



STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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GOVERNOR

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**Calpine Construction Finance
Company, L.P.
Cumberland County
Westbrook, Maine
A-743-77-1-A**

**Departmental
Findings of Fact and Order
New Source Review
Amendment #1**

After review of the air emissions license amendment application, staff investigation reports and other documents in the applicant's file in the Bureau of Air Quality, pursuant to 38 M.R.S.A., Section 344 and Section 590, the Department finds the following facts:

I. REGISTRATION

A. Introduction

FACILITY	Calpine Construction Finance Company, L.P.
PART 70 LICENSE NUMBER	A-743-70-A-I
LICENSE TYPE	Chapter 115 (New Source Review) Minor Modification
NAICS CODES	221112
NATURE OF BUSINESS	Fossil Fuel Electric Power Generation
FACILITY LOCATION	Westbrook, Maine
PART 70 LICENSE ISSUANCE DATE	December 8, 2003
NSR AMENDMENT ISSUANCE DATE	November 3, 2010
PART 70 LICENSE EXPIRATION DATE	December 8, 2008 (Continues Until Renewal Application is Acted Upon)

B. Amendment Description

Calpine Construction Finance Company, L.P. (owners of the facility located in Westbrook, Maine and otherwise known as Westbrook Energy Center) submitted an application to amend their air emission license to allow them to implement an advanced gas path (AGP) project on their two natural gas-fired, combined cycle combustion turbines. The proposed AGP project includes replacement of the combustion turbine hot gas path (HGP) components with metallurgical parts capable of withstanding higher firing temperatures and the installation of additional temperature sensors and instrumentation, controls, blowers and associated piping. The project will allow the combustion turbines to operate at higher combustion temperatures that will result in increased power generation and improved operating efficiencies. Each combustion turbine's maximum design

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heat input will increase from 1,954 MMBtu/hr to 2,013 MMBtu/hr (on a higher heating value basis).

C. Emission Equipment

The following equipment is addressed in this air emission license:

Fuel Burning Equipment

<u>Equipment</u>	<u>Maximum Capacity (MMBtu/hr)</u>	<u>Maximum Firing Rate (Mscf/hr)</u>	<u>Fuel Type, % sulfur</u>	<u>Stack #</u>
Gas Turbine #1	2,013 ¹	2,013	Natural gas, <2 grains of sulfur/100 scf of gas	1
Gas Turbine #2	2,013 ¹	2,013	Natural gas, <2 grains of sulfur/100 scf of gas	2

¹ Maximum design heat input is based on the units operating at base load with an ambient temperature of -20 °F and firing natural gas at a higher heating value of 1,000 Btu/scf

D. Application Classification

Under federal New Source Performance Standards (NSPS) provisions found in 40 CFR Part 60, reconstruction means “the replacement of components of an existing facility or affected source to such an extent that: (1) The fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable, entirely new facility or a comparable new source; and (2) it is technologically and economically feasible to meet the applicable standards set forth in this part.”. Westbrook Energy Center’s estimated cost of the project is \$2.6 million dollars per combustion turbine. Westbrook Energy reports that the current replacement cost for a new GE 7FA combustion turbine is approximately \$35 million dollars, thus the proposed project cost is less than 7.5 percent of the cost of new comparable combustion turbines. The Department finds that because the estimated cost of this project does not exceed 50 percent of the estimated cost to replace the combustion turbines, this project does not meet the definition of “reconstruction” as defined in 40 CFR Part 60.15 (NSPS provisions).

The application for Westbrook Energy Center does not violate any applicable federal or state requirements and does not reduce monitoring, reporting, testing or record keeping.

Additionally, the modification of a major source is considered a major modification based on whether or not expected emission increases exceed the “Significant Emission Increase Levels” as given in *Definitions Regulation*, 06-096 CMR 100 (last amended December 24, 2005).

The emission increases are determined by subtracting the average actual emissions of the 24 months preceding the modification (or representative 24 months) from the future projected actual emissions. The results of this test are as follows:

Pollutant	Average Past Actual Emissions 4/08 – 3/10 (tons/year)	Future Projected Actual Emissions (tons/year)	Net Change (tons/year)	Significance Level (tons/year)
PM	12	17	5	25
PM ₁₀	12	17	5	15
SO ₂	51	73	22	40
NO _x	98	118	20	40
CO	171	260	89	100
VOC	3	4	1	40

Note: The above numbers are for the combustion turbines only. None of the other equipment at the facility is affected by this amendment.

