## APPLICATION INFORMATION

RECEIVED
JUL 24 2008
BUREAU OF AIR REGULATION

### Professional Engineer Certification

1. Professional Engineer Name: **Scott H. Osbourn**
   Registration Number: **57557**
2. Professional Engineer Mailing Address...
   Organization/Firm: **Golder Associates Inc.****
   Street Address: **5100 West Lemon St., Suite 114**
   City: **Tampa** State: **FL** Zip Code: **33609**
3. Professional Engineer Telephone Numbers...
   Telephone: **(813) 287-1717** ext.**53304** Fax: **(813) 287-1716**
4. Professional Engineer Email Address: **sosbourn@golder.com**
5. Professional Engineer Statement:

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

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

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

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

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

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

Signature

Date 7/22/08

(seal)

SCOTT OSBOURN LICENSE NO. 57557 STATE OF FLORIDA PROFESSIONAL ENGINEER

*** Attach any exception to certification statement.**
**** Board of Professional Engineers Certificate of Authorization # 00001670**

## APPLICATION INFORMATION



### Owner/Authorized Representative Statement

**Complete if applying for an air construction permit or an initial FESOP.**

1. Owner/Authorized Representative Name :
   **Roy S Belden**
2. Owner/Authorized Representative Mailing Address...
   Organization/Firm: **Shady Hills Power Company, LLC**
   Street Address: **120 Long Ridge Rd.**
   City: **Stamford** State: **CT** Zip Code: **06927**
3. Owner/Authorized Representative Telephone Numbers...
   Telephone: **(203) 357-6820** ext. Fax: **(203) 961-5116**
4. Owner/Authorized Representative Email Address: **Roy.Belden@GE.com**
5. Owner/Authorized Representative Statement:

   *I, the undersigned, am the owner or authorized representative of the corporation, partnership, or other legal entity submitting this air permit application. To the best of my knowledge, the statements made in this application are true, accurate and complete, and any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department.*

Roy S. Belden — Signature

7/21/08 — Date

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   Roy S. Belden — Signature

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Golder Associates

July 21, 2008

**Via Federal Express**

Jeffery F. Koerner
New Source Review Section
Florida Department of Environmental Protection
Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

**Re:** Request for Additional Information Regarding the Site Expansion – Addition of Two 170 MW Simple Cycle Combustion Turbines – for the Shady Hills Generating Station; Project No. 1010373-007-AC (PSD-FL-402)

Dear Mr. Koerner:

Shady Hills Power Company, LLC (Shady Hills) is in receipt of the Department's June 11, 2008 request for additional information (RAI) related to the May 13, 2008, air construction permit to construct and install two simple cycle GE 7FA combustion turbines at the existing Shady Hills Generating Station. The following responses are provided to the comments in the order in which they were received.

1. Section 2-3 of the Prevention of Significant Deterioration (PSD) report provided with the application identifies the potential emissions of carbon monoxide (CO) for natural gas and distillate oil from the two simple cycle GE 7FA combustion turbines. The report states that CO for natural gas has the potential to emit 9 ppmvd and distillate oil has the potential to emit 20 ppmvd. These emissions are based on a 59°F turbine inlet air condition and a baseload of 2,390 hours/year for natural gas and 1,000 hours/year for distillate oil. Actual CO emissions data for installed units indicate levels of 1-2 ppmvd @ 15% oxygen for gas and oil firing. Please discuss the rationale for the requested higher CO emission rates. Recent PSD permits issued by the Department for the GE 7FA combustion turbines specify CO standards at 4.1 and 8.0 ppmvd @ 15% oxygen for gas and oil firing, respectively. In addition, General Electric offers a guaranteed CO emission rate of 4.1 ppmvd @ 15% oxygen. At these levels, it may be possible for the project to escape PSD review for CO emissions. Please comment.

Response: Shady Hills has re-evaluated the emission levels for carbon monoxide (CO) for the GE 7FA combustion turbines and at this time is requesting permit limits for CO as follows:

- Natural Gas Combustion, 6.5 ppmvd; and
- Distillate Oil Combustion, 13.5 ppmvd.

Based on these concentrations, the maximum annual CO emissions for the Project are 98 tons per year (TPY) assuming an average of 750 hours per year per CT, rather than the 1,000 hours per year per CT initially requested. This annual emission level is below the PSD review threshold for CO of 100 TPY. Updated emission tables are provided in Attachment A.

