25 μg/dscm (quarterly test basis) and 15 μg/dscm (annual average). Subsequent to our submittal, the Department provided additional mercury test data from Florida MWCs and further requested our consideration of a lower annual mercury limit. While we continue to believe the initially proposed mercury limits are appropriate as maximum levels for the permit, we understand the Department's concerns in limiting mercury emissions as much as practicable. Consequently, the proposed annual mercury limit is being reduced by 20 percent to 12 μg/dscm. To reflect this change, we are providing revised sections/pages of the Authority's May 2010 PSD Permit Application for PBREF2.

It is also our understanding from recent discussions with the Department that the permit will include a condition requiring the use of a CEMS for mercury. If a mercury CEMS is required, the Authority requests that the permit specifies that compliance with the mercury emission limits is to be demonstrated by performance testing and that after certification of the CEMS, the facility can demonstrate compliance either with data collected by the CEMS or by performance testing. Similar permit language exists in Condition 26 of the October 2006 PSD permit for Construction of Unit 4 at the Hillsborough County Resource Recovery Facility (Final Permit Number 0570261-007-AC (PSD-FL-369)) and is excerpted below for reference:

> *"Prior to certification of the Hg-CEMS, performance tests for Hg emissions shall be conducted quarterly during the first two years of operation then on a calendar year basis to demonstrate compliance with the concentration/reduction standards. After the certification of the Hg-CEMS, the owner or operator may demonstrate compliance with all Hg limits in this permit with data collected from the Hg-CEMS."*

**Revisions to the Authority's May 2010 Air Permit Application**

As indicated above, various revisions to the Authority's May 2010 PSD Permit Application for PBREF2 are being submitted. We are also providing signed Responsible Official and Professional Engineer certification forms as part of the submittal. The following sections/pages and tables have been revised to reflect the changes relative to $NO_X$ and mercury emissions:

- Executive Summary (entire section)
- Section 2: Page 2-4 and Figure 2-3
- Section 3: Table 3-1
- Section 4: Table 4-2
- Section 5: Section 5.3.4 and 5.3.5 (note, revised Section 5.3.5 replaces Sections 5.3.5 and 5.3.6 in the initial permit application)
- Section 5: Section 5.8.4
- Section 5: Table 5-6
- Appendix A: FDEP Application for Air Permit - Long Form (pages 16, 18, 20, 21, 22, 41, 42, 45 and 46)
- Appendix B: Emission Calculations (pages B-2, B-3, B-4, B-9 and B-10)

As previously discussed, it is both the Authority's and the Department's objective to have an air construction permit issued before the end of this year. To that end, we will continue to provide requested information in a timely manner and we appreciate the Department's cooperation and efforts in meeting the desired permitting schedule.

We look forward to discussing our permit application with your further and appreciate your continued assistance with this project. If you have any questions concerning the information provided herein, please contact myself or Ms. Leah Richter with Malcolm Pirnie Inc. at (954) 525-2499 or via e-mail at lrichter@pirnie.com.

Very truly yours,

Mark Hammond
Executive Director

Enclosures
cc: R. Bull, Florida Department of Environmental Protection
M. Bruner/SWA
R. Schauer/SWA
M. Morrison/SWA
L. Richter, Malcolm Pirnie
A. Chattopadhyay, Malcolm Pirnie
J. Cohn, Malcolm Pirnie
D. Dee, Young Van Assenderp, P.A.

## APPLICATION INFORMATION

### Application Responsible Official Certification

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

1. Application Responsible Official Name: **Mark Hammond, Executive Director**

2. Application Responsible Official Qualification (Check one or more of the following options, as applicable):

   ☐ For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C.

   ☐ For a partnership or sole proprietorship, a general partner or the proprietor, respectively.

   ☑ For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official.

   ☐ The designated representative at an Acid Rain source, CAIR source, or Hg Budget source.

3. Application Responsible Official Mailing Address...
   Organization/Firm: **Solid Waste Authority of Palm Beach County**
   Street Address: **7501 North Jog Road**
   City: **West Palm Beach** State: **Florida** Zip Code: **33412**

4. Application Responsible Official Telephone Numbers...
   Telephone: **(561) 640-4000** ext. Fax: **(561 ) 640-3400**

5. Application Responsible Official E-mail Address: **mhammond@swa.org**

6. Application Responsible Official Certification:

   *I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other applicable requirements identified in this application to which the Title V source is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application.*

   [signature] 9/10/10

   Signature Date

## APPLICATION INFORMATION

**Professional Engineer Certification**

1. Professional Engineer Name: **Amit Chattopadhyay**
   Registration Number: **52823**

2. Professional Engineer Mailing Address...
   Organization/Firm: **Malcolm Pirnie, Inc.**
   Street Address: **17-17 Route 208 North, 2nd Floor**
   City: **Fair Lawn** State: **NJ** Zip Code: **07410**

3. Professional Engineer Telephone Numbers...
   Telephone: **(201) 398 - 4311** ext. Fax: **(201) 797 - 4399**

4. Professional Engineer E-mail Address: **achattopadhyay@pirnie.com**

5. Professional Engineer Statement:

*I, the undersigned, hereby certify, except as particularly noted herein*, that:*

*(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and*

*(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.*

*(3) If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.*

*(4) If the purpose of this application is to obtain an air construction permit (check here ☑, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.*

*(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here ☐, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.*

Amit Chattopadhyay September 9, 2010

Signature Date

(seal)

AMIT CHATTOPADHYAY LICENSE No. 52823 STATE OF FLORIDA PROFESSIONAL ENGINEER

* Attach any exception to certification statement.

**Solid Waste Authority of Palm Beach County**
7501 North Jog Road • West Palm Beach, FL 33412

# Prevention of Significant Deterioration (PSD) Permit Application

## Palm Beach Renewable Energy Facility No. 2

May 2010

(September 2010 Revisions)

Report Prepared By:
**Malcolm Pirnie, Inc.**
8201 Peters Road
Suite 3400
Plantation, FL 33324
(954) 761-3460

3582056

# Executive Summary

The Solid Waste Authority of Palm Beach County (the Authority) is planning to expand its solid waste processing capacity by constructing a new waste-to-energy (WTE) facility in West Palm Beach, Florida. This new facility will be known as the Palm Beach Renewable Energy Facility Number 2 (PBREF2). The new facility will increase the Authority's solid waste processing capacity and will be constructed adjacent to the Authority's existing renewable energy facility, which is known as the North County Resource Recovery Facility (NCRRF) and is located at the Authority's 1,320-acre Palm Beach Renewable Energy Park (PBREP). PBREF2 will feature three nominal 1,000 ton per day (tpd) mass-burn municipal waste combustor (MWC) units and associated ancillary equipment to provide 3,000 tpd of additional municipal solid waste (MSW) processing capacity. Energy extracted from the combustion of MSW will be converted into electricity by a highly efficient steam turbine generator with an expected power output rating of 90–100 MW. The facility design will also feature an air cooled condenser to provide dry cooling of excess steam from the steam turbine generators, thereby minimizing water demands. State-of-the art air pollution control systems will be implemented on the MWCs to minimize air pollutant emissions and continuous emissions monitoring equipment will be operated as required to demonstrate on-going compliance with federal and state air quality regulations. The operations at the PBREF2 will complement services that are currently provided at the PBREP and will enhance the Authority's 2006 Integrated Solid Waste Management Plan (ISWM Plan) to develop a system of programs and facilities to effectively and economically manage solid waste through source reduction, recycling, composting, combustion and landfilling.