Therefore, this amendment is determined to be a minor modification under *Minor and Major Source Air Emission License Regulations* 06-096 CMR 115 (last amended December 24, 2005) since the changes being made are not addressed or prohibited in the Part 70 license. This amendment will be incorporated into the Part 70 license no later than 12 months from commencement of operation of the requested modification.

II. BEST PRACTICAL TREATMENT (BPT)

A. Introduction

In order to receive a license the applicant must control emissions from each modified unit to a level considered by the Department to represent Best Practical Treatment (BPT), as defined in *Definitions Regulation*, 06-096 CMR 100 (last amended December 24, 2005). Separate control requirement categories exist for new and existing equipment as well as for those sources located in designated non-attainment areas.

BPT for new sources and modifications requires a demonstration that emissions are receiving Best Available Control Technology (BACT), as defined in 06-096 CMR 100 (last amended December 24, 2005). BACT is a top-down approach to selecting air emission controls considering economic, environmental and energy impacts.

B. Gas Turbine #1 and Gas Turbine #2

Gas Turbines #1 and #2 are General Electric Model number MS7001FA combustion turbines. Following completion of the AGP project, each combustion turbine will have maximum design heat input capacity of 2,013 MMBtu/hr (on a higher heating value basis). Each turbine has fourteen burners and fires natural gas. The turbines are equipped with dry low NO_x (DLN) combustors and a selective catalytic reduction (SCR) system to control NO_x emissions. Each turbine exhausts to its own 165-foot stack.

NSPS requirements

The gas turbines were originally installed in 2000, and were therefore subject to the New Source Performance Standards (NSPS) contained in 40 CFR Part 60, Subpart GG *Standards of Performance for Stationary Gas Turbines*, for which construction was commenced after October 3, 1977. However, following completion of the proposed project the gas turbines will have been modified after February 18, 2005, and therefore will no longer be subject to 40 CFR Part 60 Subpart GG, but will be subject to the NSPS contained in 40 CFR Part 60, Subpart KKKK *Standards of Performance for Stationary Combustion Turbines*. Although the emission limits contained in the NSPS are less stringent than the BACT determined emission limits, 40 CFR Part 60 Subpart KKKK does contain other applicable requirements, including equipment operating and maintenance requirements, monitoring requirements, reporting requirements, and performance test requirements.

Westbrook Energy Center's BACT analysis addressed emissions of particulate matter (PM and PM₁₀), sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC) from the gas turbines. A BACT analysis was conducted in 1998 when the Westbrook Energy Center was originally proposed and initially licensed. In addition a lowest achievable emission rate (LAER) analysis was conducted for NO_x emissions since the facility was a major source for NO_x and was located in an ozone non-attainment area.

PM and PM₁₀: Because natural gas is a gaseous fuel, particulate matter emissions from a gas turbine are typically low and usually are the result of larger molecular weight hydrocarbons that are not fully combusted. The use of clean fuels such as natural gas and adhering to good combustion practices is common practice for minimizing particulate matter emissions from gas turbines. No gas turbines of similar type and size are known to operate with add-on particulate matter controls such as an electrostatic precipitator (ESP) or fabric filter nor would such controls result in appreciable reductions in particulate matter emissions. Westbrook Energy Center proposes that the use of natural gas and adhering to good combustion practices to meet the existing PM and PM₁₀ emission limit of 22

lbs/hour continues to represent BACT for the control of particulate matter emissions from the gas turbines.

SO₂: SO₂ is formed in a gas turbine from the oxidation of sulfur contained in the fuel. Natural gas inherently contains low amounts of sulfur and fuel analyses conducted on the natural gas combusted in the gas turbines at the Westbrook Energy Center demonstrate that it contains less than 2 grains of sulfur per 100 standard cubic feet (scf) of natural gas. Westbrook Energy Center proposes that the use of natural gas with a sulfur content less than 2 gr/100 scf of gas resulting in a SO₂ emission rate of less than or equal to 12 lbs/hour continues to represent BACT for the control of SO₂ emissions from the gas turbines.

