TECHNICAL EVALUATION
&
PRELIMINARY DETERMINATION

APPLICANT

Florida Power & Light Company
700 Universe Boulevard
Juno Beach, Florida 33408

Port Everglades Plant
Facility ID No. 0110036

PROJECT

Port Everglades Next Generation Clean Energy Center
Project No. 0110036-010-AC

COUNTY

Broward County, Florida

PERMITTING AUTHORITY

Florida Department of Environmental Protection
Division of Air Resource Management
Office of Permitting and Compliance
2600 Blair Stone Road, MS#5505
Tallahassee, Florida 32399-2400

April 2012

1. APPLICATION INFORMATION

1.1 Applicant Name and Address

Florida Power and Light Company (FPL)
700 Universe Boulevard
Juno Beach, Florida 33408

Authorized Representative:
Randall R. LaBauve, Vice President

1.2 Processing Schedule

- January 24, 2012: Received Air Construction Permit Application
- April 2012: Preliminary Determination Issued

1.3 Facility Description and Location

The FPL Port Everglades Plant location is at 8100 Eisenhower Boulevard, Fort Lauderdale in Broward County. The Port Everglades Plant location with respect to other FPL facilities in Florida is shown in Figure 1. The location within Port Everglades is indicated in Figure 2.

The Port Everglades Plant currently consists of four fossil fuel steam generator that together produce approximately 1,200 megawatts (MW) of electrical power and 12 small simple cycle combustion turbine generators (CTGs) that together produce approximately 504 MW. The steam generators use residual fuel oil and natural gas and exhaust through four 344-foot stacks. The small CTGs use natural gas and No. 2 fuel oil and exhaust through 44-foot stacks. There are fuel oil storage tanks, water intake structures for once-through cooling and other ancillary equipment.

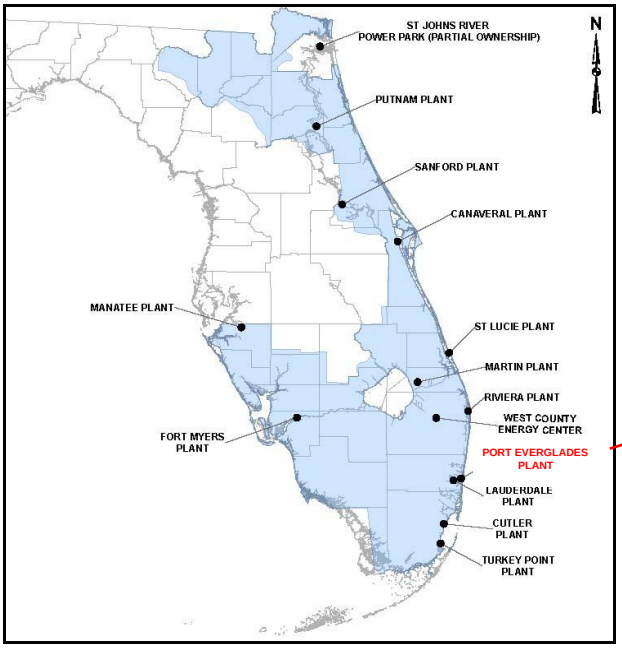


Figure 1. Port Everglades Plant in FPL System

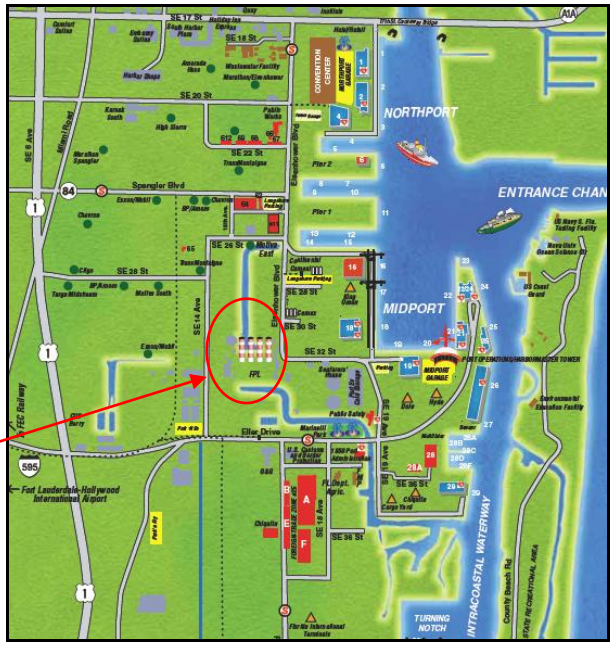


Figure 2. Location of Plant in Port Everglades

The plant is located approximately 50 kilometers (km) northeast of the nearest point at the Everglades National Park; a Prevention of Significant Deterioration (PSD) Class I area. The facility UTM coordinates are Zone 17, 578.38 km East and 2885.25 km North.

2. PROPOSED PROJECT

FPL proposes to construct a nominal 1,250 megawatts (MW) natural gas-fueled combined cycle unit (Unit 5) and ancillary equipment. The project includes the permanent shutdown and dismantling of the four existing fossil fuel steam generators and their respective stacks. Unit 5 will be called the Port Everglades Next Generation Clean Energy Center (PEEC). The steam generating units will be shut down and dismantled during 2013. There will be no overlap of operation between the existing units and the proposed PEEC, which is anticipated to have an in-service date during 2016.

2.1 Description of PEEC Project

Combined cycle Unit 5 will consist of: three nominal 250 MW combustion turbine generators (CTGs) with evaporative inlet cooling systems; three heat recovery steam generators (HRSG) equipped with selective catalytic reduction (SCR) reactors; three 149 foot exhaust stacks; and a common nominal 500 MW steam turbine generator.

FPL is considering at least two different models of combustion turbines including the Siemens "H" CTG or the Mitsubishi Power Systems (MPS) "J" CTG (or equivalent). The primary fuel for Unit 5 will be natural gas and ultralow sulfur distillate (ULSD) fuel oil will be used as backup fuel. Additional ancillary equipment to be installed includes: an auxiliary boiler; two temporary boilers used during construction; two emergency generators; a diesel fire pump; two process heaters; and a gas compression station. Details of the equipment to be installed are listed below.

Table 1. Listing of Emissions Units (EU) Comprising the PEEC

EU No.	Emission Unit Description
020	Unit 5A – One nominal 250 MW CTG with HRSG
021	Unit 5B – One nominal 250 MW CTG with HRSG
022	Unit 5C – One nominal 250 MW CTG with HRSG
023	One natural gas fueled auxiliary boiler rated at 99.8 MMBtu/hour heat input or less
024	Two nominal 9.9 MMBtu/hour natural gas-fired process heaters (one is a spare)
025	Three 5,514 horsepower (hp) natural gas compressors
026	One 2,250 kilowatts (kW) emergency generators firing ULSD fuel oil
027	One 2,250 kW emergency generators firing ULSD fuel oil
028	Two temporary natural gas or ULSD fuel oil fired boilers rated at 150 MMBtu/hour
029	One nominal 300 hp emergency diesel fire pump engine
030	One nominal 7 million gallon distillate fuel oil storage tank.

Each CTG will fire natural gas with a maximum sulfur content of 2.0 grains per 100 standard cubic feet (gr/100 SCF) as the primary fuel. The three CTGs may fire ultra low sulfur distillate (ULSD) fuel oil with a maximum sulfur content of 0.0015 percent (%) as a restricted alternate fuel up to the fuel equivalent of 3,000 hours/calendar year (aggregated over the three CTGs).

Emissions of carbon monoxide (CO), particulate matter (PM) and volatile organic compounds will be minimized by the efficient combustion of natural gas and distillate oil at high temperatures. Emissions of sulfur dioxide (SO_2) and sulfuric acid mist (SAM) will be minimized by firing natural gas and ULSD fuel oil.

Nitrogen oxides (NO_X) emissions will be reduced with lean premix combustion technology (also called dry low-NO_X or DLN) for gas firing and wet injection (water or steam) for oil firing. In combination with these NO_X controls, a SCR system further reduces NO_X emissions during combined cycle operation.

Each CTG will be equipped with a continuous emission monitoring system (CEMS) to continuously monitor NO_X emissions in accordance with the acid rain provisions. Flue gas oxygen (O_2) content or carbon dioxide (CO_2) content will be monitored as a diluent gas.

Figure 3 is an aerial photograph of the Port Everglades Plant including the four existing steam generating units and their 344-foot stacks taken from a west-southwesterly direction. Figure 4 is an artist rendition of the combined cycle unit after dismantling of the existing stacks and units and completion of the proposed project.

Figure 3. FPL Port Everglades Units 1 through 4

Figure 4. Artist Rendition of the PEEC

2.2 Combined Cycle Process Description

A CTG is an internal combustion engine that operates with rotary rather than reciprocating motion and that is coupled to an electrical generator. Figure 5 is an external view and product highlights of a MPS J CTG from a 2011 Power Engineering article. Gas Turbines Breaking the 60% Efficiency Barrier Figure 6 is a photograph of a Siemens H CTG with a portion of the shroud removed and the rotor section and combustor locations visible.

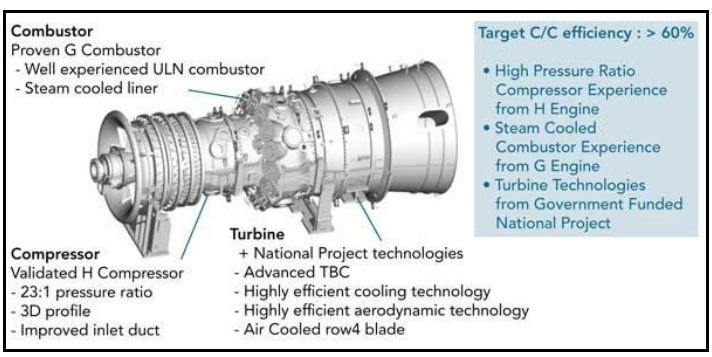


Figure 5. External View of MPS J CTG

Figure 6. Siemens H CTG

Ambient air is drawn into the multistage compressor of the CTG where it is compressed to a very high pressure ratio, which is on the order of 20:1 or more. The compressed air is then directed to the combustor section, which consists of individual steam-cooled, can-annular, DLN combustors. Fuel is introduced, ignited, and burned. The combustor outlet temperature is on the order of 2,800 to 2,900ºF.