The proposed PBREF2 will be located in an area that is in attainment with all national ambient air quality standards (NAAQS). Based on estimated potential emission levels, the PBREF2 project constitutes a major modification to an existing emission source (i.e., the PBREP) and thereby is subject to Prevention of Significant Deterioration (PSD) permitting requirements under the New Source Review (NSR) pre-construction permitting program. A summary of the potential emission levels associated with the project and identification of pollutants subject to PSD review based on applicable significant emission rate thresholds are presented in Table ES-1. The potential emissions estimates shown in Table ES-1 reflect maximum expected emissions attributed to the operation of the MWCs and ancillary equipment associated with the PBREF2. There are no increases in emissions expected from the existing units at the NCRRF or other existing operations at the PBREP as a result of the planned operation of the PBREF2.

**Table ES-1:**
**Summary of Estimated Emissions and PSD Applicability for PBREF2**

| Pollutant | Potential Emissions Estimate (tons/yr) | PSD Significant Emission Rate Threshold (tons/yr) | Subject to PSD Permitting? |
|---|---|---|---|
| Nitrogen Oxides ($NO_x$) | 402.1 | 40 | Yes |
| Carbon Monoxide (CO) | 435.0 | 100 | Yes |
| Sulfur Dioxide ($SO_2$) | 298.7 | 40 | Yes |
| Particulate Matter (PM) | 56.1 | 25 | Yes |
| Particulate Matter ($PM_{10}$) | 56.1 | 15 | Yes |
| Particulate Matter ($PM_{2.5}$) | 56.1 | 10 | Yes |
| Volatile Organic Compounds (VOCs) | 59.8 | 40 | Yes |
| Lead (Pb) | 0.65 | 0.6 | Yes |
| Fluorides | 13.6 | 3 | Yes |
| Sulfuric Acid Mist (SAM) | 95.2 | 7 | Yes |
| MWC Organics (as Dioxins/Furans) | 6.1E-05 | 3.5E-06 | Yes |
| MWC Metals (as PM) | 56.1 | 15 | Yes |
| MWC Acid Gases (as $SO_2$ & HCl) | 440.4 | 40 | Yes |
| Mercury [(1)] | 0.056 | Not applicable | No |

(1) Mercury is not a regulated pollutant under the federal PSD program. However, mercury emissions are provided in recognition of its importance and that it was formerly a listed pollutant in Florida's PSD regulation.

Pre-construction approval under the PSD permitting program is contingent upon demonstrating compliance with the following criteria:

- A demonstration that Best Available Control Technology (BACT) will be applied on a pollutant-specific basis to each emission unit that will have the potential to emit one or more pollutants subject to PSD review.
- A demonstration that both PSD increments and the NAAQS will not be violated as a result of the proposed facility's operations.
- A demonstration that no adverse impacts associated with the operation of the proposed facility are expected at any nearby Class I area and an analysis that shows that the proposed project will have no adverse impact on soils, vegetation, visibility, and other air quality related values.

For each affected emission unit, a BACT analysis was performed with respect to each pollutant subject to PSD review. Each BACT analysis was performed in accordance with the "top-down" approach recommended by USEPA. With respect to emissions from the MWCs, the applicable New Source Performance Standards (NSPS) under 40 CFR 60, Subpart Eb establish a baseline for determining BACT. For the MWCs, the proposed air pollution control technologies and emission limits are summarized below and in Table ES-2.

- Selective catalytic reduction (SCR) for control of $NO_x$ emissions
- A spray dryer absorber (SDA) in combination with a fabric filter (FF) for reducing emissions of acid gases, including sulfur dioxide ($SO_2$), hydrogen chloride (HCl), fluorides, and sulfuric acid mist (SAM)
- Control of MWC metals and particulate matter (PM, $PM_{10}$, $PM_{2.5}$) emissions by a FF system
- Adherence to good combustion practices (GCP) to minimize products resulting from incomplete combustion including carbon monoxide (CO), volatile organic compounds (VOCs) and MWC organics (dioxins/furans)
- An activated carbon injection (ACI) system with a fabric filter (FF) for control of mercury emissions

The proposed PBREF2 will be relatively unique. It will be the first new WTE facility constructed in the United States in approximately 15 years. More importantly, the proposed emission limits for the new facility's emissions of $NO_x$, $SO_2$ and mercury are lower than the most stringent permit limits specified for these pollutants from any MWC unit currently operating in the United States.

**Table ES-2:**
**MWC Emission Limits and BACT Summary**

| Pollutant | Emission Limit (at 7% oxygen) | Control Technology | Basis |
|---|---|---|---|
| Nitrogen Oxides ($NO_x$) | 50 $ppm_{vd}$ (24-hr); 45 $ppm_{vd}$ (12-month) | Selective Catalytic Reduction | BACT |
| Sulfur Dioxide ($SO_2$) | 24 $ppm_{vd}$ (24-hr) or 80% reduction | Spray Dryer Absorber (with Fabric Filter) | |
| Hydrogen Chloride (HCl) | 20 $ppm_{vd}$ or 95% reduction | | |
| Fluorides (as HF) | 3.5 $ppm_{vd}$ | | |
| Sulfuric Acid Mist (SAM) | 5 $ppm_{vd}$ | | |
| Particulate Matter (PM) | 12 mg/dscm(1) | Fabric Filter | |
| Particulate Matter ($PM_{10}$,$PM_{2.5}$) | 12 mg/dscm(1) | | |
| Lead (Pb) | 140 µg/dscm | | BACT, NSPS(2) |
| Cadmium (Cd) | 10 µg/dscm | | NSPS(2) |
| Carbon Monoxide (CO) | 100 $ppm_{vd}$ (4-hr); 80 $ppm_{vd}$ (30-day) | Good Combustion Practices | BACT, NSPS(2) |
| Volatile Organic Compounds (VOCs as propane) | 7 $ppm_{vd}$ | | BACT |
| MWC Organics (as Dioxins/Furans) | 13 ng/dscm | | BACT, NSPS(2) |
| Mercury | 25 µg/dscm or 85% reduction (quarterly test); 12 µg/dscm (12-month) | Activated Carbon Injection (with Fabric Filter) | BACT(3) |

(1) Compliance with proposed emission limits for PM, $PM_{10}$ and $PM_{2.5}$ are to be demonstrated by testing for PM in accordance with USEPA Method 5.

(2) NSPS refers to the New Source Performance Standards for large MWCs under 40 CFR 60, Subpart Eb.

(3) Although mercury is not a regulated pollutant under the PSD program, a BACT analysis was performed for mercury in recognition of the importance of minimizing mercury emissions. The short-term and annual mercury emission limits are lower than the most stringent mercury emission limit permitted for a MWC in the United States.

