TECHNICAL EVALUATION

AND

PRELIMINARY DETERMINATION

Tampa Electric Company

Big Bend Station

Solid Fuel Fired Steam Unit No. 3
Furnace and ESP Enhancements

Tampa, Hillsborough County

DEP File No. 0570039-058-AC

Department of Environmental Protection
Division of Air Resource Management
Office of Permitting and Compliance

July 2, 2012

TECHNICAL EVALUATION AND PRELIMINARY DETERMINATION

1. APPLICATION INFORMATION

1.1 Applicant Name and Address

Tampa Electric Company (TEC)
Big Bend Station - Electric Generating Facility
Apollo Beach Road
Tampa, Hillsborough County, Florida 33572

Authorized Representative: Byron Burrows, Manager – Air Programs

1.2 Reviewing and Process Schedule

03-26-12: Date of Receipt of Application.
04-09-12: DEP Incompleteness Letter for the Air Construction Permit request.
05-10-12: Received TEC Response to Incompleteness Letter.
MM-DD-12: Intent Issued.

2. FACILITY INFORMATION

2.1 Facility Location

The Big Bend Station Power Plant is located at Big Bend Road, North Ruskin, Hillsborough County. This site is approximately 75 kilometers from the Chassahowitzka National Wilderness Area, a Class I PSD Area. The UTM coordinates of this facility are Zone 17; 361.9 km E; 3075.0 km N.

2.2 Standard Industrial Classification Codes (SIC)

Industry Group No.	**49**	**Electric, Gas, and Sanitary Services**
Industry No.	**4911**	**Electric Services**

2.3 Facility Category

The TEC facility is a nominal 1998 MW (megawatts) electric generation facility. This facility consists of four steam boilers (Units Nos. 1 through 4); four steam turbines; three simple-cycle combustion turbines (CT Nos. 1, 2, and 3); solids fuels, fly ash limestone, gypsum; slag, and bottom ash storage and handling facilities, and fuel oil storage tanks.

This facility is classified as a Major or Title V Source of air pollution because emissions of at least one regulated air pollutant, such as particulate matter (PM/PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO), or volatile organic compounds (VOC) exceeds 100 TPY.

This facility is within an industry included in the list of the 28 Major Facility Categories per Table 62-212.400-1, F.A.C. Because emissions are greater than 100 TPY for at least one criteria pollutant, the facility is also a major facility with respect to Rule 62-212.400, Prevention of Significant Deterioration (PSD).

This facility is also subject to the provisions of Title IV, Acid Rain, New Source Performance Standards, and Florida's Clean Air Interstate Rule.

3. UNIT 3 PROJECT DESCRIPTION

Big Bend Unit 3, a solid fuel fired steam generating unit was constructed prior to the New Source Performance Standards (NSPS) having begun commercial operation in 1976. Unit 3 is a Riley Stoker Turbo-Furnace wet bottom design with a generator nameplate rating of 445 MW. It was equipped originally with an ESP and later added low NO_X burners, selective catalytic reduction controls (SC*R*) and integrated a flue gas desulfurization (FGD) system from the existing Unit 4 FGD.

Figure 1. Big Bend Power Plant Showing the Unit 4 FGD for scrubbing Units 3 and 4 (bottom right, four scrubber modules seen to the right of all 4 stacks at ground level) and the new common FGD for scrubbing Units 1 & 2 (far left stack, FGD is connected at the base of the stack).

These types of boilers (sometimes called slag tap furnaces) are much more compact than pulverized coal boilers used by most large utility generating stations. They can burn a wide range of fuels and generate a higher proportion of bottom ash than fly ash (50 to 80% bottom ash vs. 15 to 20% bottom ash for pulverized coal boilers). With wet-bottom boilers, the molten ash is withdrawn from the boiler and allowed to flow into quenching water. The rapid cooling of the slag causes it to immediately crystallize into a black, dense, fine-grained glassy mass that fractures into angular particles, which can be crushed and screened for several uses. (Reference: http://www.caer.uky.edu/kyasheducation/boilerslag.shtml).