The hot combustion gases are routed through the steam-cooled transition pieces then are diluted with additional cool air from the compressor and directed to the turbine (expansion) section. Energy is recovered in the turbine section in the form of shaft horsepower, of which typically more than 50 percent is required to drive the internal compressor section. The balance of recovered shaft energy is available to drive the external load unit such as an electrical generator. Turbine exhaust gas is discharged at a temperature greater than 1,125 ºF and contains more than 10% O_2. The turbine exhaust gas is available for additional energy recovery and can also support further combustion.

Each CTG/HRSG set will operate in combined cycle mode as depicted in Figure 7. The turbine exhaust gas from each CTG will produce steam in each HRSG. The steam from the three HRSG will, in-turn, drive a single, separate STG producing additional electrical power.

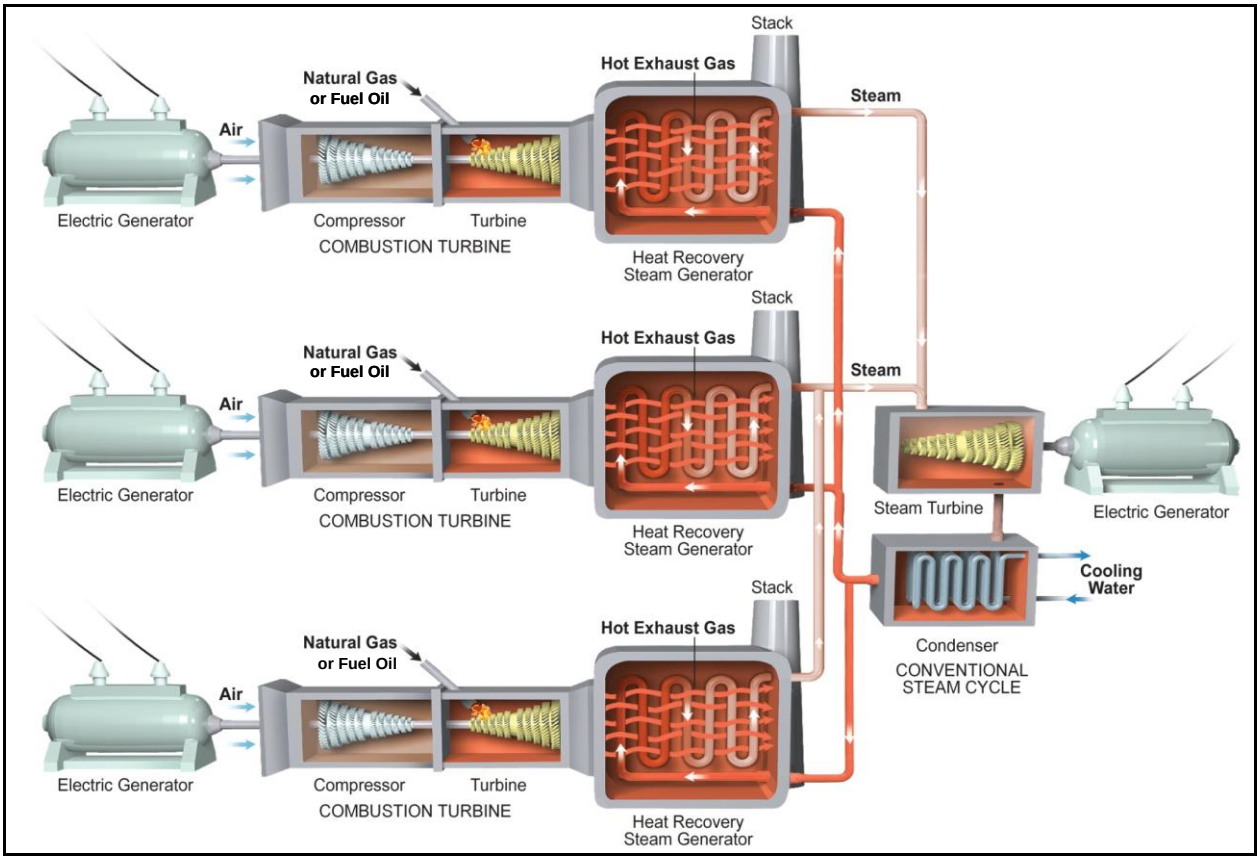


Figure 7. Natural Gas-Fueled Combined Cycle Unit with back up ULSD Fuel Oil

The MPS J CTG and the Siemens H CTG are expected to achieve approximately 60% thermal efficiency in combined cycle operation on the basis of the lower heating value (LHV) of natural gas (about 55% based on higher heating value, HHV). Several features are available to improve performance or power based on ambient conditions and power demand. .

CTG compressor inlet air cooling can be accomplished by chilling or evaporative cooling (through injection of fine water droplets). Lower compressor inlet temperatures result in a greater air mass flow rate through the CTG with a boost in electrical power production. The emissions performance remains within the normal profile of the CTG for the lower compressor inlet temperatures. This is typically implemented at ambient temperatures of 60° F or higher.

Gas-fired duct burners can be used in the HRSG to provide additional heat to the turbine exhaust gas and produce even more steam-generated electricity. Duct firing is useful during periods of high-energy demand much like small but efficient peaking unit. Duct firing is not proposed for this project.

3. AIR POLLUTION REGULATIONS

3.1 Department Regulations

Projects at stationary sources with the potential to emit air pollution are subject to the applicable environmental laws specified in Section 403 of the Florida Statutes (F.S.). The statutes authorize the Department of Environmental Protection (Department) to establish regulations regarding air quality as part of the Florida Administrative Code (F.A.C.), which includes the following applicable chapters:

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

Chapter	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

3.2 Federal Regulations

The U.S. Environmental Protection Agency (EPA) establishes air quality regulations in Title 40, Code of Federal Regulations, Part 60 (40 CFR 60) that identifies New Source Performance Standards (NSPS) for a variety of industrial activities. 40 CFR 61 specifies National Emission Standards for Hazardous Air Pollutants (NESHAP). 40 CFR 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 52, Subpart K – Florida; also known as the State Implementation Plan (SIP) for Florida.

3.3 Summary of Key Regulations Applicable to the Port Everglades Plant and PEEC

- The Port Everglades Plant is a major source of hazardous air pollutants (HAP) before and after the PEEC project.
- The Port Everglades Plant includes subject to the acid rain provisions of the Clean Air Act (CAA). The PEEC includes units subject to the acid rain provisions of the CAA.
- The Port Everglades Plant is a Title V major source of air pollution in accordance with Chapter 62-213, F.A.C. because the potential emissions of at least one regulated pollutant exceed 100 tons/year. Key regulated pollutants include CO, NO_X, PM, PM_{10}, $PM_{2.5}$, SO_2, VOC and SAM.
- The Port Everglades Plant is subject to the Clean Air Interstate Rule (CAIR) in accordance with the Final Department Rules issued pursuant to CAIR as implemented by the Department in Rule 62-296.470, F.A.C.
- The Port Everglades Plant is a major stationary source in accordance with Department Rule 62-212.400, F.A.C. - PSD.
- The PEEC project (as discussed below) does not trigger a PSD review and a requirement to conduct a Best Available Control Technology (BACT) pursuant to Department Rule 62-212.400, F.A.C.
- The proposed project includes units subject to the New Source Performance Standards (NSPS) of 40 Code of Federal Regulations Part 60 (40 CFR 60).

- The proposed project includes units subject to the National Emissions Standards for Hazardous Air Pollutants (NESHAP) of 40 CFR 63.
- The project is subject to certification under the Florida Power Plant Siting Act, 403.501-518, F.S. and Chapter 62-17, F.A.C.

4. PSD APPLICABILITY REVIEW

4.1 General PSD Applicability

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.

Commonly addressed PSD pollutants in the power industry include: CO, NO_X, PM, PM smaller than 10 micrometers (µm) (PM_{10}), PM smaller than 2.5 µm ($PM_{2.5}$), SO_2, VOC, SAM, lead (Pb), fluorides (F), and mercury (Hg).

Additional PSD pollutants that are more common to certain other industries include: hydrogen sulfide (H_2S), TRS including H_2S, reduced sulfur compounds (RSC) including H_2S, municipal waste combustor (MWC) organics measured as total tetra- through octa-chlorinated dibenzo-p-dioxins and dibenzofurans (dioxin/furan), MWC metals measured as PM; MWC acid gases measured as SO_2 and HCl, and municipal solid waste (MSW) landfill emissions as non-methane organic compounds (NMOC).

As defined in Rule 62-210.200(189)(a)1, F.A.C., a stationary source is a "major stationary source" (major PSD source) if it emits or has the potential to emit (PTE):

- 250 tons per year (tons/year) or more of any PSD pollutant; or
- 100 tons/year or more of any PSD pollutant and the facility belongs to one of the 28 listed PSD major facility categories.

The list given in the citation includes the category of "fossil fuel-fired steam electric plants of more than 250 million British thermal units per hour heat input". The given category applies to the Port Everglades Plant before and after the proposed project. The Port Everglades Plant is a major stationary source based on actual emissions of and potential to emit 250 tons/year or more of several individual PSD pollutants.

For major stationary sources such as the Port Everglades Plant, PSD applicability for modification projects is based on thresholds known as the significant emission rates (SER) as defined in Rule 62-210.200(275), F.A.C. and listed in Table 3. Any "net emissions increase" as defined in Rule 62-210.200(204), F.A.C. of a PSD pollutant from the project that equals or exceeds the respective SER is considered "significant".

Table 3. List of Significant Emissions Rates (SER) by PSD-Pollutant [1]

Pollutant	SER (tons/year)	Pollutant	SER (tons/year)
CO	100	NO_X	40
PM	25	PM_{10}	15
$PM_{2.5}$	10	Fluoride	3
Ozone (NO_X) [2]	40	Ozone (VOC) [2]	40
SO_2	40	SAM	7
Mercury	0.1	Greenhouse Gases (GHG)	75,000 [3]

1. Excluding those defined exclusively for MWC and MSW landfills.
2. Ozone (O_3) is regulated by its precursors (VOC and NO_X).
3. As carbon dioxide equivalent (CO_2e). GHG are regulated by the US EPA and not the Department.

SER also means any emissions rate or any net emissions increase of a PSD pollutant associated with a major stationary source or major modification which would construct within 10 km of a Class I area and have an impact on such area equal to or greater than 1 gram per cubic meter, 24-hour average. Although a facility may be "major" (i.e. emits or has the potential to emit 100 or 250 TPY as applicable) for only one PSD pollutant, a project must include BACT controls for any PSD pollutant that exceeds the corresponding SER given in Table 3.