BACT analyses were also performed for the affected ancillary equipment including lime and carbon storage silos and emergency (standby) equipment consisting of two diesel fire pumps and an emergency generator. FF dust collection systems were selected as BACT to control PM emissions from the storage silos. For the diesel fire pumps and the emergency generator, BACT was concluded to be good combustion practices and engine design and the use of ultra low sulfur diesel fuel to meet applicable USEPA emission standards for compression ignition stationary internal combustion engines. Since the proposed facility will incorporate an air-cooled condenser to provide dry cooling of steam exiting the steam turbine generator in lieu of a wet cooling tower, PM emissions typically associated with the operation of a wet cooling tower will be avoided. Therefore, a BACT analysis was not required for this equipment.

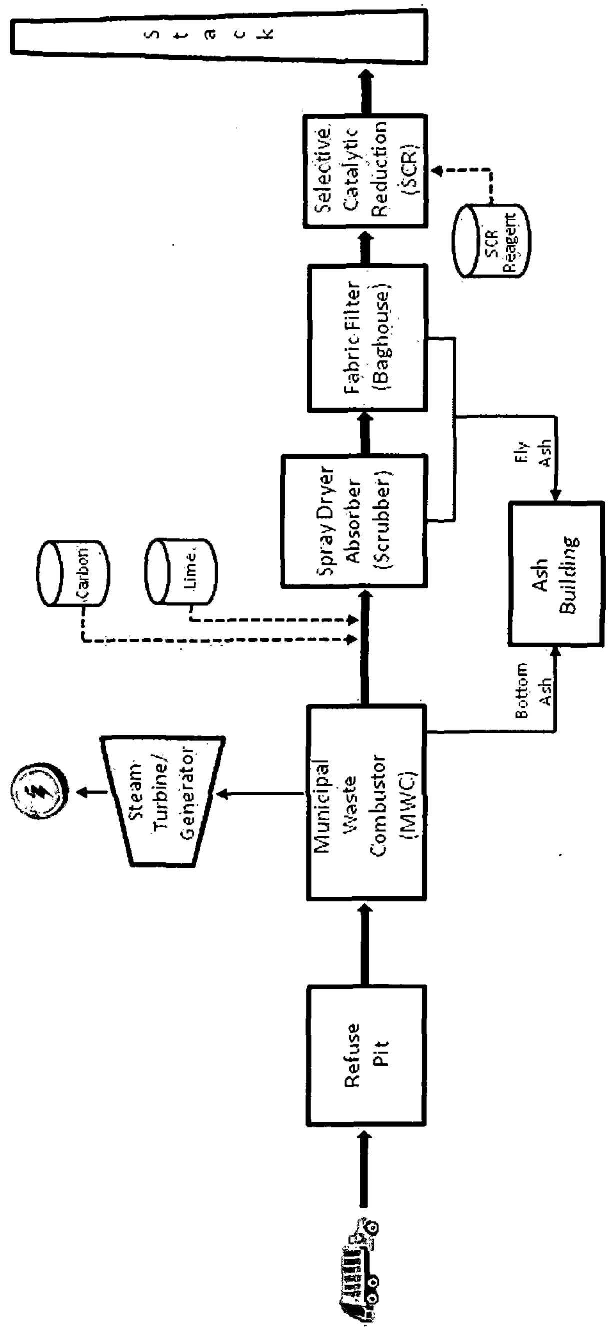
An air quality analysis was performed based on atmospheric dispersion modeling to evaluate emissions associated with the operation of the proposed facility. A Class II area impact analysis was completed and it indicates that the impacts from the PBREF2 will be less than the established PSD significance levels for all pollutants. The analysis demonstrates that the Class II PSD increments and NAAQS will not be exceeded and a full impact analysis considering other emission sources in the project area is not required. To address impacts at federally protected Class I areas, an analysis was performed to evaluate impacts at the Everglades National Park (Class I area) as requested by the National Park Service (NPS), which serves as the Federal Land Manager (FLM) for the park. Additionally, a dispersion modeling analysis was performed at the Biscayne Bay National Park (Class II area) as requested by the NPS. The analyses performed for both the Everglades National Park and Biscayne Bay National Park demonstrate that the impacts from the PBREF2 will be below Class I area significance levels and will not adversely impact air quality related values (AQRVs) within the parks. Lastly, an additional impact analysis was conducted to determine impacts on soils, vegetation, visibility, and from growth associated with the project. The additional impact analysis indicates that no adverse impacts are expected to result from the proposed project.

## 2.2. Municipal Waste Combustors (MWCs) and Air Pollution Control Systems

Multiple MWC units will be installed at the PBREF2 to provide a total MSW throughput capacity of 3,000 tpd. Three identical MWC units, each with a nominal rated MSW processing capacity of 1,000 tpd, are planned for installation at the facility. The MWCs will be mass-burn, continuous feed, stoker/grate type combustion units. Each MWC will be designed to have a maximum continuous heat input rating of 416.7 MMBtu/hr and a maximum peak (short-term) heat input rating of approximately 458.3 MMBtu/hr. An overhead bridge crane located above the refuse storage pit will mix, stack, and convey the MSW to the charging hoppers, which will subsequently feed the MWC stokers. Combustion will occur in a controlled furnace combustion system that automatically adjusts the waste feed rate and combustion air to optimize conditions for obtaining the desired steam flows. Air from the tipping floor will be maintained under negative pressure and will be used as makeup air for the combustion process, thereby minimizing odors and fugitive emissions. A natural gas-fired auxiliary burner system will be included as part of the combustion system to be used on a limited basis during periods of start-up and shutdown operations and to maintain good combustion conditions.

Each combustor will be followed by a steam-generating system consisting of a water wall radiant section, a superheater and a convection section, as well as an economizer. Steam generated by the MWCs will be directed to a highly efficient steam turbine generator set and an air-cooled condenser assembly. The turbine generator will have an estimated power output rating in the range of 90-100 megawatts (MW). The electricity generated will provide the internal electricity required for facility operations and the excess electricity will be exported for sale to the utility grid.

Air pollutant emissions from the MWCs will be minimized through a combination of good combustion practices (GCP) and air pollution control systems. Separate air pollution control systems will be installed for each MWC and the treated exhaust gas streams will discharge to the atmosphere through identical sized flues, which will be co-located in an enclosed outer concrete stack. Nitrogen oxides ($NO_x$) emissions will be controlled by selective catalytic reduction (SCR). Emissions of acid gases, including sulfur dioxide ($SO_2$) and hydrogen chloride (HCl), will be reduced by a spray dryer absorber (SDA) in combination with a fabric filter (FF) baghouse. Additionally, metals and other particulate matter (PM) emissions will be controlled by the FF device. An activated carbon injection (ACI) system will be operated for control of mercury emissions. GCP will be utilized to minimize products resulting from incomplete combustion such as carbon monoxide (CO), volatile organic compounds (VOCs) and trace organic compounds. The air pollution control systems planned for the facility are considered state-of-the-art air pollution control systems and have been proven to be




Note: multiple, identical MWC units and associated air pollution control systems will be installed with individual exhaust flues co-located in a common stack.

