



**FPL Energy**

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August 20, 2007

Mr. Thomas Cusson, Section Chief  
Bureau of Waste Prevention  
MassDEP, Central Regional Office  
627 Main Street  
Worcester, MA 01608

Mr. Donald Dahl  
US EPA, Region 1  
One Congress Street  
Boston, MA 02114-2023

**Subject: Oil-Fired Opacity Limit  
Bellingham Cogeneration Facility**

Dear Mr. Cusson and Mr. Dahl:

As previously identified with the agencies, the Bellingham Cogeneration Facility ("the Facility") has reason to believe that its combustion turbines will not meet the current opacity limit of "10% at all times" during transient oil-fired operating scenarios such as cold startups. The Facility does not have adequate historical oil-fired data to properly evaluate an alternative opacity limit and so proposed, in a letter dated June 18, 2007, to conduct an evaluation to minimize and quantify opacity emissions from its combustion turbines during oil-fired startups, shutdowns and fuel transfers (SSFT). In a letter dated July 27, 2007, the EPA responded that the Facility should submit the following additional information.

1. A top-down BACT analysis
2. Facility-wide data regarding opacity emissions from every startup, shutdown, and fuel switch when burning fuel oil, including relevant information from process data that affects combustion during these times.
3. Opacity emissions data during startup and shutdown when combusting oil from other similar types of facilities.
4. A proposed interim opacity limit that is less than 100%, averaged over a six minute timeframe.

The Facility is providing this information below:

**1. Top-down BACT Analysis**

Opacity is the characteristic of matter which renders it capable of interfering with the transmission of rays of light and causes a degree of obscuration of an observer's view. Opacity from combustion turbines is generally caused by smoke. Smoke, by definition, is the visible aerosol, which may contain fly ash, resulting from combustion of materials but does not mean condensed water vapor.

Smoke from the Facility may be the result of either particulate matter (PM) emissions or a reddish-brown discoloration associated with elevated NO<sub>2</sub> concentrations during startups and shutdowns. The Facility has record of one cold startup on oil; however, it occurred in the night and so the coloration of the exhaust could not be observed. In any case, the Facility has already demonstrated it is meeting BACT for NO<sub>x</sub>. Even if a Selective Catalytic Reduction (SCR) system was cost effective, they do not operate (i.e. NH<sub>3</sub> injection does not commence) until the catalyst has reached a minimum set point temperature, which typically occurs towards the end of a startup when opacity emissions are already under control.

Particulate matter (PM) emissions from the combustion of fuel are typically generated from high molecular weight hydrocarbons that are not fully combusted plus ash and sulfates. The sulfur content in fuel directly relates to PM emissions. Historically, the Facility was permitted to burn 0.3 percent sulfur by weight. Under the pending PSD permit, the Facility is proposing to burn ultra low sulfur fuel (ULSF) oil with a sulfur content of 0.0015 percent sulfur by weight.

Natural gas and No. 2 fuel oil have relatively low PM emission rates. The Facility has emission limits of 0.0047 lb/MMBtu on natural gas and 0.0647 lb/MMBtu on fuel oil. PM emission rates from ultra low sulfur fuel (ULSF) oil are expected to be even less than the current fuel oil. While there are available PM control options (e.g. electrostatic precipitators, fabric filter baghouses, cyclones, scrubbers) for other types of combustion sources (e.g. boilers) with dirtier fuels (e.g. coal, No. 6 fuel oil), these are not considered technically feasible methods to further reduce PM emissions or opacity from combustion turbines. Therefore, the Facility proposes the following as BACT for PM and opacity:

- Good combustion practice
- Ultra low sulfur fuel
- Low ash fuel

Results from an EPA RACT/BACT/LAER Clearinghouse search suggest that this BACT determination is consistent with other recently issued permits (within the past five years) for large combustion turbines (>25 MW) in the United States.