4.2 PSD Applicability for the Project

The project is located in Broward County, which is in an area that is currently in attainment with the state and federal AAQS or otherwise designated as unclassifiable.

The PEEC will emit the following PSD-pollutants SO_2, NO_X, CO, PM, PM_{10}, $PM_{2.5}$, SAM, VOC and lead. The shut down and dismantlement of Units 1-4 will result in net emission changes of the same pollutants that are less than the SER.

Table 4 provides PSD applicability calculations based on the net emission increases and decreases expected to result from the PEEC project. Greenhouse gas (GHG) emissions expressed as equivalent carbon dioxide (CO_2e) emissions are also included for comparison with federal greenhouse gas PSD applicability criteria.

Table 4. Net Emissions Changes in tons/year and PSD Applicability for the FPL PEEC Project

Pollutant	Baseline Emissions Units 1-4	PEEC Potential Emissions	Net Emissions Increases (Decreases)	PSD SER	Trigger PSD?
SO_2	9,494	211	(9,283)	40	No
NO_X	4,260	382	(3,878)	40	No
CO	885	958	73	100	No
PM	604	246	(358)	25	No
PM_{10}	604	246	(358)	15	No
$PM_{2.5}$	402	246	(156)	10	No
SAM	422	40	(382)	7	No
VOC	77	106	29	40	No
Lead	0.10	0.05	(0.05)	0.6	No
GHG (CO_2e)	2,551,038	4,483,085	1,932,047	75,000	No/Yes[1]

1. No, under Rule 62-212.400, F.A.C. Yes, under federal rule 40 CFR 52.21. EPA is reviewing FPL's GHG PSD application.

5. PROPOSED EMISSIONS STANDARDS FOR THE PEEC

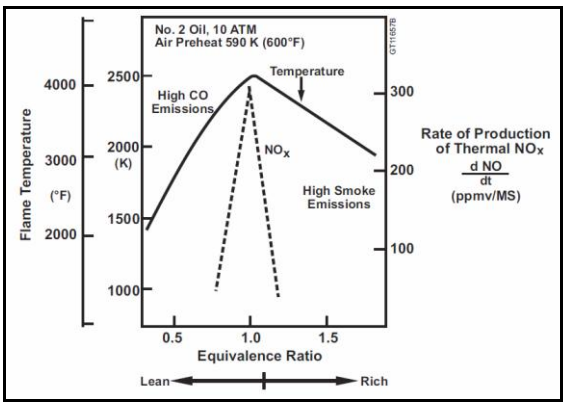
5.1 CTG Emission Standards

5.1.1 CTG NO_X Emissions Standards

NO_X Formation

NO_X is formed during combustion as a result of the dissociation of molecular nitrogen (N_2) and oxygen (O_2) to their atomic forms and subsequent recombination into seven different oxides of nitrogen, especially nitrogen oxide (NO) and nitrogen dioxide (NO_2).

Thermal NO_X forms in the high temperature area of the combustor. Thermal NO_X increases exponentially with flame temperature and linearly with residence time. Flame temperature is dependent upon the ratio of fuel burned in a flame to the amount of fuel that consumes all of the available oxygen, also known as the equivalence ratio. By maintaining a low fuel ratio (lean combustion), the flame temperature will be lower, thus reducing the potential for NO_X formation. The relation of NO_X production with respect to flame and equivalence ratios (lean versus rich operation) is shown in Figure 8. GE Report GER 3568G



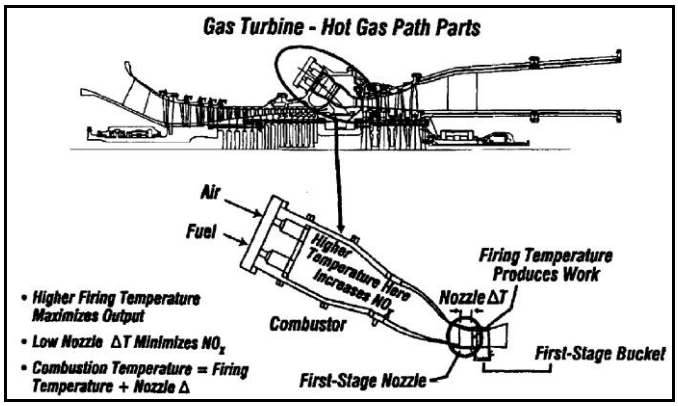


Figure 8. NO_X vs. Temperature, Equivalence Ratio Figure 9. Hot Gas Path Parts, NO_X Control

In most combustor designs, the high temperature combustion gases are cooled to an acceptable temperature with dilution air prior to entering the turbine (expansion) section. The sooner this cooling occurs, the lower the thermal NO_X formation. The relationship between flame temperature, firing temperature, work output and NO_X formation is depicted in Figure 9, which is from a General Electric discussion on these principles.

Prompt NO_X is formed in the proximity of the flame front as intermediate combustion products. The contribution of prompt to overall NO_X is relatively small in near-stoichiometric combustors and increases for leaner fuel mixtures. This provides a practical limit for NO_X control by lean combustion.

Fuel NO_X is formed when fuels containing bound nitrogen are burned. This phenomenon is not of great concern when combusting natural gas.

Uncontrolled emissions from combustion turbines range from about 100 to 600 parts per million by volume, dry, corrected to 15 percent oxygen (ppmvd @15% O_2). The Department estimates uncontrolled emissions at approximately 200 ppmvd for large frame combustion turbines.

NO_X Controls

Wet Injection. Fuel and air are mixed within traditional combustors and the combustion actually occurs on the boundaries of the flame. This is termed "diffusion flame" combustion. Injection of either water or steam directly into the combustor lowers the flame temperature and thereby reduces thermal NO_X formation. There is a physical limit to the amount of water or steam that may be injected before flame instability or cold spots in the combustion zone would cause adverse operating conditions for the CTG.

Advanced dual-fuel combustor designs can tolerate large amounts of steam or water without causing flame instability and can achieve NO_X emissions in the range of 30 to 42 ppmvd @15% O_2 when employing wet injection for backup fuel oil firing. Wet injection results in control efficiencies on the order of 80 to 90% for oil firing. These ranges values often form the basis, particularly in combined cycle turbines, for further reduction to lower (BACT-equivalent) limits by other techniques as discussed below.

Dry Low NO_X (DLN) Combustion. The excess air in lean combustion cools the flame and reduces the rate of thermal NO_X formation. Premixing of gaseous fuel and air prior to combustion can further reduce NO_X emissions. This is accomplished by minimizing localized high temperatures pockets within the combustion zones. These principles are incorporated into the MPS G DLN combustor shown in Figure 10. The MPS J DLN combustor is believed to be similar based on the Department's research.

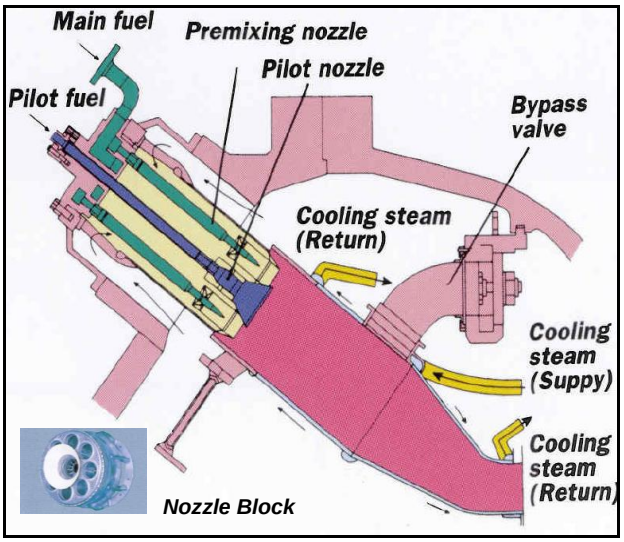


Figure 10. MPS G DLN Combustor

Table 5. Characteristics of Siemens H CTG [1,2]

Parameter	Simple Cycle	Single Shaft Combined Cycle
Power output	274 MW	410 MW
Efficiency (LHV)	40%	60%
Pressure ratio	20:1	20:1
Exhaust Temp.	1,148°F	195°F
Heat Rate (LHV)	~ 8,533	5,687
Time Hot Start	< 20 min [2]	40 min [3]
NO_X [4]	25 ppm	2 ppmvd @15% O_2
CO [5]	10 ppm	5 ppmvd @ 15% O_2

1. Siemens Brochure or FPL Riviera Plant Conversion Permit .
2. Department estimate.
3. After an overnight shutdown.
4. Combined cycle NO_X based on selective catalytic reduction.
5. Combined cycle CO value is at a high load.

The difference between combustion temperature and firing temperature into the first stage is minimized by steam cooling of the transition piece and first stage nozzle. Thus a lower combustion temperature (and lower NO_X) can be achieved by steam cooling compared with air cooling for a given firing temperature (equal work). Alternatively, a higher firing temperature (more work, greater efficiency) can be achieved by steam cooling compared with air cooling for a given combustion temperature (equal NO_X).

The MPS G combustor emits NO_X at concentrations less than 15 ppmvd @15% O_2 at loads between 60 and 100 percent of capacity. The firing temperature within the 60-100% load range is between roughly 2,500 and 2,750°F. The low NO_X values are an excellent achievement considering the high firing temperature.

The MPS J CTG has a firing temperature closer to 2,900°F and will be able to achieve an efficiency of 60% or more based on the LHV of natural gas. Because thermal NO_X increases exponentially with firing temperature, it will be more difficult for the MPS J CTG to attain the same low NO_X profile as the MPS G CTG by DLN alone.

The combustion principles of the Siemens H CTG are similar to those of the MPS J CTG. The simple cycle and combined cycle characteristics, based on company brochures and recent Department permits, are contained in Table 5 above. The Siemens H CTG will use air cooling rather than steam cooling. Because of the relatively high flame and firing temperatures, the Siemens H CTG will tend to emit higher NO_X than the previous Siemens F CTG models or than the MPS G CTG. However, very low NO_X emissions are attainable in combined cycle mode with selective catalytic reduction (SCR) technology discussed below.