MALCOLM PIRNIE | Solid Waste Authority of Palm Beach County | Process Flow Diagram Palm Beach Renewable Energy Facility No. 2 | MALCOLM PIRNIE, INC. FIGURE 2-3

**Table 3-1:**
## Summary of Emission Estimates for PBREF2

| Pollutant | Maximum Annual Emissions (tons/yr) | | | | |
|---|---|---|---|---|---|
| | MWCs | Silos | Diesel Fire Pumps | Emergency Generator | Total |
| Nitrogen Oxides ($NO_x$) | 401.86 | --- | 0.140 | 0.146 | 402.1 |
| Carbon Monoxide (CO) | 434.86 | --- | 0.066 | 0.088 | 435.0 |
| Sulfur Dioxide ($SO_2$) | 298.66 | --- | 2.75E-04 | 2.04E-04 | 298.7 |
| Hydrogen Chloride (HCl) | 141.72 | --- | --- | --- | 141.7 |
| VOCs | 59.79 | --- | 3.42E-03 | 5.77E-03 | 59.8 |
| Particulate Matter (PM)* | 56.08 | 0.036 | 6.12E-03 | 3.28E-03 | 56.1 |
| Particulate Matter ($PM_{10}$, $PM_{2.5}$)* | 56.08 | 0.036 | 6.12E-03 | 3.28E-03 | 56.1 |
| Lead (Pb) | 0.65 | --- | --- | --- | 0.65 |
| Fluorides (as HF) | 13.59 | --- | --- | --- | 13.6 |
| Sulfuric Acid Mist (SAM) | 95.22 | --- | --- | --- | 95.2 |
| MWC Organics (as Dioxins/Furans) | 6.08E-05 | --- | --- | --- | 6.08E-05 |
| Mercury (Hg) | 0.056 | --- | --- | --- | 0.056 |
| Cadmium (Cd) | 0.047 | --- | --- | --- | 0.047 |
| Ammonia Slip | 33.00 | --- | --- | --- | 33.0 |

* PM, $PM_{10}$ and $PM_{2.5}$ maximum annual emissions from the MWCs are based on emissions of PM as measured in accordance with USEPA Method 5.

**Table 4-2.**
**PSD Pollutant Applicability Summary**

| Pollutant | Significant Emission Rate Threshold (tons/yr) | Net Emissions Increase [(1)] (tons/yr) | Subject to PSD Permitting? |
|---|---|---|---|
| Nitrogen Oxides ($NO_X$) | 40 | 402.1 | Yes |
| Carbon Monoxide (CO) | 100 | 435.0 | Yes |
| Sulfur Dioxide ($SO_2$) | 40 | 298.7 | Yes |
| Particulate Matter (PM) | 25 | 56.1 | Yes |
| Particulate Matter ($PM_{10}$) | 15 | 56.1 | Yes |
| Particulate Matter ($PM_{2.5}$) | 10 | 56.1 | Yes |
| Volatile Organic Compounds (VOCs) | 40 | 59.8 | Yes |
| Lead (Pb) | 0.6 | 0.65 | Yes |
| Fluorides | 3 | 13.6 | Yes |
| Sulfuric Acid Mist (SAM) | 7 | 95.2 | Yes |
| Hydrogen Sulfide ($H_2S$) | 10 | Negligible[(2)] | No |
| Total Reduced Sulfur | 10 | Negligible[(2)] | No |
| Reduced Sulfur Compounds | 10 | Negligible[(2)] | No |
| MWC Organics (as Dioxins/Furans) | 3.5E-06 | 6.1E-05 | Yes |
| MWC Metals (as PM) | 15 | 56.1 | Yes |
| MWC Acid Gases (as $SO_2$ & HCl) | 40 | 440.4 | Yes |

(1) The net emissions increase values shown are the estimated potential emissions associated with the proposed PBREF2. No increases in emissions are expected from existing operations at the PBREP.

(2) Emissions of hydrogen sulfide, total reduced sulfur, and reduced sulfur compounds from the MWC units are expected to be negligible due to oxidizing conditions in the combustors.

### 4.2.2. PSD Requirements

The PBREF2 is subject to PSD permitting requirements as indicated above. To satisfy the requirements under the applicable PSD regulation, various analyses must be performed relative to control technology requirements and to ensure that the project will not have an adverse impact on ambient air quality. The following analyses are required under the PSD permitting program:

- Control technology analyses are required on a pollutant-specific basis to define Best Available Control Technology (BACT) for the project related emission units.
- An evaluation of ambient impacts is required with respect to PSD increments and the NAAQS resulting from the project related emissions increases. If

emission controls, MWC exhaust streams contain acid gases and substantial amounts of particulate matter. These flue gas components can erode the catalyst and substrate material and cause fouling of the catalyst if temperature controls are not tightly maintained. Consequently, an SCR system would have to be installed downstream of the acid gas and particulate control devices ("cold-side" application) to avoid these problems. Due to SCR operating temperature requirements in the 375 to 750°F range, the implementation of a "cold-side" SCR module would require installation of a heating system and the consumption of energy to re-heat the flue gas for $NO_x$ reduction.

In recognition of the above factors, it is difficult to accurately establish a $NO_x$ emission limit for a MWC in the United States using a SCR control system. Nonetheless, SCR cannot be ruled out as a technically feasible control option in this BACT analysis given its successful application for reducing $NO_x$ emissions from MWCs in other countries.

GCP – Combustion controls alone are not sufficient for a $NO_x$ removal system to satisfy BACT requirements. Nonetheless, proper combustion control has been shown to significantly reduce $NO_x$ emissions and is typically used in conjunction with other control technologies.

FGR - Similar to GCP, FGR has a limited effectiveness in reducing $NO_x$ emissions and is not sufficient alone in meeting BACT requirements. The application of FGR can be an effective method to enhance $NO_x$ removal in combination with a traditional combustor design. However, FGR is typically not being used in modern combustors featuring enhanced combustion control because it would interfere with the combustion air optimization feature. Further, the use of FGR may result in increased emissions of CO and organics from incomplete combustion (if the flame zone becomes unstable) and the potential for corrosion/fouling in the furnace may increase. In recognition of these disadvantages, the latest MWC design trends often do not incorporate FGR. Nonetheless, some current MWC designs are including variations of FGR as a component of an integrated furnace design for reducing $NO_x$ emissions. Therefore, FGR is not further considered as BACT in this analysis, but is a design option that may be used as part of an integrated furnace design to meet the permitted $NO_x$ emission limit at the discretion of the selected combustion unit vendor.

### 5.3.4. Ranking of Technically Feasible Control Alternatives

The candidate control options not eliminated from consideration as BACT based on technical deficiencies are ranked below in descending order of control effectiveness:

- Selective Catalytic Reduction (SCR) in conjunction with Good Combustion Practices (GCP).
- Selective Non-Catalytic Reduction (SNCR) in conjunction with Good Combustion Practices (GCP).