NO_x: NO_x emissions are primarily formed in gas turbines through the thermal dissociation and subsequent reaction of nitrogen and oxygen molecules in the combustion air (commonly referred to as thermal NO_x). Maine Energy Center uses a combination of dry low NO_x (DLN) combustors and selective catalytic reduction (SCR) to control NO_x emissions from the gas turbines. This is a common control strategy used by sources of similar type and size. Maine Energy Center proposes that the continued use of DLN combustors and SCR to meet a NO_x emission limit of 2.5 parts per million on a dry volume (ppmdv) basis corrected to 15 percent oxygen on a 3-hour block average basis represents BACT for the control of NO_x emissions from the gas turbines.

CO: CO emissions relate to the combustion efficiency of the gas turbine. The more complete the combustion of the natural gas, the lower the CO emissions. An add-on control device occasionally employed on gas turbines to control CO emissions is an oxidation catalyst. An oxidation catalyst lowers the activation energy necessary for CO to react with available oxygen in the turbine exhaust to complete its conversion to carbon dioxide (CO₂). A cost analysis conducted in the 1998 BACT analysis did not support the use of an oxidation catalyst for control of CO emissions from the gas turbines. Maine Energy Center proposes that the cost to retrofit the gas turbines with oxidation catalysts would be cost prohibitive and would not represent BACT for these units. They propose that the use of DLN combustors and good combustion practices and continuing to meet a CO emission limit of 15 ppmdv corrected to 15 percent oxygen on a 24-hour block average basis represents BACT for the control of CO emissions from the gas turbines.

VOC: VOC emissions form in a gas turbine from incomplete combustion of the fuel. Similar to CO, an oxidation catalyst can provide some reduction in VOC emissions, however as stated above, a cost analysis conducted in the 1998 BACT analysis did not support the use of an oxidation catalyst. Maine Energy Center proposes that the continued use of DLN combustors and good combustion

practices to meet a VOC emission limit of 3 lbs/hour represents BACT for the control of VOC emissions from the gas turbines.

Based on review of the BACT analysis submitted by the Westbrook Energy Center and our own review of the RACT/BACT/LAER Clearinghouse (RBLC), the Department finds that use of the control devices and strategies proposed by the Maine Energy Center represent BACT for the control of emissions from the gas turbines. A summary of the Department's determination of BACT for control of emissions from Gas Turbines #1 and #2 is shown in the table below.

	PM	PM ₁₀	SO ₂	NO _x	CO	VOC	NH ₃	
ppmdv @ 15% O ₂	--	--	--	2.5	15	--	10	20
ppmdv avg. time	--	--	--	3-hr block	24-hr block	--	30 day rolling	24-hr block
lbs/hr	22	22	12	18	53	3	--	--
Control Technology	Firing Natural Gas	Firing Natural Gas	Firing Natural Gas	DLN + SCR	DLN + Good Combustion Practices	DLN + Good Combustion Practices	Minimize Slip	Minimize Slip

The Department also finds that continued compliance with a visible emissions limit of 20% opacity on a six (6) minute block average basis, except for one six (6) minute block average period per hour of not more than 27% opacity represents BACT for the control of visible emissions.

C. Incorporation into the Part 70 License

The requirements in this 06-096 CMR 115 New Source Review amendment shall apply to the facility upon amendment issuance. In accordance with *Part 70 Air Emission License Regulations*, 06-096 CMR 140 (last amended December 24, 2005), Section 2(J)(2)(d), a source that has undergone a modification that has been subject to NSR requirements or that has been processed through 06-096 CMR 115, must then apply for an amendment to the Part 70 license within one year of commencing operation of the proposed modification as provided in 40 CFR Part 70.5.

D. Annual Emissions

Westbrook Energy Center shall be restricted to the annual emissions, based on a 12-month rolling total, contained in the table below.

Total Licensed Annual Emissions for the Facility

Tons/year

(used to calculate the annual license fee)

	PM	PM ₁₀	SO ₂	NO _x	CO	VOC	NH ₃
Gas Turbine #1	96	96	53	79	232	13	94
Gas Turbine #2	96	96	53	79	232	13	94
Auxiliary Boiler	0.49	0.49	0.05	1.72	7.41	1.98	--
Emergency Generator	0.11	0.11	0.06	3.52	0.94	0.09	--
Emergency Fire Pump	0.04	0.04	0.02	1.39	0.3	0.01	--
Cooling Tower	12.3	12.3	--	--	--	--	--
Total TPY	205	205	106	165	473	28	188

III. AMBIENT AIR QUALITY ANALYSIS

Westbrook Energy Center previously submitted an ambient air quality analysis demonstrating that emissions from the facility, in conjunction with all other sources, do not violate ambient air quality standards. An additional ambient air quality analysis is not required for this amendment.