Selective Catalytic Reduction (SCR). SCR is an add-on NO_X control technology that is employed in the exhaust stream following the CTG. SCR reduces NO_X emissions by injecting ammonia (NH_3) into the flue gas in the presence of a catalyst. NH_3 reacts with NO_X in the presence of a catalyst and excess oxygen (O_2) yielding molecular nitrogen (N_2) and water (H_2O) per the following simplified reaction:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$

The catalysts are available for applications at temperatures between roughly 300 and 1,100°F and typically are comprised of titanium oxide (as TiO_2), vanadium (as V_2O_5) and tungsten (as WO_3). The formulations contain progressively less vanadium and become more costly for the higher temperature applications. There are numerous examples of SCR installations at continuous duty combined cycle units throughout Florida. In combined cycle units, the catalyst can be placed at an optimal temperature

(roughly 400 to 600°F) for the purposes of high efficiency and lowest cost within the HRSG. In such applications, NO_X emissions on the order of 2.0 ppmvd @15% O_2 are achieved.

The left hand side of Figure 11 (Nooter-Eriksen) below is a diagram of a HRSG. Components 10 and 21 represent the SCR reactor and the NH_3 injection grid. The SCR system lies between low and high-pressure steam systems where the temperature requirements for conventional SCR can be met.

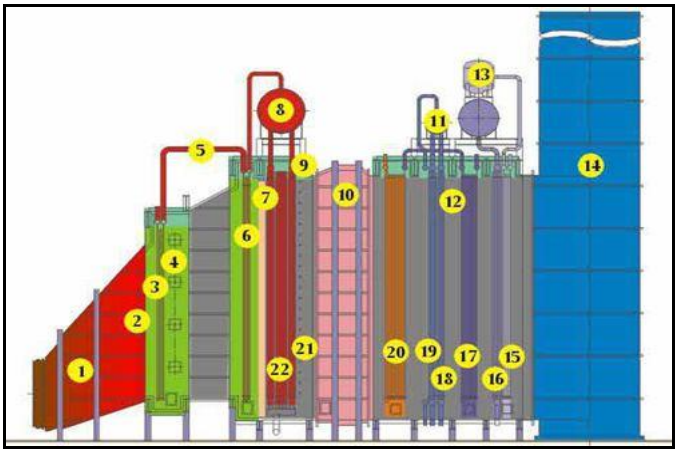


Figure 11. Key HRSG Components (10 is SCR)

Figure 12. FPL West County Energy Center

Figure 12 is a photograph of the recently constructed FPL West County Energy Center (WCEC) Unit 1 Power Block. The external lines to the NH_3 injection grid are easily visible. The magnitude of the installation can be appreciated from the relative size compared with nearby individuals and vehicles.

The SCR catalyst is typically augmented or replaced over a period of several years although vendors typically guarantee catalysts for about three years. Excessive NH_3 use can increase emissions of CO, NH_3 (slip) and $PM_{10}/PM_{2.5}$ when sulfur-bearing fuels are used.

Applicant's NO_X Emissions Standard Proposal

CTG emission standards are contained in NSPS Subpart KKKK-Standards of Performance for Stationary Gas Turbines. Refer to: Link to NSPS KKKK . The emission standards applicable to combined cycle CTGs when firing natural gas and ULSD fuel oil are 15 and 42 ppmvd @15% O_2, respectively, on a 30-unit operating day rolling basis. Refer to: Link to Table in NSPS KKKK . Table 6 is a summary of the requirements applicable to the CTGs at the PEEC project excerpted from the table in NSPS Subpart KKKK.

Table 6 – NSPS Subpart KKKK Standards for New Large Stationary Combustion Turbines

Combustion Turbine Type	Peak Load Heat Input, Power Output [1]	NO_X Standard [2]
New, modified, or reconstructed turbine firing natural gas	> 850 MMBtu/hour	15 ppm @15% O_2 or 54 ng/J, useful output (0.43 lb/MW-hour)
New, modified, or reconstructed turbine firing fuels other than natural gas	> 850 MMBtu/hour	42 ppm @15% O_2 or 160 ng/J, useful output (1.3 lb/MW-hour)
Turbines located north of the Arctic Circle, **turbines operating at less than 75% of peak load**, ..	> 30 MW output	96 ppm @15% O_2 or 590 ng/J, useful output (4.7 lb/MW-hour)

1. Heat input based on the higher heating value (HHV) or MW of useful output
2. ng/J means nanograms per joule

A NO_X standard of 96 ppmvd @15% O_2 applies for turbines operating at less than 75% of peak load.

FPL proposes NO_X limits for the PEEC when firing natural gas and ULSD fuel oil of 2.0 and 8.0 ppmvd @15% O_2, respectively, on a 30-unit operating day rolling average with compliance by CEMS. FPL proposes to meet the emission limits by a combination of DLN technology, wet injection and SCR.

The applicant's proposed emission standards are acceptable and will insure that: PSD for NO_X is not triggered; the CTGs will comply with the NO_X emission standards in NSPS Subpart KKKK; and the project will not cause or contribute to a violation of the AAQS for NO_2, $PM_{2.5}$, or ozone.

5.1.2 CTG CO and VOC Emission Standards

CO and VOC Formation and Combustor Characteristics

CO and VOC are emitted from CTGs due to incomplete fuel combustion. Most CTGs incorporate good combustion practices to minimize emissions of CO and VOC. The primary control techniques are based upon high temperature, sufficient time, turbulence, and excess air. Additional control can be obtained by installation of an oxidation catalyst.

According to Table 5 above, the Siemens H CTG can achieve 5 ppmvd of CO @15% O_2 at high load for a combined cycle configuration. The Department does not yet vendor provided information about the performance of the MPS J CTG with respect to CO, although emissions will likely be very low at high load based on the high firing temperature and the performance of the earlier MPS G CTG at the FPL West County Energy Center.

Typically, VOC concentrations are an order of magnitude less than CO concentrations. Therefore, while burning natural gas, VOC emissions will likely be less than 1 ppm at high loads for both the Siemens H CTG and the MPS J CTG.

CO and VOC emissions in the turbine exhaust gas while firing fuel oil in the CTGs should be very low based on the high combustion temperature and the relatively high temperature and excess air in the turbine exhaust gas.

FPL's CO and VOC Emissions Standard Proposal

FPL proposed emission standards CO and VOC based on good combustion practices. The proposed emission standards contained in Table 7 for CO and VOC account for several CTG equipment manufacturer options. These values will also insure that the PEEC project will not trigger PSD reviews and BACT determinations for CO and VOC.

Table 7. FPL Emission Standard Proposal for CO and VOC

Modes	**CO**		**VOC**	
	ppmvd @15% O_2	lb/hour	ppmvd @15% O_2	lb/hour
Natural Gas	9.0	56.2	1.2	4.1
ULSD Fuel Oil	35.0	195	10.0	37.0

FPL indicated that it would comply with the CO emission standards on a 30-unit operating day rolling basis using CO-CEMS. Realistically the emissions expected are about one order of magnitude less than proposed. Even the values proposed are sufficient to avoid triggering PSD and a BACT determination. They are also on the same order of magnitude as the ground level 1-hour and 8-hour CO AAQS.

The Department has determined that an initial stack test is sufficient to demonstrate compliance with the CO and VOC concentration and mass emission rate standards. Thereafter an annual stack test to demonstrate compliance with the CO concentration will suffice to provide reasonable assurance of compliance with all CO and VOC standards. These conclusions apply only to the PEEC project do not necessarily apply to projects that trigger PSD review including a BACT determination for CO and VOC.

5.1.3 CTG Sulfur Dioxide (SO_2) and Sulfuric Acid Mist (SAM) Emissions Standard

SO_2 control processes can be classified into five categories: fuel/material sulfur content limitation, absorption by a solution, adsorption on a solid bed, direct conversion to sulfur, or direct conversion to sulfuric acid. A review of the BACT determinations for CTGs contained in the BACT Clearinghouse shows that the exclusive use of low sulfur fuels constitutes the top control option for SO_2 from CTGs. Basically the use of low sulfur fuels simply means that the sulfur reduction was accomplished to very low levels at the refinery or gas conditioning plant prior to distribution.

For this project the applicant has proposed the use of ULSD fuel oil ($\leq$ 0.0015 percent sulfur) and clean natural gas ($\leq$ 2.0 gr sulfur/100 SCF). The NSPS Subpart KKKK Limit for SO_2 is 0.060 lb SO_2/MMBtu heat input. Compliance can be demonstrated by the fuel quality characteristics in a current, valid purchase contract, tariff sheet or transportation contract for the fuel, specifying that the maximum total sulfur content is 0.05% weight percent or less for oil and less than 20 gr/100 SCF for gas.

The applicant's proposed emission standards are acceptable and will insure that: PSD for SO_2 and SAM will not be triggered; the CTGs will comply with the SO_2 emission standards in NSPS Subpart KKKK; and the project will not cause or contribute to a violation of the AAQS for SO_2 or $PM_{2.5}$.

5.1.4 CTG Particulate Matter ($PM/PM_{10}/PM_{2.5}$) Emission Standards

<u>PM/PM_{10} $PM_{2.5}$ Formation and Control Options</u>

PM, PM_{10} and $PM_{2.5}$ will be emitted from the CTGs due to incomplete fuel combustion. They are minimized by use of clean fuels and good combustion.

Natural gas and ULSD fuel oil will be efficiently combusted at high temperature and with excess air in the CTGs. Clean fuels are necessary to avoid damaging turbine blades and other components already exposed to very high temperature and pressure. Natural gas is an inherently clean fuel and contains no ash. The ULSD fuel oil to be combusted contains a minimal amount of ash and its use will be limited making any conceivable add-on control technique for $PM/PM_{10}/PM_{2.5}$ either unnecessary or impractical.

<u>Applicant's $PM/PM_{10}/PM_{2.5}$ Proposal</u>

FPL proposes $PM/PM_{10}/PM_{2.5}$ emissions standard as a visible emissions (VE) standard of 10% opacity in conjunction with the use of inherently clean fuels. The clean fuel standards are:

- The CTGs shall fire natural gas as the primary fuel, which shall contain no more than 2.0 gr sulfur/100 SCF;
- As a restricted alternate fuel, the CTGs may fire ULSD fuel oil containing no more than 0.0015% sulfur by weight.
- VE shall not exceed 10% opacity based on a 6-minute average.

The applicant's proposed emission standards are acceptable and will insure that: PSD for $PM/PM_{10}/PM_{2.5}$ will not be triggered; and the project will not cause or contribute to a violation of the AAQS for PM_{10} or $PM_{2.5}$.