2. Please describe the evaporative cooling equipment that will be installed on the simple cycle units. What is the expected maximum temperature reduction from the evaporative cooling equipment?

Response: A number of components make up the evaporative cooling system. The main components are briefly described below:

- Evaporative Media Blocks – The media blocks are direct contact, irrigated media utilizing cross-fluted cellulose blocks which are impregnated with insoluble anti-rot salts and rigidifying saturants. These blocks are retained in place by facing plates within the cooler section. Air entering the cooler and passing through the water saturated media is cooled through adiabatic exchange of heat.
- Mist Eliminator Panels – Mist eliminator blocks are installed directly downstream of the cooler media blocks. These panels protect the turbine from water droplets that may be pulled from the evaporative media blocks. Water separated out of the air stream by the mist eliminator blocks drains forward by gravity into the bottom of the cooler into a sump.
- Distribution Pads – Located on top of the media at each water distribution manifold, these pads ensure that the water is evenly distributed across the top of the media.

The evaporative cooler is used where significant operation of the turbine occurs in the warm months and where low relative humidities are common. The cooler air, being denser, gives the machine a higher mass-flow rate and pressure ratio, resulting in an increase in turbine output and efficiency. In addition to achieving extra power, the use of an evaporative cooler increases water vapor in the inlet air, thereby lowering the amount of nitrogen oxides produced in the combustion process.

The evaporative cooler design specifications are as follows (note that these values are design estimates, provided for informational purposes only):

| **Component/Condition** | **Setting** |
|---|---|
| Air Flow | 772,027 cfm |
| Evaporative Cooler Air Pressure Drop | 0.28 in. w.g. |
| Drift Eliminator Media Air Pressure Drop | 0.03 in. w.g. |
| Evaporative Cooler Media Velocity (ISO) | 538 fpm |
| Estimated Saturation Efficiency | 88 percent |

| **Component/Condition** | **Setting** |
|---|---|
| Relative Humidity | 64% |
| **Entering Conditions** | |
| Dry Bulb Temperature | 95 F |
| Wet Bulb Temperature | 84.3 F |
| **Water Conditions** | |
| Evaporation Rate | 16 gpm |
| Maximum Blow Down Rate | 16 gpm |
| Make up water Rate | 32 gpm |

The temperature reduction is not a design requirement for the cooler. Instead the design specification identifies that the cooler has a saturation efficiency of a minimum of 85 percent. Saturation efficiency is defined as follows:

SE% = [(DBE-DBL)/(DBE-WBE)] x 100

DBE = Dry Bulb Entering Temperature
DBL = Dry Bulb Leaving Temperature
WBE = Wet Bulb Entering Temperature

Accordingly, the maximum temperature decrease really depends on the condition of the incoming air (the wet and dry bulb temperatures) which is basically the humidity of the incoming air.

3. Please provide a discussion of the expected combustion turbine maintenance schedules and compare natural gas and oil.

Response: Combustion maintenance scheduling is based on independent counts of fired starts and fired hours (whichever occurs first). For a peaking plant, as in our case, combustion maintenance scheduling is "starts-based" and fuel type does not change the planned maintenance interval. A base loaded plant will be "hours-based" and fuel type does have an effect. For a base loaded plant, the distillate fuel type has an hours factor of 1.5 compared to 1.0 for gas fuel.

4. See Table B-4 of the application. This table identifies a cost associated with a "selective catalytic reduction bypass duct and stack". Please explain.

Response: Table B-4 has been updated and the bypass duct and stack have been removed. See Attachment B.

5. Were the acid rain forms provided in the application sent to Region 4 of the Environmental Protection Agency (EPA)?

Response: The Acid Rain application forms were only provided initially to the Department, however, the U.S. EPA has since been provided with copies of these application forms.

6. The application requests an average operation of 3,390 hours/year/unit with no single unit operating more than 5,000 hours/year. As requested by EPA Region 4 in the past, please revise the control equipment cost estimates for "5,000" hours/year of operation. In addition, please revise the control equipment estimates for the following items:

- An equipment life of 20 years;
- Zero indirect costs for overhead, property taxes, and insurance (see page 2-48 of EPA's OAQPS manual);
- Exclude the "MW loss and Heat Rate Penalty" cost (the table references EPA, page 6-20, but there is no page 6-20 in EPA's OAQPS cost manual);
- For the oxidation catalyst, assume replacement every 5 years or provide vendor data to support replacement every 3 years for 4,000 hours/year on natural gas or 1,000 hours/year on ultra low sulfur distillate oil; and
- Do not double count catalysts costs (see page 2-33 and 2-46 of EPA's OAQPS cost manual).