### 5.3.5. Selection of BACT for $NO_x$ Emissions

As indicated above, SCR and SNCR are the technically feasible control alternatives available for controlling $NO_x$ emissions from the MWCs. Operating experience at European WTE facilities demonstrates the effectiveness of SCR in reducing $NO_x$ emissions to lower levels in comparison with SNCR. Notwithstanding the substantial costs associated with implementing SCR to control $NO_x$ emissions from a MWC (and considerable incremental costs to reduce $NO_x$ emissions below levels achievable through the use of SNCR), the Authority recognizes the environmental importance of reducing $NO_x$ emissions and the selection of SCR for $NO_x$ control as a growing trend across various types of newly proposed power generating facilities in the United States. As requested by the FDEP to achieve the greatest reduction in $NO_x$ emissions for this project, SCR will be used to reduce $NO_x$ emissions from the MWCs. The proposed emission limits (corrected to 7 percent oxygen, dry basis) for $NO_x$ are a concentration of 45 $ppm_v$ as a 12-month average and a concentration of 50 $ppm_v$ as a 24-hour average. These emission levels were selected considering European SCR operating experience and are also based on preliminary discussions with the FDEP and technical discussions with Rambøll Denmark A/S, an engineering firm with specialized WTE experience in Europe.

## 5.4. BACT Analysis for Emissions of MWC Acid Gases ($SO_2$ and HCl), Fluorides, and SAM from the MWC

Emissions of acid gases including $SO_2$ and HCl, fluorides (HF), and sulfuric acid mist (SAM) will be generated from the operation of the MWC units. Acid gases are produced in the combustion unit from chemical reactions between sulfur, chlorine, fluorine, and other compounds in MSW and combustion air. The sections which follow discuss the technologies evaluated to reduce acid gas emissions from the MWC units to be installed at the PBREF2.

### 5.4.1. Description of Acid Gas Emissions from MWCs

Elemental sulfur chemically bound to other compounds in municipal solid waste (MSW) is a primary contributor to pollutant emissions from solid waste combustion. During combustion in the MWC a fraction of the sulfur is converted to various gaseous sulfur compounds, the rest leaves the MWC as bottom ash and fly ash. The specific sulfur compounds released from the MWC are dependent on the presence of other gaseous compounds, combustion temperatures, and chemical (oxidizing or reducing) conditions in the combustion chamber. The oxidizing or reducing conditions directly influence the types of sulfur compounds that form.

Excess oxygen (oxidizing) conditions, typical of a MWC, produce $SO_2$ and $SO_3$. Conversely, deficient oxygen (reducing) conditions produce hydrogen sulfide ($H_2S$), carbonyl sulfide (COS) and elemental sulfur. Since the new unit will be operated under widely considered the control system of choice for reducing mercury emissions from MWCs.

### 5.8.4. Selection of BACT for Mercury

ACI in conjunction with a FF is chosen to represent BACT for the purpose of reducing mercury emissions from the MWCs. On a short-term basis (three test average from a quarterly test event), mercury emissions will be controlled to a maximum concentration of 25 µg/dscm corrected to 7 percent $O_2$ or an 85 percent reduction in mercury emissions will be achieved, whichever is less stringent. Annual mercury emissions (average of all test results from four quarterly test events) will be limited to 12 µg/dscm corrected to 7 percent $O_2$. The proposed mercury emission levels are more stringent than any emission limitation currently established for a MWC in the United States.

## 5.9. Control Technology Analyses for Ancillary Equipment

In addition to the MWCs, the PBREF2 will include the installation of ancillary equipment. BACT analyses are required to address potential air pollutant emissions from the following ancillary equipment:

- Storage silos for lime and carbon
- Diesel fire pumps
- Emergency generator

For the lime and carbon storage silos, the only pollutant to address is PM (including $PM_{10}$ and $PM_{2.5}$). Consequently, a BACT analysis addressing PM emissions from this equipment is provided below. For the emergency fuel burning equipment, which includes diesel fire water pump engines and a diesel-fired emergency generator, BACT analyses for $NO_x$, $SO_2$, CO, PM and VOC emissions are required and are presented in the sections below.

### 5.9.1. BACT Analysis for PM Emissions from the Storage Silos

Lime and carbon will be used in the air pollution control systems for the MWC and stored at the facility in storage silos. Lime will be kept in storage silos for use in the SDA systems for control of $SO_2$ and other acid gases. Similarly, carbon will be stored in a storage silo for use in controlling mercury emissions by the ACI system. The lime and carbon 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 FF (dust collector) mounted on the roof of the silo to control PM emissions. The FFs will be designed to discharge collected dust directly back into the storage silos. Emissions of PM are expected to be very low (less than 0.05 tons per year) due to the operation of the FFs and the limited number of filling events.

**Table 5-5:**
## BACT Summary for MWCs

| Pollutant | Proposed Emission Limit (at 7% oxygen) | Proposed Control Technology |
|---|---|---|
| $NO_x$ | 50 $ppm_{vd}$ (24-hr); 45 $ppm_{vd}$ (12-month) | Selective Catalytic Reduction |
| $SO_2$ | 24 $ppm_{vd}$ (24-hr) or 80% reduction | Spray Dryer Absorber (with Fabric Filter) |
| HCl | 20 $ppm_{vd}$ or 95% reduction | |
| Fluorides (as HF) | 3.5 $ppm_{vd}$ | |
| Sulfuric Acid Mist | 5 $ppm_{vd}$ | |
| PM, $PM_{10}$, $PM_{2.5}$ and MWC Metals | 12 mg/dscm | Fabric Filter |
| Lead | 140 μg/dscm | |
| CO | 100 $ppm_{vd}$ (4-hr); 80 $ppm_{vd}$ (30-day) | Good Combustion Practices and Design |
| VOCs | 7 $ppm_{vd}$ | |
| MWC Organics (as Dioxins/Furans) | 13 ng/dscm | |
| Mercury | 25 μg/dscm or 85% reduction (quarterly test); 12 μg/dscm (12-month) | Activated Carbon Injection (with Fabric Filter) |

**Table 5-6:**
## BACT Summary for Ancillary Equipment

| Equipment | Pollutant(s) | Proposed Control Technology |
|---|---|---|
| Storage Silos | PM | Fabric Filter |
| Diesel Fire Pumps | $NO_x$, PM, $SO_2$, CO, VOC | Good Combustion Practices & Design and Use of Ultra Low Sulfur Fuel |
| Emergency Generator | $NO_x$, PM, $SO_2$, CO, VOC | Good Combustion Practices & Design and Use of Ultra Low Sulfur Fuel |

**Prevention of Significant Deterioration (PSD)**
**Permit Application**
Solid Waste Authority of Palm Beach County

# Appendix A

## FDEP Air Permit Application Form

Palm Beach Renewable Energy Facility No. 2

(September 2010 Revisions)

3582056

**Emissions Unit Control Equipment/Method:** Control 1 of 4

| | |
|---|---|
| 1. Control Equipment/Method Description: **Selective Catalytic Reduction (SCR)** | |
| 2. Control Device or Method Code: **139** | |

**Emissions Unit Control Equipment/Method:** Control 2 of 4

| | |
|---|---|
| 1. Control Equipment/Method Description: **Gas Scrubber – Spray Dryer Absorber** | |
| 2. Control Device or Method Code: **013** | |

**Emissions Unit Control Equipment/Method:** Control 3 of 4

| | |
|---|---|
| 1. Control Equipment/Method Description: **Fabric Filter (High Temperature, T > 250 °F)** | |
| 2. Control Device or Method Code: **016** | |

**Emissions Unit Control Equipment/Method:** Control 4 of 4

| | |
|---|---|
| 1. Control Equipment/Method Description: **Activated Carbon Injection System (Carbon Adsorption)** | |
| 2. Control Device or Method Code: **207** | |