5.1.5 National Emission Standards for Hazardous Air Pollutants (NESHAP) Applicable to CTGs

According to previous permits and the present application, the Port Everglades Plant is and will continue to be classified as a major stationary source of hazardous air pollutants (HAP). The CTGs are potentially subject to NESHAP Subpart YYYY - Stationary Combustion Turbines. The applicability of this rule has been stayed for lean premix and diffusion flame gas-fired combustion turbines such as planned for this project. The requirements of NESHAP Subpart YYYY (including a formaldehyde emission standard) will apply if and when any CTG at the PEEC actually burns ULSD fuel oil 1,000 or more hours/year. If, as expected, CO and VOC emissions are actually very low, then formaldehyde emissions will be minimal.

5.1.6 Department Draft Emissions Standards for CTGs

Emissions from each CTG shall not exceed the values given in Table 8.

Table 8. Summary of Emission Standards Applicable to the CTGs at the PEEC

Pollutant	Fuel	Emission Standard [a,b]	Basis	Compliance Demonstration [c]
NO_X	Oil	8.0 ppmvd @15% O_2	Application	30 unit rolling operating days (Compliance by CEMS)
		42 ppmvd @15% O_2	Subpart KKKK	
	Gas	2.0 ppmvd @15% O_2	Application	
		15 ppmvd @15% O_2	Subpart KKKK	
CO	Oil	35.0 ppmvd @15% O_2	Application Avoids PSD	Initial Stack Test Only
		195 lb/hour		
	Gas	9.0 ppmvd @15% O_2	Application Avoids PSD	Initial Stack Test Only
		56.2 lb/hour		
VOC	Oil	10.0 ppmvd @15% O_2	Application Avoids PSD	Initial Stack Test Only
		37.0 lb/hour		
	Gas	1.2 ppmvd @15% O_2	Application Avoids PSD	Initial Stack Test Only
		4.1 lb/hour		
SO_2 [d]	Oil, Gas	2.0 gr. sulfur/100 SCF gas 0.0015% sulfur fuel oil [f]	Application Subpart KKKK	Fuel Record Keeping
$PM/PM_{10}/PM_{2.5}$ [e]	Oil, Gas	2.0 gr. sulfur/100 SCF gas 0.0015% sulfur fuel oil [f]	Application Avoids PSD	Fuel Record Keeping
		10 percent opacity		Initial and Annual Visible Emissions Test [g]

a. Concentration standards are expressed as parts per million, by volume, dry at 15 percent oxygen and abbreviated as ppmvd @15% O_2.
b. The mass emission rate standards are expressed as pounds per hour (lb/hour) and are based on a turbine inlet condition of 59°F, no inlet air cooling, and 100% load. The results and may be adjusted to actual test conditions in accordance with the performance curves and/or equations filed with the Department.
c. "Unit operating day" means a 24-hour period between 12 midnight and the following midnight during which any fuel is combusted at any time in the unit. It is not necessary for fuel to be combusted continuously for the entire 24-hour period. [40 CFR 60.4420]
d. The applicant requested the stated sulfur fuel limits. These satisfy the emission standards contained in NSPS Subpart KKKK.
e. The fuel sulfur specifications combined with the low NO_X emission limit, efficient combustion design and operation of the combustion turbines effectively limit $PM/PM_{10}/PM_{2.5}$ emissions.
f. Compliance with the fuel sulfur specifications shall be determined by the methods for determination of fuel sulfur as detailed in Condition 25 of this permit.
g. Compliance with the 10% opacity standard shall be demonstrated by conducting 30-minute tests in accordance with EPA Method 9 - Visual Determination of Opacity.

5.2 Emission Standards for Auxiliary Boiler

The project will include one natural-gas fueled auxiliary boiler rated at 99.8 MMBtu/hour that will be used less than 2,000 tons/year. The purpose of the auxiliary boiler is to provide steam for CTG combustor cooling until steam of sufficient quality can be provided by the HRSG. The auxiliary boiler is subject to the emission standards summarized in Table 9.

Table 9. Applicable Emission Standards for Natural Gas-Fueled Auxiliary Boiler at PEEC

Applicable Rules	VE [4]	SO_2 and PM	HAP
NSPS Subpart Dc [1] NESHAP Subpart DDDDD [2] Rule 62-296.406, F.A.C. [3]	20% [4]	2 gr S/100 SCF (BACT)	Work Practices, Tune-ups

1. NSPS Subpart Dc-Small Industrial-Commercial-Institutional Steam Generating Units (≥ 10 and < 100 MMBtu/hour).
2. NESHAP Subpart DDDDD-Industrial, Commercial, and Institutional Boilers and Process Heaters (at Major HAP Sources).
3. Rule 62-296.406, F.A.C.-Fossil Fuel Steam Generators-Visible Emissions, BACT for NO_X and PM (< 250 MMBtu/hour).
4. Visible Emissions (VE). 20% opacity except for one six-minute period/hour during which opacity ≤ 27%.

The emission standards in Table 9 are consistent with: the minor stationary source status of the PEEC project (non-PSD); compliance with the relevant NSPS; the Department's "Small Boiler" BACT rule; and the NESHAP applicable to boilers major HAP sources, including the Port Everglades Plant.

5.3 Emission Standards for the Temporary Construction Boilers

The project will include two new or used, temporary, skid mounted construction boilers without permanent foundations. The construction boilers will be used to clean the HRSGs, the steam generator and associated piping prior to permanent operation of the combined cycle unit. Each temporary construction boiler will operate on either natural gas or ULSD fuel oil and will be rated at approximately 150 MMBtu/hour.

These construction boilers will be used for 12 months or less since the activities for which these boilers are required have a defined time period (prior to HRSG steam connections and before the operation of the combined cycle unit). One or both boilers would operate at any given time based on the project requirements. The NSPS Subpart Db and Department emission standards for small boilers are listed in Table 10. Link to NSPS Subpart Db

Table 10. Potentially Applicable NSPS and Department Emission Standards for Construction Boilers

Rules	Fuel	SO_2 and PM	NO_X	VE [3]
NSPS Subpart Db [1] Rule 62-296.406, F.A.C. [2]	Gas	2 gr S/100 SCF (BACT)	0.10 lb/MMBtu (30-day)	20% [3]
	Fuel Oil	0.0015% S (BACT)		

1. NSPS Subpart Db-Industrial-Commercial-Institutional Steam Generating Units (≥ 100 and < 250 MMBtu/hour). Subpart Db applies to units that commence construction, modification, or reconstruction after June 19, 1984. Alternative NO_X limits apply to units constructed between 1984 and 1986.
2. Rule 62-296.406, F.A.C.-Fossil Fuel Steam Generators-Visible Emissions, BACT for SO_2 and PM (< 250 MMBtu/hour).
3. Visible Emissions (VE). 20% opacity except for one six-minute period/hour during which opacity ≤ 27%.

The emission standards in Table 10 are consistent with the minor stationary source status of the PEEC project (non-PSD), compliance with the relevant NSPS and the Department's Small Boiler BACT rule.

The current NESHAP 40 CFR 63, Subpart DDDDD was promulgated on March 21, 2011. On December 23, 2011 EPA published notice of a full consideration of the current NESHAP Subpart DDDDD that is expected to be finalized by summer 2012. The key limits from the current and proposed versions applicable to natural gas or light liquid-fueled boilers are given in Table 11 below.

These limits do not apply to temporary boilers that are located at a given construction site for 12 months or less. However, they are provided for informational purposes. The time from when the applicant brings the first temporary boiler to the site and the date when the applicant removes the last temporary boiler from the site will need to be monitored by the applicant to avoid applicability of the emission standards given in Table 11.

Table 11. NESHAP Subpart DDDDD – Emission Limits for Gas and Light Liquid-Fueled Boilers.

Rule Version	Fuel	Emission Standards [1]				
		PM limit	HCl Limit	Mercury	CO [4]	dioxin/furan [2]
03/21/2011 (Current)	Fuel Oil (Existing)	0.0075 [3]	0.00033	$3.5x10^{-6}$	10 ppm	4 ng TEQ/dscm
	Fuel Oil (New)	0.0013 [3]	0.00033	$2.1x10^{-6}$	3 ppm	0.002 ng TEQ/dscm
	Natural Gas (All)	Conduct a tune of the boiler annually as specified in Section 40 CFR 63.7540				
12/23/2011 (Proposed)	Fuel Oil (Existing)	0.0034 [3]	0.0012	$26x10^{-6}$	7 ppm	Work Practices
	Fuel Oil (New)	0.0011 [3]	0.0012	$0.49x10^{-6}$	3ppm	
Both	Oil or Gas	Emission Standards do not apply to temporary boilers [5]				

1. Units are lb/MMBtu except as indicated.
2. ng TEQ/dscm means nanograms of toxic equivalents per dry standard cubic meter at 7% O_2.
3. 3-run average.
4. ppm means parts per million by volume, dry basis, at 3% oxygen.
5. Temporary boilers are limited to 12 months on-site by the proposed rule.

5.4 Emissions Standards for Natural Gas Process Heaters

Two natural gas heaters rated at 9.9 MMBtu/hour are required for the project. One is designated as a spare. The purpose of these units is to heat natural gas above dew point temperature and prevent condensation. The gas heaters are not subject to NSPS Subpart Dc and not subject to NESHAP Subpart DDDDD. The natural gas fuel sulfur specification is sufficient for these units and consistent with the minor stationary source status of the PEEC project.

5.5 Emission Standards for the Compressor Station

Three natural gas-fueled combustion turbine-compressors (CTC) rated at 5,514 horsepower (hp) are required for the project. These will be used to increase pressure from the existing pipeline network to Unit 5. The three CTC are subject to the requirements applicable to combustion turbines at NSPS Subpart KKKK.

Refer to Table 12. FPL proposes NO_X emission standards for the three CTC that are more stringent than the applicable NO_X emission standard given in NSPS Subpart KKKK for combustion turbines with a heat input rating of 54 MMBtu/hour. FPL has also proposed a CO emission standard not required by NSPS Subpart KKKK.

The emission standards in Table 12 are consistent with: the minor stationary source status of the PEEC project (non-PSD) and compliance with the NSPS Subpart KKKK.

5.6 Emission Standards for Diesel Emergency Generators

Two standby diesel emergency generators rated at 2,250 kilowatts (kW) are required for the project (model year 2011 and later). These will be used when electricity is not available to the site, such as during hurricanes. The emergency generators are subject to NSPS Subpart IIII and NESHAP Subpart ZZZZ (requirements are equal). Refer to: Link to NSPS Subpart IIII and Link to NESHAP ZZZZ . The emission standards are summarized in Table 13.