Please provide the vendor quote for the selective catalytic reduction (SCR) and oxidation catalyst equipment costs.

Response: The NOx control cost analysis has been updated and is included as Attachment B. The control costs are based on vendor quotes from 2003 and scaled up to 2008 cost based on ENR's

Construction Cost Index included as Attachment B. The following changes have been made for the cost analysis:

- Equipment life of 20 years and associated Capital Recovery Factor of 9.44%;
- Per OAQPS page 2-48, indirect costs for overhead, property taxes, and insurance have all been set equal to zero;
- MW loss and Heat Rate Penalty is from *EPA 1993 Alternative Control Techniques Document--NOx Emissions from Stationary Gas Turbines*, Page 6-20. These losses are associated with the addition of SCR and have been included and accepted by the State in previous BACT cost analysis for SCR control of combustion turbines. As such no changes have been made other than clarification of reference to the EPA 1993 Alternative Control Techniques Document--NOx Emissions from Stationary Gas Turbines.
- CO oxidation catalyst costs have not been updated since CO is no longer subject to PSD review per RAI response No. 1; and
- To prevent double counting of SCR catalyst in the cost analysis, the cost of the catalyst has been removed from the capital cost of the system.

In addition to the changes noted above, additional cost analyses are provided assuming that a single CT could operate up to 5,000 hrs/yr. A summary of the resulting cost-effectiveness evaluation is as follows:

| Scenario | Cost Effectiveness ($/ton) |
|---|---|
| 2,640 hr/y gas and 750 hr/yr oil | 9,640 |
| 4,250 hr/yr gas and 750 hr/yr oil | 8,407 |
| 5,000 hr/yr gas only | 14,050 |

7. For the facility, the existing combustion turbines have operated at the following maximum rates over the last seven years:

- Less than 1,500 hours/year/combustion turbine total (2002/2003); and
- Less than 325 hours/year/combustion turbine on oil (2002/2003).

Please explain why the proposed peaking units will operate a maximum of:

- 5,000 hours/year/combustion turbine (total);
- 1,000 hours/year/combustion turbine on oil; and
- An average of 3,390 hours/year/combustion turbine.

Response: GE has revised the permit request for oil combustion to an average of 750 hours/year/CT. However, the total maximum requested hours of operation (i.e., gas and oil-firing combined) of an average of 3,390 hours per year per CT is based on anticipated demand and the parameters of the Power Purchase Agreement (PPA). During 2007, Shady Hills experienced a demand of 2,448 total operating hours for CT1, 2,223 total hours for CT2 and 2,502 total hours for CT3. Of these totals, oil firing ranged from ~ 55 to 75 hours annually per CT. The units continue to be dispatched more frequently in 2008 than in previous years, with January through June operating hours totaling 1,414 for CT1, 1,390 for CT2 and 1,413 for CT3. If these actual operating hours were doubled to estimate operating hours for the full 2008 calendar year, it's evident that an upward trend in demand is continuing.

Therefore, regarding the above-requested operating hours, Shady Hills believes an average of 3,390 total operating hours per CT is justified based on past operating history, the anticipated annual growth in energy demand and the obligations under the PPA which require this type of operating flexibility. The request for up to a maximum of 5,000 hours per year of operation for an individual CT, again, is necessary in the event other CTs are not operational or otherwise unavailable. The total operating hours among the two CTs would not increase, however, the maximum hours on an individual CT could. At the Department's request, the response to Comment 6 above provided a revised cost-effectiveness determination based on the ability of an individual CT to operate up to 5,000 hours per year. Finally, as stated above, Shady Hills has revised the requested oil-firing hours to an average of 750 hours per CT, rather than the 1,000 hours per CT initially requested. Shady Hills requires this operational flexibility in order to comply with power demand obligations in the event of a natural gas curtailment. Further, it's anticipated that a certain amount of the oil-firing may entail the use of biofuels, which would be important in attaining any future renewable portfolio standards.

