TECHNICAL EVALUATION

Florida Power Corporation dba
Progress Energy Florida (PEF)
P.L. Bartow Power Plant Unit 1

Biofuel Test Burn

Pinellas County

DEP File No. 1030011-011-AC

Department of Environmental Protection
Division of Air Resource Management
Bureau of Air Regulation

February 4, 2009

I. APPLICATION INFORMATION

A. APPLICANT NAME AND ADDRESS

Florida Power Corporation dba
Progress Energy Florida (PEF)
1601 Weedon Island Dr.
St. Petersburg, Florida 33702

Authorized Representative:
Tom Lawery, Plant Manager

B. PROCESSING SCHEDULE

- The Florida Department of Environmental Protection (Department) received a construction permit application (DEP File No. 1030011-011-AC) on March 25, 2008 requesting that Florida Power Corporation dba Progress Energy Florida, Inc. (PEF) be allowed to test burn a E-Grass based liquid biofuel in combustion turbines (CT) and/or steam units (SU) at the P.L. Bartow Power Plant.
- The Department held a meeting on April 9, 2008 to discuss the application with representations of PEF.
- The Department deemed the application complete on April 24, 2008.
- PEF requested and provided various waivers to the Department's processing clock and submitted a revised application on November 10, 2008. In the revised application a vegetable based biofuel produced by New Generation Biofuels (NGB) called SuperClassic (SC) was added to the test burn request.
- The Department sent a request for additional information (RAI) with regard to the revised application to PEF on December 10, 2008.
- PEF responded to the RAI on December 23, 2008. In the response PEF requested that the test burning of the E-grass biofuel be removed from the application with only the test burning of the SC biofuel remaining in the field test.
- The Department deemed the revised application complete on January 20, 2009.
- On January 23, 2009, PEF requested by email that the test of the SC biofuel be limited to 12,000 gallons in SU No. 1 at the Bartow facility, with the testing of the SC biofuel in a CT at the facility occurring at a later date under a different permit (DEP File No. 1030011-014-AC).
- A draft permit package was issued by the Department on February 4, 2009.

C. FACILITY LOCATION

The P.L. Bartow Power Plant is located on Weedon Island on the eastside of St. Petersburg in Pinellas County as shown in Figure 1. Figure 2 is a picture showing the stacks for the three residual fuel oil fired steam electrical generators (also called steam units).

D. FACILITY CLASSIFICATION CODE (SIC)

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

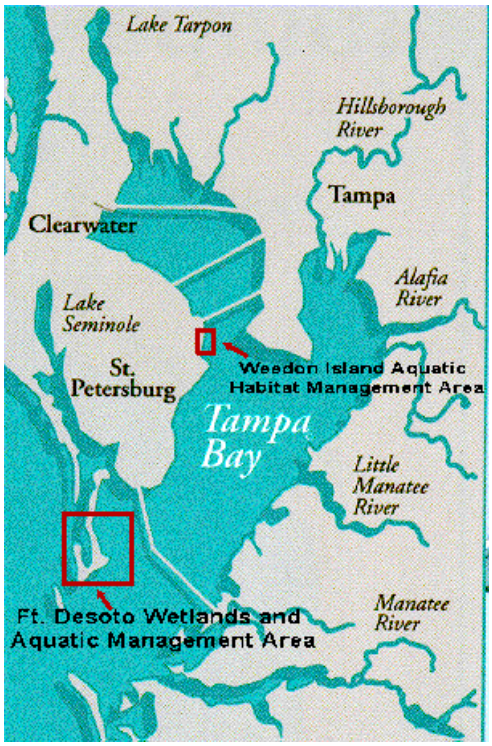

Figure 1. Location of Weedon Island. **Figure 2. Steam Units at P.L. Bartow Plant.**

E. Regulatory Categories

SU 1, 2 and 3 are older residual fuel oil fired units that were built prior to the existence of EPA and Department standards. They comprise part of a major stationary source with respect to the rules for the Prevention of Significant Deterioration (PSD) and operate pursuant to a facility Title V operation permit. The units are also subject to the Title IV Acid Rain Program and the Clean Air Interstate Rule (CAIR). SU 1, 2 and 3 will be permanently shut down in the spring of 2009 in conjunction with the startup of a natural gas-fueled combined cycle unit.

II. PROPOSED PROJECT

A. Basic Description

PEF will test 12,000 gallons of a vegetable based biofuel in SU 1. The biofuel is called SuperClassic (SC) and was developed by New Generation Biofuels (NGB). According to information provided in the application, NGB SC biofuel is formulated from processed palm, canola or recycled vegetable oils.