## C. EMISSION POINT (STACK/VENT) INFORMATION
**(Optional for unregulated emissions units.)**

**Emission Point Description and Type**

| | |
|---|---|
| 1. Identification of Point on Plot Plan or Flow Diagram: **See Figure 2-2 and Air Quality Modeling Report** | 2. Emission Point Type Code: **2 (see comment below)** |

3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking:

**Not applicable**

4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:

**Not applicable**

| | | |
|---|---|---|
| 5. Discharge Type Code: **V** | 6. Stack Height: **310 feet** | 7. Exit Diameter: **8.1 feet** |
| 8. Exit Temperature: **315 °F** | 9. Actual Volumetric Flow Rate: **184,310 acfm** | 10. Water Vapor: **19.6 %** |

| | |
|---|---|
| 11. Maximum Dry Standard Flow Rate: **94,936 dscfm (at 7% oxygen)** | 12. Nonstack Emission Point Height: feet |
| 13. Emission Point UTM Coordinates... Zone: **17** East (km): **585.30** North (km): **2961.74** | 14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS) Longitude (DD/MM/SS) |

15. Emission Point Comment:

**Each of the three MWC units will have a separate exhaust flue. The exhaust flues will be co-located and contained in a common outer stack.**

**The flow rate data provided in items 9. and 11. reflect the design condition. Actual flow rates are expected to vary over a range of operating conditions.**

## E. EMISSIONS UNIT POLLUTANTS

**List of Pollutants Emitted by Emissions Unit**

| 1. Pollutant Emitted | 2. Primary Control Device Code | 3. Secondary Control Device Code | 4. Pollutant Regulatory Code |
|---|---|---|---|
| **NOX** | **139** | | **EL** |
| **CO** | | | **EL** |
| **SO2** | **013** | **016** | **EL** |
| **H106** | **013** | **016** | **EL** |
| **VOC** | **0** | **207** | **EL** |
| **PM** | **016** | | **EL** |
| **PM10** | **016** | | **EL** |
| **PM2.5** | **016** | | **EL** |
| **PB** | **016** | | **EL** |
| **FL, H107** | **013** | **016** | **EL** |
| **SAM** | **013** | **016** | **EL** |
| **D/F** | **0** | **207** | **EL** |
| **H114** | **207** | **016** | **EL** |
| **H027** | **016** | | **EL** |
| **NH3** | | | **EL** |
| | | | |
| | | | |
| | | | |

## F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

**(Optional for unregulated emissions units.)**

**Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.**

**Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions**

| | |
|---|---|
| 1. Pollutant Emitted: **NOX** | 2. Total Percent Efficiency of Control: **80-85%** |
| 3. Potential Emissions: **37.38** lb/hour **133.95** tons/year | 4. Synthetically Limited? ☐ Yes ☑ No |
| 5. Range of Estimated Fugitive Emissions (as applicable): to tons/year | |
| 6. Emission Factor: **50 $ppm_{vd}$ at 7% oxygen (24-hour daily avg.) and 45 $ppm_{vd}$ at 7% oxygen (12-month rolling avg.)** Reference: **BACT** | 7. Emissions Method Code: **0** |
| 8.a. Baseline Actual Emissions (if required): tons/year | 8.b. Baseline 24-month Period: From: To: |
| 9.a. Projected Actual Emissions (if required): tons/year | 9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years |
| 10. Calculation of Emissions: **See Appendix B for detailed emission calculations** | |
| 11. Potential, Fugitive, and Actual Emissions Comment: | |

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

**Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.**

**Allowable Emissions** Allowable Emissions 1 of 1

| | |
|---|---|
| 1. Basis for Allowable Emissions Code: **OTHER** | 2. Future Effective Date of Allowable Emissions: |
| 3. Allowable Emissions and Units: **50 $ppm_{vd}$ at 7% oxygen (24-hour) and 45 $ppm_{vd}$ at 7% oxygen (12-month)** | 4. Equivalent Allowable Emissions: **37.38** lb/hour **133.95** tons/year |
| 5. Method of Compliance: **CEMS** | |
| 6. Allowable Emissions Comment (Description of Operating Method): **The allowable emission limits shown above are proposed as BACT and are more stringent than the NOx emission limit required by 40 CFR 60, Subpart Eb.** | |

**Allowable Emissions** Allowable Emissions __ of __

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

**Allowable Emissions** Allowable Emissions __ of __

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

## F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

**(Optional for unregulated emissions units.)**

**Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.**

**Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions**

| | |
|---|---|
| 1. Pollutant Emitted: **H114 (Hg)** | 2. Total Percent Efficiency of Control: **85%** |
| 3. Potential Emissions: **9.78E-03** lb/hour **0.0187** tons/year | 4. Synthetically Limited? ☐ Yes ☑ No |
| 5. Range of Estimated Fugitive Emissions (as applicable): to tons/year | |
| 6. Emission Factor: **25 µg/dscm at 7% oxygen (quarterly test average)** **12 µg/dscm at 7% oxygen (12-month rolling average)** Reference: | 7. Emissions Method Code: **0** |
| 8.a. Baseline Actual Emissions (if required): tons/year | 8.b. Baseline 24-month Period: From: To: |
| 9.a. Projected Actual Emissions (if required): tons/year | 9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years |
| 10. Calculation of Emissions: **See Appendix B for detailed emission calculations** | |
| 11. Potential, Fugitive, and Actual Emissions Comment: | |

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

**Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.**

**Allowable Emissions** Allowable Emissions 1 of 2

| | |
|---|---|
| 1. Basis for Allowable Emissions Code:<br>**OTHER** | 2. Future Effective Date of Allowable Emissions: |
| 3. Allowable Emissions and Units:<br>**25 µg/dscm at 7% oxygen (quarterly test)**<br>**12 µg/dscm at 7% oxygen (12-month avg.)** | 4. Equivalent Allowable Emissions:<br>**9.78E-03** lb/hour **0.0187** tons/year |
| 5. Method of Compliance:<br>**USEPA Method 29** | |
| 6. Allowable Emissions Comment (Description of Operating Method):<br>**The allowable short-term and annual emission limits proposed as indicated above are more stringent than the emission limit required by 40 CFR 60, Subpart Eb.** | |

**Allowable Emissions** Allowable Emissions 2 of 2

| | |
|---|---|
| 1. Basis for Allowable Emissions Code:<br>**RULE** | 2. Future Effective Date of Allowable Emissions: |
| 3. Allowable Emissions and Units:<br>**85% emission reduction** | 4. Equivalent Allowable Emissions:<br>lb/hour tons/year |
| 5. Method of Compliance:<br>**USEPA Method 29** | |
| 6. Allowable Emissions Comment (Description of Operating Method):<br>**The above emission reduction level is prescribed by 40 CFR 60, Subpart Eb.** | |