**2. Historical Opacity Data from SSFT**

Provided in Attachment 2 is a summary of historical oil-fired opacity data from the combustion turbines' Continuous Opacity Monitoring System (COMS). As presented, there is one cold startup in which the unit tripped, 27 fuel transfers (overlapped with unit shutdowns) and five older incidents with limited information. In consultation with a third party combustion expert,

relevant process data will be identified and collected during subsequent oil-fired SSFT in an attempt to minimize opacity and refine the operating procedures, as needed.

While starting up on gas and switching to fuel oil may result in lower opacity levels than starting up on oil alone, this is not always the preferred method since unstable combustion dynamics associated with fuel transfers increases the risk that the unit will trip. In addition, the Facility must be able to startup on oil in the event of a natural gas shortage.

**3. Opacity data from other facilities**

FPL does not have representative opacity data from a similar unit within its fleet (i.e. oil-fired SSFT data on a turbine equipped with a COMS). Mr. Donald Dahl from the EPA Region I office indicated<sup>1</sup> that manufacturer's data would be a suitable replacement. Provided in Attachment 2 is a graph obtained from Siemens Westinghouse that illustrates opacity levels during an oil-fired startup. As shown, opacity levels are above the current 10% limit. No additional data was available from Siemens Westinghouse.

**4. Proposed Interim Opacity Limit**

The Facility proposes to adopt the Massachusetts' limit for smoke, 310 CMR 7.06(1)(a):

No person shall cause, suffer, allow, or permit the emission of smoke which has a shade, density, or appearance equal to or greater than No. 1 of the Chart for a period, or aggregate period of time in excess of six minutes during any one hour, provided that at no time during the said six minutes shall the shade, density, or appearance be equal to or greater than No. 2 of the Chart.

The "Chart" refers to the Ringelmann Chart and No. 1 of the Chart is equivalent to 20% opacity and No. 2 of the Chart is equivalent to 40% opacity. The Facility's COMS is not a "direct-compliance" monitor; however, it will be used to identify and report incidents that result in opacity measurements in excess of this standard. An EPA Method 9 test is the compliance method for opacity since COMS measurements may be affected by uncombined water.

This is the same startup/shutdown opacity limit recently issued to the Blackstone Energy Company, LLC combustion turbines (180 MW each) that only fire natural gas (Operating Permit Transmittal No. W027087).

We anticipate that you will be agreeable to the proposed interim opacity limit to address our concern related to oil-fired SSFT operations and hope that we can move forward with the fuel oil diversity permitting. If you have any questions, please feel free to contact Sean Gregory at (978) 730-9977 or me at (401) 946-2883. Thank you for your attention to this matter.

Sincerely,

*JGW For Peter Holzapfel*

Peter G. Holzapfel  
General Manager

**JIM WHITE**  
**PLANT MANAGER**

<sup>1</sup> Phone call with Sean Gregory of DSG Solutions, 8/16/07.

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cc: James White, FPL Energy  
Paul Aronian, FPL Energy  
Tim Oliver, FPL Energy  
Sean Gregory, DSG Solutions, LLC  
Bellingham Cogeneration Facility, file copy.

**Attachment 1**  
**Historical Opacity Data**

**Bellingham Historical Opacity Data Analysis**  
**During Fuel Oil Firing Operating Periods Between January 2003 to Present<sup>(1)</sup>**