Table 12. Applicable Emission Standards for Compressor Station (three CTC) at PEEC

Pollutant	Emission Standard	Basis	Compliance [a]
NO_X	15.0 ppmvd @15% O_2	Application	30 unit rolling operating days (Compliance by CEMS)
	25 ppmvd @15% O_2	Subpart KKKK	
CO	25.0 ppmvd @15% O_2	Application, Avoids PSD	Initial Stack Test Only
SO_2 [b]	2.0 gr. sulfur/100 SCF gas [b]	Application Subpart KKKK	Fuel Record Keeping
$PM/PM_{10}/PM_{2.5}$ [c]	2.0 gr. sulfur/100 SCF gas	Application, Avoids PSD	Fuel Record Keeping
	10 percent opacity [d]		Initial and Annual Visible Emissions Test

a. "Unit operating day" means a 24-hour period between 12 midnight and the following midnight during which any fuel is combusted at any time in the unit. It is not necessary for fuel to be combusted continuously for the entire 24-hour period. [40 CFR 60.4420]
b. The applicant requested the stated sulfur fuel limits. These satisfy the emission standards contained in NSPS Subpart KKKK. Compliance with the fuel sulfur specifications shall be determined by the methods for determination of fuel sulfur as detailed in Section 3. A. Condition 25 of this permit.
c. The fuel sulfur specifications combined with the low NO_X emission limit, efficient combustion design and operation of the combustion turbines effectively minimize potential $PM/PM_{10}/PM_{2.5}$.
d. Compliance with the 10% opacity standard shall be demonstrated by conducting 30-minute tests in accordance with EPA Method 9 - Visual Determination of Opacity.

Table 13. Emission Standards for Diesel Emergency Generators

Emergency Generator (> 560 kW)	**CO** (g/kW-hr)[1]	**PM** (g/kW-hr)	**NMHC[2]+NO_X** (g/kW-hr)	**Diesel Fuel[3]** (sulfur)
Model year 2011 and later	3.5	0.20	6.4	15 ppm

1. g/kW-hr means grams per kilowatt-hour.
2. NMHC means Non-Methane Hydrocarbons.
3. Nonroad diesel specification of 15 ppm is from 40 CFR part 80, subpart I – Motor Vehicle Diesel Fuel; Nonroad, Locomotive, and Marine Diesel Fuel; and ECA Marine Fuel.

The emission standards in Table 13 are consistent with: the minor stationary source status of the PEEC project (non-PSD) and compliance with NSPS Subpart IIII and NESHAP Subpart ZZZZ.

5.7 Emissions Standards for Emergency Fire Pump Engines

One 300-horsepower (hp) fire pump engine is required for the project. It will be used sparingly and will fire ULSD fuel oil. The emergency fire pump engine is subject to NSPS Subpart IIII and NESHAP Subpart ZZZZ (requirements are equal). The applicable emission standards are summarized in Table 14.

Table 14. Emission Standards for Emergency Fire Pump Engines.

Emergency Pumps (175 hp ≤ and < 600 hp)	**PM [1]** (g/hp-hr)	**NMHC [2]+NO_X** (g/hp-hr)	**Diesel Fuel [3]** (sulfur)
Subpart IIII (2009 and later)	0.15	3.0	15 ppm

1. g/hp-hr means grams per horsepower-hour.
2. Non-Methane Hydrocarbons
3. Nonroad diesel specification of 15 ppm is from 40 CFR part 80, subpart I – Motor Vehicle Diesel Fuel; Nonroad, Locomotive, and Marine Diesel Fuel; and ECA Marine Fuel.

The emission standards in Table 14 are consistent with: the minor stationary source status of the PEEC project (non-PSD) and compliance with NSPS Subpart IIII and NESHAP Subpart ZZZZ.

5.8 Requirements for the Distillate Fuel Oil Storage Tank

The project includes a nominal 7 million gallons ULSD fuel oil storage tank. Large tanks storing a liquid with a maximum true vapor pressure less than 3.5 kPa are not subject to NSPS Subpart Kb in accordance with section 40 CFR.110b(b). Link to NSPS Subpart Kb .

6. PERIODS OF EXCESS EMISSIONS

6.1 Excess Emissions Prohibited

In accordance with Rule 62-210.700(4), F.A.C., "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." All such preventable emissions shall be included in the compliance determinations for NO_X emissions.

6.2 Alternate Standards and Excess Emissions Allowed

In accordance with Rule 62-210.700, F.A.C., "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." In addition, the rule states that, "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." Therefore, the Department has the authority to regulate defined periods of operation that may result in emissions in excess of the proposed standards based on the given characteristics of the specific project.

During a cold startup of the steam turbine-generator, each CTG/HRSG system is sequentially brought on line at low load to gradually increase the temperature of the steam turbine generator and prevent thermal metal fatigue. The gradual warming of the HRSG and steam turbine generator components is accomplished by operating the CTGs for extended periods at reduced loads, which results in higher emissions. The durations are minimized by use of the auxiliary steam boiler proposed for the project. In general, the sequences of startup/shutdown are managed by the automated control system.

Based on information from FPL regarding startup and shutdown, the Department included conditions in the draft permit establishing excess emission data exclusions. Among these are exclusions from the 30-operating day state NO_X permit limits for the CTG/HRSG systems. These exclusions cannot vary or supersede any federal provision of the NSPS or Acid Rain programs. (refer to Section 3, Condition 12)

7. AIR QUALITY IMPACT ANALYSIS

7.1 Introduction

The proposed PEEC project will not increase emissions of criteria pollutants at levels in excess of PSD significant emission rates (SER). Although the proposed project is not PSD applicable, the applicant provided an air quality analysis to ensure that the conversion will not cause or contribute to a violation of a National Ambient Air Quality Standard (NAAQS).

7.2 Major Stationary Sources in Palm Beach, Broward, and Miami-Dade County

The current largest stationary sources in the Miami-Dade/Broward//Palm Beach Tri-County Area are listed below. The information is from annual operating reports submitted to the Department from 2010. The future estimates for the FPL PEEC that will replace Units 1-4 are included for comparison.

Table 15. Major Sources of NO_X in the Miami-Dade/Broward/Palm Beach Tri-County Area (2010)

Owner	Site Name	tons/year
FPL	**Port Everglades Plant (Units 1-4 to be shut down)**	**3,216** [1]
FPL	Lauderdale Plant	2,378
FPL	Turkey Point Plant	1,989
Wheelabrator N. Broward, Inc.	North Broward Resource Recovery Facility	1,357
Wheelabrator S. Broward, Inc.	South Broward Resource Recovery Facility	1,338
Miami-Dade County	Miami-Dade County Resource Recovery Facility	1,270
New Hope Power	Okeelanta Cogeneration	884
SWA [2] of Palm Beach County	North County Resource Recovery Facility	729
CEMEX	Miami Cement Plant	709
Titan/Tarmac America	Tarmac-Pennsuco Cement	683
Sugar Cane Growers Co-op	Sugar Cane Growers Co-op	573
Osceola Farms	Osceola Farms	460
FPL	**PEEC (Future Maximum Potential Emissions)**	**382** [3]
FPL	West County Energy Center	299
Miami-Dade Water & Sewer Dept.	Alexander Orr Water Treatment Plant	208
United Technologies Corp	Pratt Whitney	172

1. Port Everglades Plant 2006-2010 baseline NO_X emissions were 4,260 tons/year.
2. SWA is Solid Waste Authority.
3. At 8,760 hours/year and maximum emission rates. Actual emissions will typically be lower.

Table 16. Major Sources of SO_2 in the Tri-County Area (2010)

Owner	Site Name	tons/year
FPL	**Port Everglades Plant (Units 1-4 to be shut down)**	**3,982** [1]
FPL	Turkey Point Plant	3,185
Waste Management Inc.	Monarch Hill	281
FPL	Lauderdale Plant	247
Sugar Cane Growers Co-op	Sugar Cane Growers Co-op	213
FPL	**PEEC (Future Maximum Potential Emissions)**	**211** [2]
New Hope Power	Okeelanta Cogeneration	181
Wheelabrator N. Broward, Inc.	North Broward Resource Recovery Facility	180
Miami-Dade Water & Sewer Dept.	Central District Wastewater Treatment Plant	149
Wheelabrator S. Broward, Inc.	South Broward Resource Recovery Facility	144
SWA of Palm Beach County	North County Resource Recovery Facility	140
Palm Beach County Water Utilities	Southern Region Water Reclaim	128

1. Port Everglades Plant 2006-2010 baseline SO_2 emissions were 9,494 tons/year.
2. At 8,760 hours/year and maximum emission rates. Actual emissions will typically be lower.

Table 17. Major Sources of PM_{10} in the Tri-County Area (2010)

Owner	Site Name	tons/year
FPL	West County Energy Center	336
Sugar Cane Growers Co-op	Sugar Cane Growers Co-op	293
Osceola Farms	Osceola Farms	285
FPL	Turkey Point Plant	276
FPL	**PEEC (Future Maximum Potential Emissions)**	**246** [2]
FPL	Lauderdale Plant	126
New Hope Power	Okeelanta Cogeneration	94
Titan/Tarmac America	Tarmac-Pennsuco Cement	91
SWA of Palm Beach County	North County Resource Recovery Facility	85
CEMEX	Miami Cement Plant	84
Miami-Dade County	Miami-Dade County Resource Recovery Facility	47
FPL	**Port Everglades (Units 1-4 to be shut down)**	**12** [1]

1. Existing Port Everglades Plant PM_{10} emissions were very low in 2010 due to less generation, less residual oil use and increased gas use. Emissions from 2006 to 2010 ranged from 12 to 634 tons/year. Baseline emissions were 604 tons/year.
2. At 8,760 hours/year and maximum emission rates. Actual emissions will typically be lower.

Table 18. Major Sources of CO in the Tri-County Area (2010)

Owner	Site Name	tons/year
Osceola Farms	Osceola Farms	11,647
Sugar Cane Growers Co-op	Sugar Cane Growers Co-op	11,563
New Hope Power	Okeelanta Cogeneration	1,947
CEMEX	Miami Cement Plant	683
FPL	**PEEC (Future Maximum Potential Emissions)**	**958**
SWA of Palm Beach County	North County Resource Recovery Facility	655
FPL	**Port Everglades Plant (Units 1-4 to be shut down)**	**542** [1]
Titan/Tarmac America	Tarmac-Pennsuco Cement	498
Miami Dade Solid Waste Mgmt	South Dade Landfill	347
FPL	Turkey Point Plant	334
Waste Management Inc.	Monarch Hill	300
FPL	Lauderdale Plant	239
Miami Dade Solid Waste Mgmt	North Dade Landfill	222
Waste Management Inc.	Medley Landfill	134
Wheelabrator North Broward, Inc	Wheelabrator North Broward	97

1. Port Everglades Plant 2006-2010 baseline CO emissions were 885 tons/year.
2. At 8,760 hours/year and maximum emission rates. Actual emissions will typically be lower.