The changes to Unit 3 emissions controls over the past 15 years have exacerbated a wet slagging problem in the radiant areas and fouling in the convective pass of the boiler and consequently have lower steam temperatures in the superheater, reheater, and economizer sections of the furnace. The two main types of deposits in boilers are slagging and fouling. Slagging results from deposits within the furnace, in areas directly exposed to flame radiation such as furnace walls and some widely spaced pendant super-heaters. This slagging takes place in the hottest parts of boiler. Radiant boiler slagging can be sticky or molten deposits that are difficult to remove by soot blowing or other online techniques. Fouling is the second type of boiler deposit. These deposits are in areas not directly exposed to flame radiation such as the more closely spaced tubes in convection sections of boiler like the economizer located in the back pass section of the boiler. Fouling takes place as flue gas & suspended fly ash cool down. The effects of ash deposition on boiler performance includes a reduction of heat transfer from combustion gas to water-steam and leads to an increase in the furnace exhaust gas temperature, and can therefore lead to a further increase in the slagging deposition rate. As this deposition process continues, it results in continually changing conditions in the boiler and degrades the boiler performance. The formation mechanisms of slagging and fouling are very different for each form of boiler deposits. When excessive ash deposition becomes a performance issue, the as-fired fuel properties should be evaluated, including the coal propensity to slag or foul. Operating parameters like increasing boiler excess air levels can also mitigate slagging since

localized reducing atmospheres within the boiler can increases the potential for coal ash to slag. Historically, TECO was able to operate at higher excess air levels in Unit 3 to minimize slagging in the boiler but when the low NO_X burners were installed and other back end pollution controls were added, it limited this option for higher excess air levels. The proposed changes to the boiler's radiant and convective heat transfer sections are reported to be necessary in order to address boiler slagging and fouling that have become worse with add on pollution controls, especially the low NO_X burners.

In this project TECO has proposed modifications to the furnace for Unit 3 to address a slagging problem by improving the heat transfer sections and by changes to the nose area at the top of the furnace. The nose extension will increase the velocity of the exhaust gases and thereby reduce fouling while also reducing radiant heating of the ash to help keep ash temperatures in the upper furnace below the ash fusion temperature where slagging can occur. These changes include adding additional boiler surface area to increase the outlet steam temperature of the superheater, reheater and economizer sections. TEC will replace the original high temperature superheater, reheater, and economizer as well as the radiant superheater and the nose arch as part of this project. These changes should allow this unit to operate with less fouling and up to the original designed levels for electrical power production.

On December 16, 1999, TECO representatives signed a Consent Final Judgment with DEP which resulted in large emission decreases from each of the four emissions units at the Big Bend Power Station for SO_2, NO_X and particulate matter. And on February 29, 2000, TECO representatives signed a consent decree with the EPA which set out a schedule of emission reduction projects at the Big Bend Power Station. As part of the Consent Order, Big Bend Unit3 was retrofit with a SCR system for NO_X control and the exhaust flow was required to operate (with some exceptions) with emissions routed to a common SO_2 scrubber (with Unit 4) and then these exhaust gases were directed to common stack CS002. As a result of a more recent project, Unit 4 exhaust gases are no longer co-mingled with Unit 3 exhaust as they were when this unit began to utilize the common scrubber. This unit was originally designed as a pressurized furnace and was subsequently converted to balance draft furnace as part of the SCR installation. The Consent Order also required optimization of the existing ESP. The Consent Order has resulted in significantly lower emission limits for SO_2, NO_X and PM and has also required continuous PM monitoring on this unit. In 2008, after installation of the SCR system, the NO_X emission limit was reduced to 0.12 lb/MMBtu for Unit 3 due to the consent order. The PM limit was also reduced to 0.03 lb/MMBtu to as a result of an ESP optimization study required by the Consent Order. The SO_2 emissions from the entire Big Bend facility have also been reduced dramatically as a result of the Consent Order.