Fuel Oil Operating Hours		Opacity (%)		# of 1-min Avegs >10%	Fuel Oil Startup Conditions Oil Only or Fuel Swap
Startup Hour	Shutdown Hour	Max 1-min Avg	Max 5-min Avg		
12/22/00 Hr 11*		n/a	14.5	n/a	Unknown
12/22/00 Hr 19*		n/a	16.1	n/a	Unknown
12/23/00 Hr 0*		n/a	11.3	n/a	Unknown
12/23/00 Hr 3*		n/a	15.8	n/a	Unknown
12/27/00 Hr 7-8*		n/a	16.3	n/a	Unknown
11/16/02 Hr 0	11/16/02 Hr 1	82.2	49.7	22	Unit 1 Cold Startup (oil only) - DAHS data shows only 7 intermittent process on fuel oil minutes indicative of Unit Trip(s). Unit 1 peaked at 7.6MW during this fuel oil only startup attempt.
12/4/02 Hr 16	12/4/02 Hr 19	2.2	1.4	0	Fuel Swap
12/6/02 Hr 5	12/6/02 Hr 14	1.7	1.2	0	Fuel Swap
1/11/03 Hr 4	1/11/03 Hr 15	3.1	2.5	0	Fuel Swap
1/13/03 Hr 4	1/13/03 Hr 15	2.0	1.8	0	Fuel Swap
1/15/03 Hr 4	1/15/03 Hr 15	2.5	1.9	0	Fuel Swap
1/17/03 Hr 4	1/17/03 Hr 15	2.2	1.8	0	Fuel Swap
1/19/03 Hr 4	1/19/03 Hr 4	3.3	1.9	0	Fuel Swap - Only 3 minutes of Oil Firing during Unit Shutdown.
1/21/03 Hr 4	1/21/03 Hr 15	2.8	2.0	0	Fuel Swap
1/23/03 Hr 3	1/23/03 Hr 17	1.5	1.3	0	Fuel Swap
1/25/03 Hr 3	1/25/03 Hr 17	1.8	1.5	0	Fuel Swap
1/27/03 Hr 3	1/27/03 Hr 16	1.5	1.4	0	Fuel Swap
1/29/03 Hr 4	1/29/03 Hr 10	17.9	12.3	4	Fuel Swap - Opacity Incident occurred during Unit 1 Oil Shutdown and Unit 2 Oil Swap to Gas.
1/31/03 Hr 5	1/31/03 Hr 16	2.3	1.9	0	Fuel Swap
2/9/03 Hr 3	2/9/03 Hr 16	2.5	2.2	0	Fuel Swap
2/11/03 Hr 3	2/11/03 Hr 16	2.4	2.4	0	Fuel Swap
2/13/03 Hr 3	2/13/03 Hr 16	2.6	2.5	0	Fuel Swap
2/15/03 Hr 3	2/15/03 Hr 9	4.0	3.9	0	Fuel Swap
2/26/03 Hr 3	2/26/03 Hr 16	1.9	1.4	0	Fuel Swap
1/14/04 Hr 22	1/20/04 Hr 23	18.4	17.3	15	Fuel Swap - Opacity Incident occurred during fuel swap from gas to oil
1/24/04 Hr 7	1/24/04 Hr 12	2.2	1.6	0	Fuel Swap
1/26/04 Hr 7	1/26/04 Hr 12	2.8	1.7	0	Fuel Swap
2/15/04 Hr 5	2/15/04 Hr 13	2.0	1.6	0	Fuel Swap
2/17/04 Hr 5	2/17/04 Hr 14	2.3	2.0	0	Fuel Swap
3/17/04 Hr 7	3/20/04 Hr 2	1.8	1.8	0	Fuel Swap - Gas Signal in Data Error during 3/17 Hr 7
6/9/04 Hr 19	6/9/04 Hr 20	1.4	0.9	0	Fuel Swap - Two partial Operating Hours on Oil
1/27/05 Hr 9	1/28/05 Hr 10	3.3	3.3	0	Fuel Swap
2/25/05 Hr 10	2/26/05 Hr 9	1.0	0.9	0	Fuel Swap

<sup>(1)</sup> Bellingham Final Operating Permit Transmittal No. 79300 states Opacity limit <10% at all times, during all modes of operation, including startups and shutdowns.

\*The current DAHS maintains minute opacity data between September 2002 to present, since these opacity incidents occurred prior to this date, minute opacity data was not available.

**Attachment 2**

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**Manufacturer's Opacity Data**

# C Distillate Oil Fuel Startup

Data Recorded 11-13-93

