TECHNICAL EVALUATION

AND

PRELIMINARY DETERMINATION

Tampa Electric Company

Big Bend Station

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

Revised July 23, 2012

1. APPLICATION INFORMATION

1.1 Applicant Name and Address

Tampa Electric Company (TEC)
Big Bend Station - Electric Generating Facility
13031 Wyandotte Road
Apollo Beach, 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.
07-02-12: Intent Issued.
07-18-12: Extension of time to request a hearing granted to 08-15-12.
08-23-12: Intent Revised/Reissued.

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 1,892 MW (megawatts) electric generation facility. This facility consists of four steam boilers (Unit Nos. 1 through 4); four steam turbines; two simple-cycle combustion turbines (SCCT 4A and 4B); 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 (SCR) and integrated a flue gas desulfurization (FGD) system from the existing Unit 4 FGD.

Figure 1. Big Bend Power Plant showing the 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 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 {such as roofing shingles and sand blasting grit}. (Reference: http://www.caer.uky.edu/kyasheducation/boilerslag.shtml).

Changes which have been made to Unit 3 emissions controls over the past 15 years have exacerbated a 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, which 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 these 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, TEC 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 TEC has proposed the following modifications to the furnace for Unit 3 to address slagging and lower steam temperatures. Additional surface area will be added to the high temperature superheater, radiant superheater and high temperature reheater to increase the outlet steam temperature from the boiler. TEC will also replace the original high temperature superheater, reheater, and economizer as well as the radiant superheater and extend the nose arch as part of this project. The nose arch extension will increase the velocity of the exhaust gases and thereby reduce fouling while also reducing radiant heating of the ash to maintain ash temperatures in the upper furnace below the ash fusion temperature where slagging can occur. These changes should allow this unit to operate with less fouling and up to the original designed levels for electrical power production. These changes are needed in part because of the added emission controls installed under the Consent Decree discussed in the next section.

Figure 2. Boiler Tube Fouling

(http://www.intelligent-sootblowing.com/Seiten/slaggingandfouling.html)

On December 16, 1999, TEC 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. On February 29, 2000, TEC 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 Decree, Big Bend Unit 3 was retrofit with a SCR system for NO_X control and the exhaust flow (with some exceptions) was routed to a common SO_2 scrubber (with Unit 4) and then these exhaust gases were directed to common stack Common Stack 2. As a result of the December 2007 duct split project, Units 3 and 4 utilize separate SO_2 scrubbers and exhaust stacks. Common Stack 3 is now fully dedicated to Unit 3 and Common Stack 2 is now fully dedicated to Big Bend Unit 4.

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 Decree also required optimization of the existing ESP. The Consent Decree 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 Decree. The PM limit was also reduced to 0.03 lb/MMBtu to as a result of an ESP optimization study required by the Consent Decree. The SO_2 emissions from the entire Big Bend facility have also been reduced dramatically as a result of the Consent Decree.

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. TEC representatives have described the method for determining heat input using fuel sampling and analysis of weekly composite samples as described in the next paragraph. TEC measures heat input by coal sampling and analysis from manual grab samples and total weight going to each coal bunker during the course of a day. Coal is fed to each unit's bunker from six blending bins that have a capacity of about a 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 measure total bin weight from each of the six bins that feed the coal bunkers. Each bunker is reloaded several times per day depending on the fuel requirements (operating load levels). Daily 5 gallon (approximately) manual samples are collected and blended to prepare 100 gram samples (approximately) for a weekly composite sample that is analyzed for heat content, moisture, sulfur and trace metals. Once the heat content of the composite sample is determined, the heat input is then 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 <u>has not</u> requested an increase in the design heat input rate listed in the current permit. TEC believes the nameplate rating of 4,115 MMBtu/hr is representative of the current unit design capacity. In the application, TEC 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 and Risk (PAR) a computer model the applicant expects the future projected and past boiler utilization rates to be essentially equal. Therefore, if the PAR model is correct, future actual emissions will not increase significantly after these furnace and ESP improvements. In addition, the relatively low price of natural gas compared to coal has caused lower utilization rates for coal fired units similar to Unit 3. TEC submits that this project will not trigger the requirements of Rule 62-212.400 F.A.C for PSD/NSR.

3.1 ESP Upgrades

In the EPA Consent Decree, Condition 32 required TEC to complete an ESP optimization study. Based on the results of this study and EPA's approval of the study's recommendations, TEC 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 of the Consent Decree. 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. TEC 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

The Consent Decree paragraph 44.B. and Consent Final Judgment paragraph V.M. provides that TEC is protected from triggering New Source Review requirements with regard to repairs, maintenance and physical or operational changes while completing the terms of the agreement. Since both documents are still in effect, this project is exempt for the PSD requirements, including the 5 year monitoring requirements. In addition, the emission controls (SCR, FGD and ESP optimization) imposed under the state and federal orders discussed above had been designed to control emissions at or near BACT levels.

Therefore, with this construction permit the department will authorize the physical changes to the Unit 3 furnace described above. The Department will also authorize the ESP upgrades for Unit 3 by the same air construction permit.

4. RULE APPLICABILITY

This project has been 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

The Department makes a preliminary determination that the proposed 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, and the conditions specified in the draft permit. No air quality modeling analysis is required for this project. Martin Costello, P.E., is the project engineer responsible for reviewing the application and drafting the permit. Additional details of this analysis may be obtained by contacting the project engineer at the Department's Office of Permitting and Compliance at Mail Station #5505, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.