Table 19. Major Sources of VOC in the Tri-County Area (2010)

Owner	Site Name	Tons/year
Osceola Farms	Osceola Farms	737
Sugar Cane Growers Co-op	Sugar Cane Growers Co-op	496
FPL	**PEEC (Future Maximum Potential Emissions)**	**106** [1]
Dryplast Products	Dryplast Products	91
ExxonMobil Oil Corporation	ExxonMobil Port Everglades Terminal	88
New Hope Power	Okeelanta Cogeneration	62
Flowers Baking Co of Miami	Flowers Baking Co of Miami	60
AAR Landing Gear Services	AAR Landing Gear Services	53
Hess Corporation	Hess Fort Lauderdale Terminal	48
FPL	**Port Everglades Plant (Units 1-4 to be shut down)**	**46** [2]
Chevron Products Company	Chevron Port Everglades Terminal	46
Motiva Enterprises, LLC	Motiva Enterprises South	46

1. At 8,760 hours/year and maximum emission rates. Actual emissions will typically be lower.
2. Port Everglades Plant 2006-2010 baseline VOC emissions were 77 tons/year.

The main industrial pollutants in Broward and the Tri-county area are from power plants, waste-to-energy facilities, sugar mills (including cogeneration) and cement plants.

7.3 SO_2 and NO_X Emission Trends from Power Plants in Florida

The Department graphed the SO_2 and NO_X emission trends during the period 1998-2010 from power plants in Florida that report their emissions to the EPA Clean Air Markets database. The results are summarized in Figure 13.

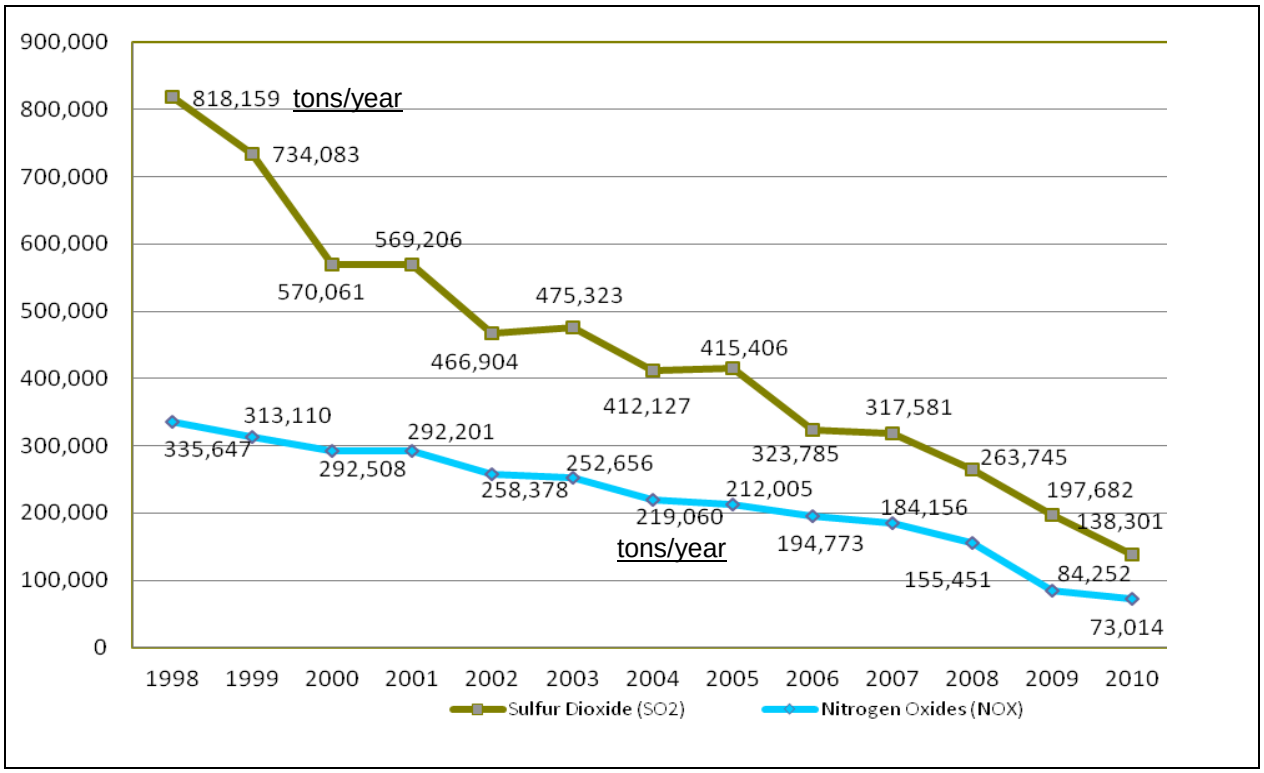


Figure 13. SO_2 and NO_X reductions in tons/year at Florida Power Plants (1998-2010)

SO_2 emissions from power plants in Florida have declined by nearly 680,000 tons/year and 83% referenced to 1998. NO_X emissions from power plants in Florida were reduced by nearly 263,000 tons/year and 78% referenced to 1998. The main reasons include installation of air pollution control equipment on conventional coal-fueled power plants and construction of natural gas-fueled combined cycle units such as the planned PEEC to add or replace system capacity.

7.4 SO_2 and NO_X Trends from FPL Peninsular facilities

Per Tables 15 and 16 above, FPL facilities are the largest sources of SO_2 and NO_X (precursors of $PM_{2.5}$ and/or ozone) in the Tri-County area. The Department graphed the SO_2 and NO_X emission trends during the period 1998-2010 from FPL fossil-fueled plants located in the Florida peninsula. Most of the plants are in South Florida. The results are summarized in Figure 14.

During the period 1998-2010 there was a *decrease* from 221,400 to 20,400 tons/year (91%) of SO_2 emissions from the FPL fossil fleet in peninsular Florida. Similarly there was a *decrease* from 93,700 to 17,900 TPY (81%) in NO_X emissions.

The state-wide and FPL system SO_2 and NO_X downward trends will continue as conventional power plants operators complete their air pollution projects and as FPL starts up their new modernization projects at the Cape Canaveral and Riviera Plants. Emissions from the new PEEC will be low by comparison with the present and historical emissions at the Port Everglades Plant and miniscule by comparison with state-wide and FPL system emission reductions over the past decade.

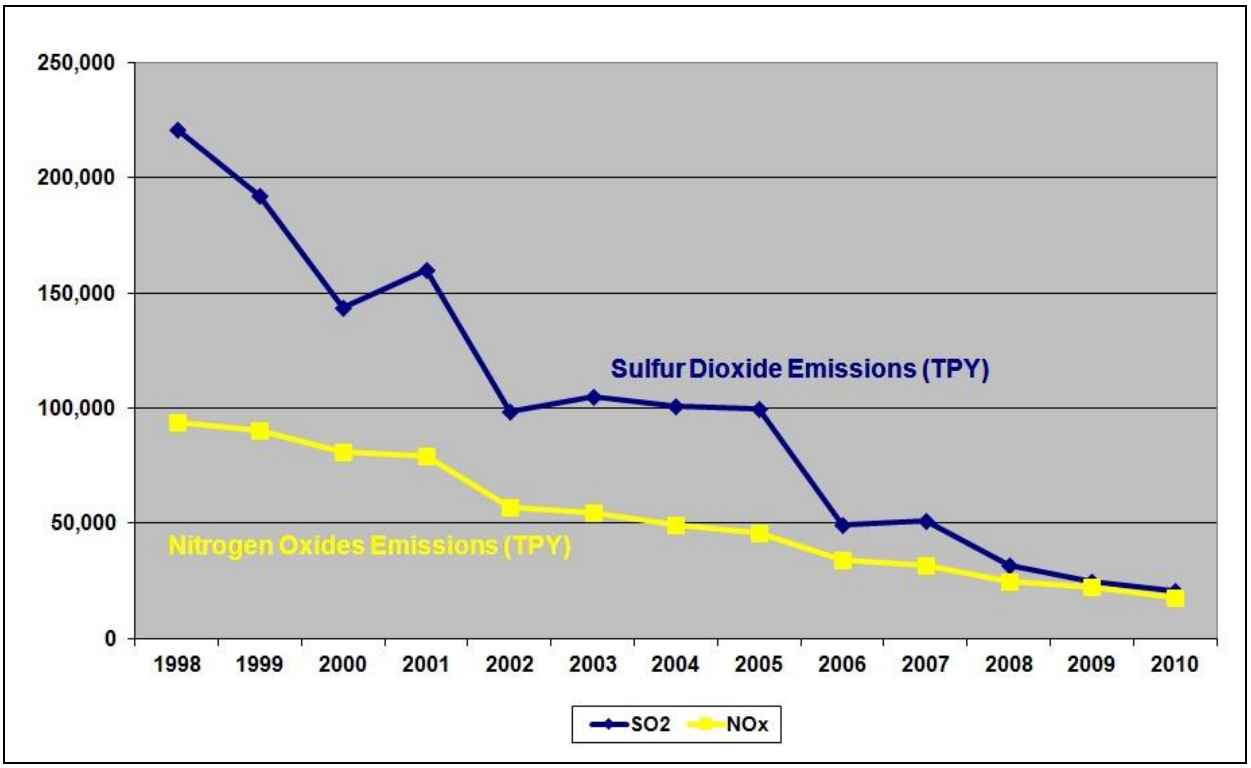


Figure 14. SO_2 and NO_X reductions in TPY at FPL Peninsular Facilities (1998-2010)

7.5 Air Quality and Monitoring in the Broward County

The Broward County Environmental Protection and Growth Management Department operates several monitors across the county measuring PM_{10}, $PM_{2.5}$, CO, ozone, NO_2 and SO_2. The 2010 monitoring network closest to the project site is shown below in Figure 15. The 2009-2011 ambient air summaries for the stations near the project site are given in Table 20.