ORDER

Based on the above Findings and subject to conditions listed below, the Department concludes that the emissions from this source:

- will receive Best Practical Treatment,
- will not violate applicable emission standards,
- will not violate applicable ambient air quality standards in conjunction with emissions from other sources.

The Department hereby grants Air Emission License A-743-77-1-A pursuant to the preconstruction licensing requirements of 06-096 CMR 115 and subject to the specific conditions below.

Severability. The invalidity or unenforceability of any provision, or part thereof, of this License shall not affect the remainder of the provision or any other provisions. This License shall be construed and enforced in all respects as if such invalid or unenforceable provision or part thereof had been omitted.

SPECIFIC CONDITIONS

(1) Gas Turbines #1 and #2

A. Emissions from either Gas Turbine (#1 or #2) shall not exceed the following, except during start-up and shutdown periods as allowed for under the Part 70 license, A-743-70-A-I: [06-096 CMR 115, BACT]

	NO_x (ppmdv corrected to 15% O₂)	CO (ppmdv corrected to 15% O₂)	NH₃ (ppmdv corrected to 15% O₂)	
Emission Limit	2.5	15	10	20
Averaging Time	3-hr block	24-hr block	30 day rolling	24-hr block

B. Emissions from the Gas Turbines (#1 and #2) shall not exceed the following, except during start-up and shutdown periods as allowed for under the Part 70 license, A-743-70-A-I: [06-096 CMR 115, BACT]

Emission Unit	PM (lb/hr)	PM₁₀ (lb/hr)	SO₂ (lb/hr)	NO_x (lb/hr)	CO (lb/hr)	VOC (lb/hr)	NH₃ (lb/hr)
Gas Turbine #1	22	22	12	18	53	3	27
Gas Turbine #2	22	22	12	18	53	3	27

C. Visible emissions from either Gas Turbine (#1 or #2) stack shall not exceed 20% opacity on a six (6) minute block average basis, except for one six (6) minute block average period per hour of not more than 27% opacity including during start-up and shutdown periods.
 [06-096 CMR 115, BACT]

D. In order to demonstrate that the modification to the Gas Turbines (#1 and #2) remains a minor modification, actual emissions from the gas turbines combined shall not exceed the following annual emission rates which are based on past "actual emissions" plus slightly less than "significant emission increase" levels, with the exception of the VOC emission limit which is based on the total licensed annual emissions limit for VOCs:

Emission Units	PM (TPY)	PM ₁₀ (TPY)	SO ₂ (TPY)	NO _x (TPY)	CO (TPY)	VOC (TPY)
Gas Turbines #1 and #2	36	26	90	137	270	26

Compliance with these annual emission limits shall be determined on a 12-month rolling total basis for a period of ten years following commencing operation of the proposed modification. Calculations of annual emissions from the gas turbines shall be based on the best information available, including, but not limited to continuous emission monitoring system data, stack test data, and mass balance methods as appropriate.
[06-096 CMR 115]

(2) NSPS Applicability

Westbrook Energy Center shall comply with all applicable requirements contained in 40 CFR Part 60 Subpart KKKK *Standards of Performance for Stationary Combustion Turbines*.
[40 CFR Part 60 Subpart KKKK]

(3) Incorporation into the Part 70 License

Within one year of commencing operation of the proposed modification, the Maine Energy Center shall submit an application for amendment of the Part 70 license in accordance with *Part 70 Air Emission License Regulations*, 06-096 CMR 140 (last amended December 24, 2005), Section 2(J)(2)(d), to incorporate any new applicable requirements.

DONE AND DATED IN AUGUSTA, MAINE THIS 3rd DAY OF November, 2010.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY: *Jane P. Beaudry*
BETH NAGUSKA, ACTING COMMISSIONER

PLEASE NOTE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES

Date of initial receipt of application: August 30, 2010

Date of application acceptance: September 22, 2010

Date filed with the Board of Environmental Protection:

This Order prepared by Eric Kennedy, Bureau of Air Quality.