B. Characteristics of NGB SC

NGB SC is designed for use in applications where No. 2 diesel, other distillates or biodiesel are used. This particular biofuel is an emulsion. NGB SC is manufactured using a process that is different than biodiesel and glycerin is not generated during its production. A product data sheet for the SC biofuel is summarized below in Table 1. More information on NGB can be found at their web site: www.newgenerationbiofuels.com/index.php

Table 1. SC Biofuel Specifications (source: PEF).

Test	Units	Test Method	Typical	Min.	Max.
Flash Point	°F	D93		114	
	°C			45.56	
Water & Sediment	% Vol.	D1796 or D2709	0.1		1.0
Moisture[a]	% Vol.	---	20 to 30		
Kinematic Viscosity[b]	cSt	D445	34.5		60.0
Ash	% mass	D482			0.001
Sulfated Ash	% mass	D874			0.001
Sulfur	ppm	D5453	0		<1
Copper Strip Corrosion	---	D130			1b
Pour Point	°F	D97	-0.4	5	-11
	°C		-18	-15	-24
Carbon Residue[c]	% mass	D4530	0.05		
Total Acid Number	mg KOH/g	D664	0.04		
Oxidation Stability	hours	EN 14112	2.3		
Phosphorus Content	ppm	D4951 or IAC 027	<1.0		6.0
Sodium + Potassium	ppm	EN 14538 or IAC 027	<1.0		3.0
Calcium & Magnesium	ppm	EN 14538 or IAC 027	<1.0		3.0
Iodine Number	---	AOCS Cd 1d-62	67.5		
Lubricity @ 60 °F[d]	mm	D6079	0.170		
Vapor Press. @ 100 °F	psi	D323 proc. A	0.7		
Ultimate Analysis (CHONS)	% mass	D5291	C=55.7 H=11.6 O=32.67 N=<0.3 S=0		
Gravity @ 60 °F	Degrees API	D4052	21.06		
Specific Gravity 60 °F	---	AOCS Cc 10a-25	0.9339		
Lead	ppm	IAC 027 mod. B			<0.1
Copper	ppm	IAC 027 mod. B			<0.1
Vanadium	ppm	IAC 027 mod. B			<0.05
Heat of Combustion[e]	Btu/gal	D240		~91,500	

(a) From material safety data sheet provided by NGB for the SC biofuel contained in Appendix A of revised application.

(b) At 40 °F in centistokes (mm^2/s).

(c) 100 percent of sample.

(d) Wear scar diameter.

(e) From response to RAI: Higher Heating Value (HHV) of SC biofuel with a density of 7.69 lb/gal, this corresponds to a Lower Heating Value (LHV) of approximately 87,000 Btu/gallon.

C. PROJECT DESCRIPTION

Testing of SC biofuel will be conducted in late February to mid March 2009 in SU No. 1 that is destined for permanent shut down on March 21, 2009. The fuel will be delivered by tanker truck and maintained in the same tank. The total amount of biofuel tested will be 12,000 gallons, which is equivalent to approximately two tanker trucks. The biofuel will be fed from the tank utilizing an electrically powered pump skid. No changes will be made in the service of any of the existing tanks at the facility.

Following is the sequence of biofuel introduction to SU 1:

1. **Phase I**: Two igniter lances located on the 2nd burner level will be utilized to inject the SC biofuel into the furnace The SU will be brought up to load using conventional light-off procedures. Once the No. 6 burner levels are operating at a stable condition, the SC biofuel system will be valved in and the SC biofuel will be injected into the existing No. 6 fuel oil flame. A visual inspection will be made to ensure the biofuel is fully combusting. It is anticipated that the duration during of this test phase will be approximately 4 hours with a total SC biofuel usage of approximately 1,200 gallons.

2. **Phase II**: If Test Phase I is successfully completed, Test Phase II will commence. In this test phase, the objective is to determine if the SC biofuel will ignite using the pilot spark designed to light No. 2 fuel oil. Lower burners will be service during the test phase. The SC biofuel will be introduced to the furnace while the pilot spark is operated. A successful test burn will be one that lights the fuel and maintains stable flame conditions. Visual flame inspection will be performed and existing flame detection equipment will be used to determine if a flame profile is detected.