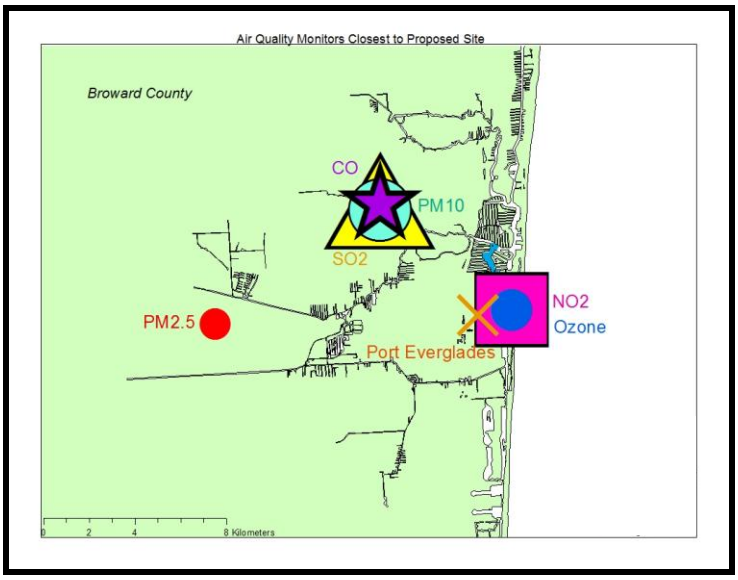


Figure15. Relevant Broward County Air Monitoring Network

Table 20. Ambient Air Quality Measurements Nearest to the Project Site (2009-2011)

Pollutant	Location (Site Number)	Averaging Period	Ambient Concentration			
			Compliance Period	Value	Standard	Units [a]
PM_{10}	Lincoln Park Elementary (0110010)	24-hour [b]	2011	21	150	$\mu g/m^3$
		Annual [e]	2011	13	50	$\mu g/m^3$
$PM_{2.5}$	U of F Ag Research Center (0111002)	24-hour [d]	2009-2011	18	35	$\mu g/m^3$
		Annual [e]	2009-2011	9	15.0	$\mu g/m^3$
SO_2	Lincoln Park Elementary (0110010)	1-hour [i]	2011	39	75	ppb
		24-hour [b]	2011	0.003	0.14	ppm
		3-hour [b]	2011	0.01	0.5	ppm
		Annual [f]	2011	0.001	0.03	ppm
NO_2	John U. Lloyd State Park (0118002)	Annual [c]	2011	6	53	ppb
		1-hour [h]	2009-2011	44	100	ppb
CO	Lincoln Park Elementary. (0110010)	1-hour [f]	2011	2	35	ppm
		8-hour [g]	2011	1	9	ppm
Ozone	John U. Lloyd State Park (0118002)	8-hour [g]	2011	0.060	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.
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
i. Three-year average of the annual 99th percentile maximum daily 1-hour value

7.6 Existing Ambient Air Quality Near Project Site – $PM_{2.5}$ and Ozone

Ozone 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 authorized agricultural fires, natural drought-related fires and natural emissions from vegetation. These two precursors participate in photochemical reactions that occur on an area-wide basis and are highly dependent on meteorological factors.

$PM_{2.5}$ (also known as PM_{fine}) is another key indicator of the overall state of regional air quality. 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.

Ozone limits and measurements in Table 20 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 given in Table 20 and Figure 16.

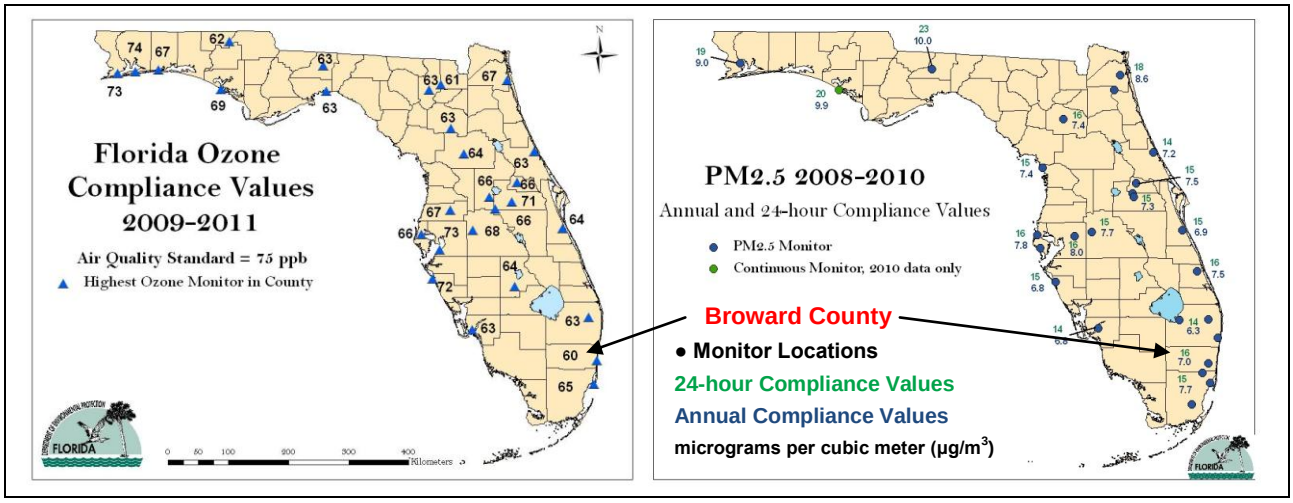


Figure 16. Florida Ozone Compliance Values **Figure 17. Florida $PM_{2.5}$ Compliance Values**

$PM_{2.5}$ limits and measurements are summarized on three-year blocks, rolled annually. The reported 2010 24-hour compliance value for $PM_{2.5}$ is 16 µg/m^3 as indicated above in Figure 17 for the Broward County site. However, the updated data for the 2009-2011 period shown above in Table 20 reports a value of 18 µg/m^3. The updated data was used in the AAQS analysis. These values were calculated by taking the average 24-hour readings recorded each day during the three years (2009-2011). 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 µg/m^3.

The simple average of all $PM_{2.5}$ measurements within each three years (2009-2011) was also calculated and then the mean of the three averages (9 µg/m^3) was reported as the annual compliance value and compared with the standard of 15 µg/m^3. Based on the data, Broward County and the entire Tri-County area is in attainment with the ozone and the $PM_{2.5}$ ambient air quality standards.

7.7 Air Quality Impact Analysis

The applicant voluntarily provided an air quality analysis which included air quality modeling to show compliance with the NAAQS.

7.7.1 Receptor Grid:

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 75 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 starting at the property line and extending to 5 kilometers. Beyond 2 kilometers, Cartesian receptors with a spacing of 250 meters were used out to 5 kilometers from the facility.

7.7.2 Models and Meteorological Data Used in the Air Quality Analysis

PSD Class I & II Areas: The AERMOD modeling system was used to evaluate the pollutant emissions from the proposed project. 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.

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 PEEC stack heights are less than the GEP stack heights. Accordingly, building downwash effects were included in the modeling analysis.

The AERMET meteorological data used for this analysis consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper air soundings from the National Weather Service (NWS) stations located at the Fort Lauderdale-Hollywood International Airport and Florida International University (FUI) in Miami. The 5-year period of meteorological data was from 2006 through 2010. The NWS office at the airport is located approximately 2.5 km southwest of the project site. The areas between the airport and the project site are flat with very similar land characteristics. Therefore, the meteorological parameters collected at the Fort Lauderdale-Hollywood International Airport are determined to be representative of the project site. Because the distance from the project site to the meteorological station is so small, and the terrain between the two sites is flat, wind direction and wind speed frequencies that are experienced at the airport are considered to be highly similar to what would be experienced at the project site. Therefore, the airport wind direction and wind speed frequencies are also considered to be representative of the project site.

7.7.3 AAQS Analysis

The total impact on ambient air quality is obtained by adding a "background" concentration to the maximum modeled concentration. This "background" concentration takes into account all sources of a particular pollutant that are not explicitly modeled. The results of the AAQS analysis are summarized in Table 21. As shown in the table, emissions from the proposed facility (and all other development in the area) are not expected to cause or contribute to a violation of an AAQS.

7.8 Additional Impacts Analysis

7.8.1 Ozone

Ozone is an area-wide pollution issue and the solution to reducing ozone levels is broad-based local and regional reductions in NO_X and VOC emissions (the precursors to ozone formation).

The continuing FPL system-wide NO_X decreases in general (Figure 14), including those due to the PEEC project, should help to reduce ozone on a regional basis including Broward County (given cooperation of meteorological factors). The ozone benefits of such reductions will be reinforced by reductions due to implementation of other NO_X control projects, particularly at coal-fueled power plants, around the state as operators complete their air pollution control projects pursuant to the Clean Air Interstate Rule (CAIR) or its successor, the Cross State Air Pollution Rule (CSAPR).

Table 21. Projected Ambient Air Quality Concentrations after PEEC

Pollutant	Averaging Time	Major Sources Impact ($\mu g/m^3$)	Background 2009- 2011 ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	AAQS ($\mu g/m^3$)	Total Impact Greater Than AAQS?
PM_{10}	24-hour	5	21	26	150	NO
	Annual	1	13	14	50	NO
$PM_{2.5}$	24-hour	5	18	23	35	NO
	Annual	1	9	10	15	NO
SO_2	1-hour	6	102	108	195	NO
	3-hour	6	31	37	1,300	NO
	24-hour	3	8	11	260	NO
	Annual	1	3	4	60	NO
NO_2	Annual	17	11	28	100	NO
	1-hour	31	83	114	188	NO
CO	1-hour	141	2,300	2,441	40,000	NO
	8-hour	71	1,150	1,221	10,000	NO

7.8.2 Impact on Soils, Vegetation, and Wildlife:

Substantial net emissions reductions of approximately 13,000 tons/year of PSD pollutants due to the PEEC project for sulfuric acid mist, SO_2, PM_{10} and NO_X will help ameliorate past air pollution effects on soils, vegetation and wildlife. The applicant modeled the impacts from the existing facility for comparison purposes.

7.8.3 Impact on Visibility:

There will be some visibility improvement in the immediate vicinity because of the reduction of particulate emissions due to the PEEC project. However substantial improvement already occurred when electrostatic precipitators were installed on Units 1-4 pursuant to a 2002 agreement with the Department. The project will contribute to regional visibility (regional haze) improvement due to the significant reductions in condensable and fine particulate precursors (especially SO_2 and NO_X).

8. PRELIMINARY DETERMINATION

The Department makes a preliminary determination that the proposed PEEC Project will comply with all applicable state and federal air pollution regulations as conditioned by the Draft Permit. This determination is based on a technical review of the complete application, reasonable assurances provided by the applicant, the draft emissions standards determinations, review of the air quality impact analysis, and the conditions specified in the draft permit.

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