**Allowable Emissions** Allowable Emissions __ of __

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

## F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS

**(Optional for unregulated emissions units.)**

**Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.**

**Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions**

| | |
|---|---|
| 1. Pollutant Emitted: **NH3** | 2. Total Percent Efficiency of Control: |
| 3. Potential Emissions: **2.76** lb/hour **11.00** tons/year | 4. Synthetically Limited? ☐ Yes ☑ No |
| 5. Range of Estimated Fugitive Emissions (as applicable): to tons/year | |
| 6. Emission Factor: **10 $ppm_{vd}$ at 7% oxygen**<br>Reference: **anticipated maximum ammonia slip level for SCR system** | 7. Emissions Method Code: **0** |
| 8.a. Baseline Actual Emissions (if required): tons/year | 8.b. Baseline 24-month Period: From: To: |
| 9.a. Projected Actual Emissions (if required): tons/year | 9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years |
| 10. Calculation of Emissions:<br>**See Appendix B for detailed emission calculations** | |
| 11. Potential, Fugitive, and Actual Emissions Comment: | |

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

**Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.**

**Allowable Emissions** Allowable Emissions 1 of 1

| | |
|---|---|
| 1. Basis for Allowable Emissions Code: **OTHER** | 2. Future Effective Date of Allowable Emissions: |
| 3. Allowable Emissions and Units: **10 ppm$_{vd}$ at 7% oxygen** | 4. Equivalent Allowable Emissions: **2.76** lb/hour **11.00** tons/year |
| 5. Method of Compliance: **USEPA Conditional Test Method CTM027 (initial performance test only)** | |
| 6. Allowable Emissions Comment (Description of Operating Method): **The allowable emission limit shown above is the anticipated maximum ammonia slip level for the SCR control system.** | |

**Allowable Emissions** Allowable Emissions __ of __

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

**Allowable Emissions** Allowable Emissions __ of __

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

**Prevention of Significant Deterioration (PSD)**
**Permit Application**
Solid Waste Authority of Palm Beach County

# Appendix B

## Emission Calculations

Palm Beach Renewable Energy Facility No. 2

(September 2010 Revisions)

3582056

MALCOLM PIRNIE

# TABLE B-1
## Summary of Annual Emission Estimates for MWCs and Ancillary Equipment
### Palm Beach Renewable Energy Facility No. 2

| Pollutant | Maximum Annual Emissions, tons/yr | | | | |
|---|---|---|---|---|---|
| | MWCs[(1)] | Silos[(2)] | Diesel Fire Pumps[(3)] | Emergency Generator | Total |
| Nitrogen Oxides ($NO_x$) | 401.86 | --- | 0.140 | 0.146 | 402.1 |
| Carbon Monoxide (CO) | 434.86 | --- | 0.066 | 0.088 | 435.0 |
| Sulfur Dioxide ($SO_2$) | 298.66 | --- | 2.75E-04 | 2.04E-04 | 298.7 |
| Hydrogen Chloride (HCl) | 141.72 | --- | --- | --- | 141.7 |
| Volatile Organic Compounds (VOCs) | 59.79 | --- | 3.42E-03 | 5.77E-03 | 59.8 |
| Particulate Matter (PM)[(4)] | 56.08 | 0.036 | 6.12E-03 | 3.28E-03 | 56.1 |
| Particulate Matter ($PM_{10}$)[(4)] | 56.08 | 0.036 | 6.12E-03 | 3.28E-03 | 56.1 |
| Particulate Matter ($PM_{2.5}$)[(4)] | 56.08 | 0.036 | 6.12E-03 | 3.28E-03 | 56.1 |
| Lead | 0.65 | --- | --- | --- | 0.65 |
| Hydrogen Fluoride (HF) | 13.59 | --- | --- | --- | 13.6 |
| Sulfuric Acid Mist ($H_2SO_4$) | 95.22 | --- | --- | --- | 95.2 |
| MWC Organics (Dioxin/Furans) | 6.08E-05 | --- | --- | --- | 6.08E-05 |
| Mercury | 0.056 | --- | --- | --- | 0.056 |
| Cadmium | 0.047 | --- | --- | --- | 0.047 |
| Ammonia Slip | 33.00 | --- | --- | --- | 33.0 |

(1) Maximum annual emissions are total emissions from three identical MWCs. The MWCs will each have a nominal MSW processing capacity of 1000 tpd.
(2) Maximum annual emissions are total emissions from lime and carbon storage silos.
(3) Maximum annual emissions are total emissions from two identical diesel fire pump units each with a nominal 250 HP power output rating.
(4) Maximum annual emissions of PM, $PM_{10}$ and $PM_{2.5}$ reflect emission levels to be demonstrated by testing for PM in accordance with USEPA Method 5.

# TABLE B-2a
## Emissions Estimates for Municipal Waste Combustors (MWCs)
### Palm Beach Renewable Energy Facility No. 2

| Estimated Exhaust Parameters at Design Condition for a MWC with a MSW Processing Capacity of 1000 tpd (65% Average Excess Air and 5,000 Btu/lb HHV for MSW) | | | |
|---|---|---|---|
| Exhaust Oxygen (dry basis), % | 8.33 | Corrected Exhaust Flow, dscfm at 7% oxygen | 94,936 |

| Pollutant | Maximum Concentration | Units [2] | Maximum Estimated Emissions [1] | |
|---|---|---|---|---|
| | | | lbs/hr [3] | tons/yr |
| Nitrogen Oxides ($NO_x$), 24-hour basis | 50 | $ppm_{vd}$ | 37.38 | |
| Nitrogen Oxides ($NO_x$), 12-month rolling basis | 45 | $ppm_{vd}$ | | 133.95 |
| Carbon Monoxide (CO), 4-hour basis | 100 | $ppm_{vd}$ | 45.50 | |
| Carbon Monoxide (CO), 30-day rolling basis | 80 | $ppm_{vd}$ | | 144.95 |
| Sulfur Dioxide ($SO_2$), 24-hour basis | 24 | $ppm_{vd}$ | 25.00 | 99.55 |
| Hydrogen Chloride (HCl) | 20 | $ppm_{vd}$ | 11.86 | 47.24 |
| VOCs (as propane) | 7 | $ppm_{vd}$ | 5.01 | 19.93 |
| Particulate Matter (PM) [4] | 12 | mg/dscm | 4.69 | 18.69 |
| Particulate Matter ($PM_{10}$) [4] | 12 | mg/dscm | 4.69 | 18.69 |
| Particulate Matter ($PM_{2.5}$) [4] | 12 | mg/dscm | 4.69 | 18.69 |
| Lead | 140 | µg/dscm | 0.055 | 0.22 |
| Fluorides (as HF) | 3.5 | $ppm_{vd}$ | 1.14 | 4.53 |
| Sulfuric Acid Mist ($H_2SO_4$) | 5 | $ppm_{vd}$ | 7.97 | 31.74 |
| MWC Organics (Dioxins/Furans) | 13 | ng/dscm | 5.09E-06 | 2.03E-05 |
| Mercury, quarterly test basis [5] | 25 | µg/dscm | 9.78E-03 | |
| Mercury, 12-month rolling basis | 12 | µg/dscm | | 1.87E-02 |
| Cadmium | 10 | µg/dscm | 3.91E-03 | 1.56E-02 |
| Ammonia Slip | 10 | $ppm_{vd}$ | 2.76 | 11.00 |

(1) Maximum estimated emissions reflects a single MWC unit with a nominal rated MSW processing capacity of 1000 tpd.