3. **Phase III**: Upon successful completion of Test Phase II, the third test phase will attempt igniting the No. 6 oil burner using the SC biofuel as the ignition fuel. The furnace will be brought up to load using conventional methods with the exception of the two 2nd level burners, which will utilize SC biofuel injected through the igniter lance as its ignition source. Stable main burner flame utilizing No. 6 fuel oil will determine the success of this test phase. Upon main burner ignition, the SC biofuel injection can be discontinued and the SU operated as needed.

III. REQUESTED PERMIT DETAILS

In summary, PEF has requested the following major conditions in the AC for the test burning of the SC biofuel at the P.L. Bartow Power Plant:

- To test burn the SC biofuel in SU No. 1 at the Bartow facility;
- Test the SC biofuel as a replacement for No. 2 fuel oil used as a startup fuel;
- Test the SC biofuel as a supplemental fuel (10 percent by volume) to the No. 6 fuel oil currently used during normal operation of the SU; and
- To limit the use of the biofuel during the test burn to two tanker trucks (~12,000 gallons), with testing completed by March 21, 2009 when SU No. 1 is scheduled to be permanently shut down.

IV. EFFECTS ON EMISSIONS

Following is PEF's review of the expected effects on emissions:

A. SULFUR DIOXIDE (SO_2)

Because of the sulfur content of the biofuel is nearly zero, emissions of SO_2 will decrease compared with use of the residual fuel oil (< 2.5% sulfur) or even the distillate oil used to assist with startup.

B. PARTICULATE MATTER (PM/PM_{10})

Because of the low ash content, PM/PM_{10} emissions during the test burn should be less than the values when the SU is burning No. 2 (starter) distillate fuel or No. 6 (operational) residual fuel oil. The low sulfur and low metals will reduce emissions of sulfuric acid mist and acid smut fallout, other factors being equal. Unit 1 is the only one of three residual fuel oil-fired units located at the site that has an electrostatic precipitator (ESP) for PM/PM_{10} control.

C. NITROGEN OXIDES (NO_X)

According to PEF, (NO_X) emissions while burning the biofuel should be less than NO_X emissions while burning No. 6 residual fuel oil. The reason is that the fuel bound nitrogen (FBN) content of the SC biofuel is at the low range of No. 6 fuel oil (<=3,000 ppm). At the same time, the relatively high moisture content (20 to 30 %) of the SC biofuel should act as an inhibitor to thermal NO_X formation.

Although the FBN of the biofuel is greater than the FBN of No. 2 (starter) distillate oil, PEF expects comparably less emissions when using the biofuel because it is the thermal NO_X that dominates emissions from such furnaces.

The Department does not necessarily agree with the claims above, but these would be proven during an actual test.

D. CARBON MONOXIDE (CO) AND VOLATILE ORGANIC COMPOUNDS (VOC)

According to PEF, carbon monoxide (CO) and volatile organic compounds (VOC) emissions may be slightly higher but well below significant emissions rates (SER) when burning the SC biofuel due to the higher moisture content of the bio-fuel which could affect combustion efficiency. Data obtained during testing should allow all these estimates to be verified.

E. VISIBLE EMISSIONS (OPACITY)

Visible emissions (VE) as measured by plume opacity are often quite high from the existing units. The testing of biofuel should not have adverse effects on the present VE characteristics of the unit.

V. PARAMETERS MONITORED DURING TESTING

A. OPERATIONAL PARAMETERS

Igniter nozzle tip inspections will be performed at the end of each test phase to ensure no coking occurred during the test burns. A visual inspection of the furnace walls will also be performed to verify that no visual residue remains in the furnace.

B. EMISSIONS MONITORING

Continuous Emission Monitoring (CEM) equipment for SO_2, NO_X, and opacity will be used to measure emissions during each test phase.

VI. PRELIMINARY DETERMINATION

The department does not necessarily agree with all the applicant's assumptions with regard to pollution emissions reductions that will occur when firing the biofuel. However the Department believes the applicant can conduct the testing within the permitted operational and emission limitations of the existing Title V permit based on the biofuel material properties provided by PEF in their revised application and response to the department's RAI.

The use of 12,000 gallons of biofuel in SU No. 1 prior to its permanent shut down will not increase emissions significantly when compared with the thresholds for PSD review.

Additional details of this analysis may be obtained by contacting David Read by phone at (850) 414-7268, by email at David.Read@dep.state.fl.us or by mail at the Department's Bureau of Air Regulation, Mail Station #5505, 2600 Blair Stone Road, Tallahassee, Florida, 32399-2400.