One aspect to review for any furnace modification is the impact on heat input to the boiler. It is important to first understand how heat input is quantified for Unit 3. TECO representatives have described the method for determining heat input using fuel sampling and analysis of weekly composite samples as described in the next paragraph. TECO measures heat input by coal sampling and analysis from manual grab samples and total weight going to the coal bunker for Unit 4 over the course of a day. Coal is fed to Unit 4's bunker from six blending bins that have a capacity of about half day of coal operation per bin. The bunker has a conveyer scale to measure the weight of coal loaded from each bin. There are scales that measures total bin weight from each of the six bins that feed the Unit 4 coal bunker. The bunker is reloaded several times per day depending on the Unit 4's fuel requirements (operating load levels). Daily 5 gallon manual samples are taken and pulverized/reduced to 100 gram samples, and blended for a weekly composite sample that is analyzed for heat content, moisture, sulfur and trace metals. For a given week, each daily coal sample is reduced from the original 100 gram fuel sample to a smaller weight that is proportional to the daily fuel demand for that week. For example, if each day Unit 4 burned the same amount of coal, then each day's contribution to the weekly composite would be 15 grams to provide the

Figure 2. Boiler Tube Fouling (http://www.intelligent-sootblowing.com/Seiten/slaggingandfouling.html)

weekly 105 gram sample that is analyzed. Once the heat content of the coal is determined, then the heat input is calculated by multiplying the feed rate of coal (tons/yr) by the heat content of the coal to obtain million British Thermal Units per hour (MMBtu/hr). Alternatively, heat input is also determined for each of the Big Bend units as required in Part 75 using the continuous emission monitoring system on an hourly basis.

For this project the applicant has not requested an increase in the value of the heat input listed in the current permit for Unit 3, the original design value and what the company believes is the current maximum heat input of the boiler today, the nameplate rating of 4,115 MMBtu/hr. In the application, TECO stated that the boiler will operate at the existing low NO_X condition, using 10% excess air as designed for the Low NO_X burners, and the past actual and future actual emissions are projected to be identical. Based on a Planning a growth computer model (PAR) the applicant expects the future projected and past boiler utilization rates to be essentially equal. Therefore, if the PAR model is correct, annual emissions will not increase significantly after these furnace and ESP improvements. TECO submits that this project will not trigger the requirements of Rule 62-212.400 F.A.C for PSD/NSR.

It is apparent to the department that the physical changes proposed (replacements of radiant super heater, reheater, economizer, and nose arch) to the Unit 3 furnace are modifications which have the potential to result in higher capacity factors or consistently higher heat inputs following this project and therefore may (but not necessarily) lead to increases in annual emissions of pollutants regulated by Rule 62-212.400 F.A.C. for PSD. As an indication of any future increases associated with this project, TECO will be required to evaluate the following pollutants for which CEMS data is recorded: PM, NO_X, SO_2 and CO from Unit 3. Because TECO has projected future emissions at levels that are not significantly higher than the past actual emissions (and not by comparison with potential to emit emission levels), the following provisions from Rule 62-212.300(1)(e) F.A.C. will apply:

(e) If the Department issues any construction permit which avoids the requirements of subsections 62-212.400(4) through (12), F.A.C., based in whole or in part on projected actual emissions calculations, the permit shall contain the following monitoring, reporting and recordkeeping provisions:

1. The permittee shall monitor the emissions of any PSD pollutant that the Department identifies could increase as a result of the construction or modification and that is emitted by any emissions unit that could be affected; and, using the most reliable information available, calculate and maintain a record of the annual emissions, in tons per year on a calendar year basis, for a period of 5 years following resumption of regular operations after the change, or for a period of 10 years following resumption of regular operations if the change increases the design capacity of that emissions unit or its potential to emit that PSD pollutant. Emissions shall be computed in accordance with Rule 62-210.370, F.A.C.