8. Does the facility have a firm contract for the primary fuel of natural gas?

Response: GE will obtain a contract for primary fuel upon development of a Power Purchase Agreement for the project. However, the parameters of the fuel procurement contract will be reflective of the assumptions provided in other associated responses.

9. The application indicates that the facility will become a major source of hazardous air pollutants (HAP) with the additional units. Therefore, the combustion turbines will be subject to the provisions of National Emissions Standards for Hazardous Air Pollutants (NESHAP) Subpart YYYY. Since this regulation has been stayed, currently the only requirement is to notify the Department that the facility is a major source of HAP and the affected units. Please revise the application pages accordingly.

Response: The application incorrectly indicated that the facility will become a major source of hazardous air pollutants. As indicated on Page 2-5,

"The MACT standard in 40 CFR, Subpart YYYY is potentially applicable to the Project. However, Shady Hills Generating Station will not be a major source of HAP emissions since emissions are projected to be below 10 tons per year (TPY) of a single HAP and less than 25 TPY for all HAPs. "

10. A Level 2 VISCREEN analysis was performed which showed potential impacts over the threshold screening level outside the Chassahowitzka PSD Class I area. In addition, the 4.4 m/s wind speed associated with this analysis seemed high. A lower wind speed may result in impacts over the threshold level inside the Class I area. Please provide further detailed justification for this value in order to evaluate whether a PLUVUE analysis should be required.

Response: The Stability Array (STAR) program that was used to compute the wind speed and stability class frequencies was modified. The original STAR wind speed frequencies of 0-3, 4-6, 7-10, 11-16, 17-21 and GT 21 knots were replaced with the following wind speed categories: 0-2, 3-4, 5-6, 7-8, 9-10 and GT10 knots. The first 5 wind speed categories equate closely to 0-1, 1-2, 2-3, 3-4, and 4-5 m/s. The revised STAR frequencies for the south-southeast (SSE), south (S) and the average of the two wind direction sectors is summarized in Table 7-4 Rev. Based on the revised combined wind direction (WD) sector wind speed frequencies, the realistic meteorological condition for VISCREEN Level 2 was D stability and 4.0 m/s. VISCREEN modeling output for natural gas and oil firing are summarized in Figures 7-19 rev and 7-20 rev. The air modeling results vary slightly from the results in the original application which were based on D stability and a wind speed of 4.4 m/s.

Supplement Information: Individual WD Sector Analyses:

The original Level 2 analysis was based on the average wind frequencies from combining both the SSE and S wind direction sectors and assumed a fixed nearest receptors distance of 28 km. These two assumptions produced very conservative plume impacts. Figure 1 shows that over 95 percent of Chassahowitka NWA lies within the SSE sector. The small section that lies within the S wind direction sector is at a minimum distance from the Shady Hills plant of 35 km and a maximum distance of 36 km from the plant. For the SSE wind direction, the actual wind frequencies are so low that the cumulative frequency never reaches 1.0 (see Table 7-4 rev) through the last listed condition of D stability and 5 m/s. As such, D stability and 6 m/s wind speed were assumed as the realistic Level 2 meteorological conditions for the SSE wind direction sector. Similarly, from Table 7-4 rev, D stability and 3 m/s wind speed were assumed as the realistic Level 2 meteorological conditions for the S wind direction sector.
The results for natural gas and fuel oil-firing for the SSE wind direction sector are shown in Figures 7-21 and 7-22, respectively. The results for natural gas and fuel oil-firing for the S wind direction sector are shown in Figures 7-23 and 7-24, respectively. The revised tables and figures referred to in this response are included as Attachment C.

As these responses are providing additional information of an engineering nature, a State of Florida professional engineering certification has also been provided, in accordance with Rule 62-4.050(3), F.A.C. In addition, the appropriate Responsible Official certification page has been signed and included in this submittal.

Should you have any question regarding these responses or need additional information, please contact the undersigned at (813) 287-1717 or Roy Belden at 203-357-6820.

Sincerely,

GOLDER ASSOCIATES INC.

David Larocca
Senior Project Engineer

Scott Osbourn, P.E.
Senior Consultant

Attachments

cc: Mara Nasca, Southwest District Office (Mara.Nasca@dep.state.fl.us)
Roy S. Belden, GE Energy Financial Services
William Stevens, GE Energy Financial Services
Rick Waggoner, Compliance Opportunities Group