(2) Limits shown reflect concentrations corrected to 7% oxygen.

(3) Hourly emissions shown reflect maximum hourly values calculated at 110% of maximum continuous rating (MCR) for the combustor.

(4) Maximum estimated emissions for PM, $PM_{10}$ and $PM_{2.5}$ reflect emissions to be measured as PM by USEPA Method 5 testing. $PM_{10}$ and $PM_{2.5}$ emissions are conservatively assumed to be equivalent to the total PM emission rate.

(5) For mercury, the short-term maximum concentration is based on a three test average for a quarterly performance test event.

# TABLE B-2b
## Emission Calculations for Municipal Waste Combustors (MWCs)
## Palm Beach Renewable Energy Facility No. 2

| Data from Table B-2a | |
|---|---|
| Corrected Exhaust Flow, dscfm at 7% oxygen | 94,936 |
| $NO_x$ Emission Limit, $ppm_{vd}$ (at 7% oxygen), 24-hour basis | 50 |
| $NO_x$ Emission Limit, $ppm_{vd}$ (at 7% oxygen), 12-month basis | 45 |
| CO Emission Limit, $ppm_{vd}$ (at 7% oxygen), 4-hr average basis | 100 |
| CO Emission Limit, $ppm_{vd}$ (at 7% oxygen), 30-day rolling basis | 80 |

**MWC Emission Calculations**

***Calculations for $NO_x$***

Estimated Maximum Hourly Emissions

= 94,936 dscfm × 50 $ppm_{vd}$ × $10^{-6}$ / 0.7302 atm-$ft^3$/ lbmol-R
× 1 / (460 + 68) R × 46 lb/lbmol × 60 min/hr
= 33.98 lbs/hr × 1.1 (increase to 110% of MCR)
= 37.38 lbs/hr

Estimated Maximum Annual Emissions

= 94,936 dscfm × 45 $ppm_{vd}$ × $10^{-6}$ / 0.7302 atm-$ft^3$/ lbmol-R
× 1 / (460 + 68) R × 46 lb/lbmol × 60 min/hr
= 30.583 lbs/hr × 8760 hr/yr × ton / 2000 lbs
= 133.95 tons/yr

***Calculations for CO***

Estimated Maximum Hourly Emissions

= 94,936 dscfm × 100 $ppm_{vd}$ × $10^{-6}$ / 0.7302 atm-$ft^3$/ lbmol-R
× 1 / (460 + 68) R × 28 lb/lbmol × 60 min/hr
= 41.368 lbs/hr × 1.1 (increase to 110% of MCR)
= 45.50 lbs/hr

Estimated Maximum Annual Emissions

= 94,936 dscfm × 80 $ppm_{vd}$ × $10^{-6}$ / 0.7302 atm-$ft^3$/ lbmol-R
× 1 / (460 + 68) R × 28 lb/lbmol × 60 min/hr
= 33.094 lbs/hr × 8760 hr/yr × ton / 2000 lbs
= 144.95 tons/yr

# TABLE B-2b (Continued)
## Emission Calculations for Municipal Waste Combustors (MWCs)
### Palm Beach Renewable Energy Facility No. 2

| Data from Table B-2a | |
|---|---|
| Corrected Exhaust Flow, dscfm at 7% oxygen | 94,936 |
| Mercury Emission Limit, μg/dscm (at 7% oxygen), qtr. test basis | 25 |
| Mercury Emission Limit, μg/dscm (at 7% oxygen), 12-month basis | 12 |
| Cadmium Emission Limit, μg/dscm (at 7% oxygen) | 10 |

**<u>MWC Emission Calculations</u>**

***Calculations for Mercury***

Estimated Maximum Hourly Emissions

$= 94{,}936 \text{ dscfm} \times 25 \ \mu\text{g/dscm} \times \text{m}^3 / 35.31 \text{ ft}^3 \times 60 \text{ mins/hr}$
$\times \text{g} / 10^6 \ \mu\text{g} \times \text{lb} / 453.6 \text{ g}$
$= 8.891 \times 10^{-3}$ lbs/hr × 1.1 (increase to 110% of MCR)
$= 9.78 \times 10^{-3}$ lbs/hr

Estimated Maximum Annual Emissions

$= 94{,}936 \text{ dscfm} \times 12 \ \mu\text{g/dscm} \times \text{m}^3 / 35.31 \text{ ft}^3 \times 60 \text{ mins/hr}$
$\times \text{g} / 10^6 \ \mu\text{g} \times \text{lb} / 453.6 \text{ g}$
$= 4.268 \times 10^{-3}$ lbs/hr × 8760 hr/yr × ton / 2000 lbs
= 0.0187 tons/yr

***Calculations for Cadmium***

Estimated Maximum Hourly Emissions

$= 94{,}936 \text{ dscfm} \times 10 \ \mu\text{g/dscm} \times \text{m}^3 / 35.31 \text{ ft}^3 \times 60 \text{ mins/hr}$
$\times \text{g} / 10^6 \ \mu\text{g} \times \text{lb} / 453.6 \text{ g}$
$= 3.556 \times 10^{-3}$ lbs/hr × 1.1 (increase to 110% of MCR)
$= 3.91 \times 10^{-3}$ lbs/hr

Estimated Maximum Annual Emissions

$= 94{,}936 \text{ dscfm} \times 10 \ \mu\text{g/dscm} \times \text{m}^3 / 35.31 \text{ ft}^3 \times 60 \text{ mins/hr}$
$\times \text{g} / 10^6 \ \mu\text{g} \times \text{lb} / 453.6 \text{ g}$
$= 3.556 \times 10^{-3}$ lbs/hr × 8760 hr/yr × ton / 2000 lbs
= 0.0156 tons/yr

# TABLE B-2b (Continued)
## Emission Calculations for Municipal Waste Combustors (MWCs)
## Palm Beach Renewable Energy Facility No. 2

| Data from Table B-2a | |
|---|---|
| Corrected Exhaust Flow, dscfm at 7% oxygen | 94,936 |
| Ammonia Emission Limit, $ppm_{vd}$ (at 7% oxygen) | 10 |

**MWC Emission Calculations**

***Calculations for Ammonia***

Estimated Maximum Hourly Emissions

$= 94{,}936 \text{ dscfm} \times 10 \text{ ppm}_{vd} \times 10^{-6} / 0.7302 \text{ atm-ft}^3/\text{ lbmol-R}$

$\times 1 / (460 + 68) \text{ R} \times 17 \text{ lb/lbmol} \times 60 \text{ min/hr}$

$= 2.512 \text{ lbs/hr} \times 1.1$ (increase to 110% of MCR)

$= 2.76$ lbs/hr

Estimated Maximum Annual Emissions

$= 94{,}936 \text{ dscfm} \times 10 \text{ ppm}_{vd} \times 10^{-6} / 0.7302 \text{ atm-ft}^3/\text{ lbmol-R}$

$\times 1 / (460 + 68) \text{ R} \times 17 \text{ lb/lbmol} \times 60 \text{ min/hr}$

$= 2.512 \text{ lbs/hr} \times 8760 \text{ hr/yr} \times \text{ton} / 2000 \text{ lbs}$

$= 11.00$ tons/yr