2. The permittee shall report to the Department within 60 days after the end of each year during which records must be generated under subparagraph 62-212.300(1)(e)1., F.A.C., setting out the unit's annual emissions during the calendar year that preceded submission of the report. The report shall contain the following:
   a. The name, address and telephone number of the owner or operator of the major stationary source;
   b. The annual emissions as calculated pursuant to subparagraph 62-212.300(1)(e)1., F.A.C.;
   c. If the emissions differ from the preconstruction projection, an explanation as to why there is a difference; and
   d. Any other information that the owner or operator wishes to include in the report.

3. The information required to be documented and maintained pursuant to subparagraphs 62-212.300(1)(e)1.

3.1 ESP Upgrades

In the EPA Consent Order, Condition 32 required TECO to complete an ESP optimization study. Based on the results of this study and EPA's approval of the study's recommendations, TECO implemented several changes to the ESPs on each unit. The ESP study resulted in recommendation for an emission standard for PM of 0.03 lb/MMBtu for Units 1-3, and 0.01 lb/MMBtu for Unit 4 which has an oversized ESP and is capable of the lower standard. Early modifications to the ESPs were done to optimize the flow and collection efficiency of each of the 4 ESPs and consisted of:

- Flyash gate valve replacements
- New ESP Power controls
- Independent DCU for each of the units
- New/upgraded flyash controls
- Balancing of flows/temperatures

These changes were made before 2004 pursuant to Condition 32. The ESPs for each unit have all demonstrated that they can meet the lower emission limits shown above. The current project is part of some remaining work identified in the study to further improve the ESP performance. TECO is proposing to implement the following additional changes to the Unit 3 ESP:

- Wide plate spacing (12 in plate spacing), and rigid electrodes
  - Convert first 3 mechanical fields of lower precipitator on Unit 3 from weighted wire electrodes with 9 inch plate spacing to rigid electrodes and 12 inch spacing
- Increase the Transformer/Rectifier Sectionalization
  - convert existing 16 fields of lower and upper precipitator to 32 electrically isolated fields
- Upgrade ESP control system
  - Install automatic voltage controls on all T/R sets and high frequency power supplies
  - Automatic voltage control and rapper control systems

Therefore, pursuant to Rule 62-212.300, F.A.C., the department will authorize these physical changes to the Unit 3 furnace along with 5 years of monitoring for emissions changes by an air construction permit. The department will also authorize the ESP upgrades for Unit 3 by the same air construction permit. The permit will require TECO to review the monitoring data for PM, NO_X SO_2 and CO on Unit 3 for 5 years following this project, and to compare with the actual emission levels that have been reported in the application for this project.

4. RULE APPLICABILITY

This project will be reviewed under Rule 62-212.300 F.A.C., General Preconstruction Review Requirements. This proposed AC revision for Unit 3 (furnace and ESP improvements), is not subject to review under Rule 62-212.400 F.A.C., Prevention of Significant Deterioration (PSD) at this time, because this project is not projected to result in a modification and potential emission changes, if any, do not exceed the significant emission rates given in Chapter 62-212, Table 62-212.400-2, F.A.C.

This facility is located in an area (Hillsborough County) designated "unclassifiable" for SO_2, "maintenance" for Ozone (O_3), and lead (Pb), in the "area of influence" of the PM maintenance area and "attainment" for all the other criteria pollutants. [Rule 62-204.360, F.A.C.].

This facility shall comply with all applicable provisions of the Florida Administrative Code (including applicable portions of the Code of Federal Regulations incorporated therein). These requirements are to be incorporated in the current Title V Operation Permit for this facility.

5. SOURCE IMPACT ANALYSIS

Emission Limitations: This revision does not impose any new emission limits or changes to existing limits. The construction permit allows the applicant to modify Unit 3 furnace and ESP and there is not expected to be significant changes to the annual emissions as a result of this project.

6. CONCLUSION

Based on the foregoing technical evaluation of the application and additional information submitted by the applicant, the Department has made a preliminary determination that the proposed project will comply with all applicable state and federal air pollution regulations.

Martin Costello, P.E.