VERMONT AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation
Air Pollution Control Division

TECHNICAL SUPPORT DOCUMENT

FOR

PERMIT TO CONSTRUCT

#AP-11-015

Permit Date: February 10, 2012

Beaver Wood Energy Fair Haven, LLC
Fair Haven, VT

Prepared By: Steven K. Snook
Air Pollution Control Division

This Technical Support Document details the Agency of Natural Resources, Department of Environmental Conservation, Air Pollution Control Division review for the Air Pollution Control Permit to Construct and is intended to provide additional technical information, discussion and clarification in support of the Permit. It is not intended to provide a comprehensive review of the Facility or permit process or duplicate the information contained in the Permit.

Facility:
Beaver Wood Energy Fair Haven, LLC
Wood fired power boiler
Wood pellet manufacturing
Exit 1, Route 4
Fair Haven, Vermont 05261

Application Contact Person:
Tim Donnelly or Amy Austin
MacMillan & Donnelly, Inc.
361 U.S. Route One, Suite 2
Falmouth, ME 04105
Phone - (207) 781-7392

Facility Contact Person:
Thomas Emero
Beaver Wood Energy Fair Haven, LLC
82 Village Street
Medfield, MA 02053
Phone - (508) 321-1181

1.0 INTRODUCTION

Beaver Wood Energy Fair Haven, LLC (hereinafter "Permittee") has proposed to construct/install and operate a 34 MW (gross) wood fired electrical generating station and a 115,000 ton/yr wood pellet manufacturing facility at Exit 1 (across from the Vermont Visitor Center) on Route 4 in Fair Haven, Vermont (also referred to herein as "Facility").

Administrative Milestones

Table 1-1: Administrative Summary

Administrative Item	Result or Date
Date Application Received:	2/22/2011
Date Administratively Complete:	2/22/2011
Date Draft Decision:	9/15/2011 Approved
Date & Location Draft Decision/Comment Period Noticed:	9/15/2011 *The Rutland Herald*
Date & Location Public Meeting Noticed:	9/22/2011 *The Rutland Herald*
Date & Location of Public Meeting:	10/13/2011 Fair Haven Grade School
Deadline for Public Comments:	10/17/2011
Date Proposed Decision:	2/10/2012
Classification of Source Under §5-401:	§5-401(3): Electric power generation facilities §5-401(4): Wood products industries
Classification of Application:	New Source Review/ Prevention of Significant Deterioration Construction Permit
New Source Review Designation of Source:	Major Stationary Source
Facility SIC Code(s) & Descriptions:	4911 – Electrical Services 2499 – Wood Products not Elsewhere Classified

The allowable emissions for the Facility are summarized below:

Table 1-2: Estimated Air Contaminant Emissions (tons/year)[1]						
PM/PM$_{10}$/PM$_{2.5}$	***SO_2***	***NO_x***	***CO***	***VOC***	***HAPs[2]***	***CO_2e[3]***
63.2	43.2	99.9	190.5	49.9	<10/25	470,900

[1] PM/PM$_{10}$ - particulate matter, SO_2 - sulfur dioxide, NO_x - oxides of nitrogen, CO - carbon monoxide, VOC – volatile organic compounds, HAPs - hazardous air pollutants.
[2] Emissions of individual HAPs each < 10 tpy and emissions of total HAPs combined <25 tpy.
[3] CO_2e 'at the stack' – includes emissions from biogenic sources. See section 3.3 for details. This is not a facility limit.

Total PM emissions from the Facility, including both filterable and condensable components, are conservatively assumed to also be categorized as $PM_{2.5}$ and thus also PM_{10}. Filterable PM represents the PM that is in solid form in the heated exhaust gas at the point of sampling. Condensable PM represents pollutants that are in gaseous form in the heated exhaust at the point of sampling but will become PM upon cooling and condensing and includes high molecular weight organics.

2.0 FACILITY DESCRIPTION AND LOCATION

2.1 Facility Locations and Surrounding Area

Beaver Wood Energy Fair Haven, LLC. (also referred to herein as "Permittee") owns a property on Route 4 in the town of Fair Haven, Vermont (also referred to herein as "Facility"). The Facility is located approximately 2 km from the center of Fair Haven.

2.2 Facility Description

Operations performed at the Facility are classified within the Standard Industrial Classification Code - 4911 (Electrical Services) and 2499, wood products, not elsewhere classified. The regulated sources of air contaminant emissions at the Facility are listed in Table 2-1. Refer to Table 2-2 for information on air pollution control equipment used at the facility

TABLE 2-1: Equipment and Stack Information				
Equipment/Make/Model	Capacity/ Size	Fuel or input material	Air Pollution Control Equipment	Stack Height (feet)
Main Boiler: wood fired Advanced Stoker Boiler	482 MMBtu/hr [1]	wood	Multi-clone, ESP, Multi Pollutant Catalytic Reactor	180
Two auxiliary/start-up burners for the main boiler	60 MMBtu/hr (each)	ULSD [6]		
Main Boiler: Cooling Tower – 2 cells	25,000 gpm (nominal)	-	Drift eliminator	-
Pellet Plant: Wood fired burner for rotary drum dryer.	30 MMBtu/hr	wood	Low NOx burner, cyclone & fabric filter	100
Pellet Plant: Rotary drum dryer – 60' long, single pass	15 ODT/hr [2]	wood		
Pellet Plant: Wood pellet processing equipment (hammermill, storage silos, conveyors, pellet mills, pellet cooler, pellet bagging)	115,000 ODT/yr [3]	Wood / wood pellets	Fabric filter(s)	-
Fly ash storage silo	900	Wood ash	Fabric filter	-
Dry wood storage	25,000 ft^3	Dry wood	None	-
Pellet storage silos (2 silos)	22,500 ft^3 each	Wood pellets	None	-
Two (2): Caterpillar C32 Diesel Engine Generator	1,000 kW [4] (each)	ULSD	Tier 2 per 40 *CFR* Part 89	-
Two (2): Caterpillar C15 Diesel Engine Generator	500 kW [4] (each)			-
Diesel Engine Fire Pump	400 bhp [5]		Tier 3 per 40 *CFR* Part 89	-
Temporary Five (5) Diesel Engine Generators – for construction	100 kW [4] (each)			-
Temporary Fuel oil boiler – for use during the construction phase of the project	< 10 MMBtu/hr	ULSD	None	TBD

1 MMBtu/hr – million British Thermal Units of heat input per hour
2 ODT/hr - oven-dry ton of wood output per hour
3 ODT/yr - oven-dry ton of wood output per year
4 kW – rated kilowatt output
5 bhp – rated brake horse power output
6 ULSD – ultra low sulfur diesel (0.0015% or 15 ppm sulfur content).

Table 2-2: Air Pollution Control Equipment	
Main Boiler – multi-clone	Pressure Drop: 3.2" w.c. nominal Inlet Temperature: 450 ^oF Dimensions: 13'-10" D x 24'-8" W x 10'-4" H Air Flow Rate: 269,000 acfm
Main Boiler – ESP	Inlet Temperature: 450 ^oF Air Flow Rate: 269,000 acfm <u>ESP</u> 4-field single chamber, solid electrodes and collecting plates. Method of cleaning: rapping Dimensions: 99,467 ft^2 Specific Collection Area: 370 ft^2/1000 acfm
Main Boiler - Multi Pollutant Catalytic Reduction (MPCR) including oxidation catalyst for CO and selective catalytic reduction for NOx.	Inlet Temperature: 425 ^oF Details not available at this time.
Pellet burner / rotary dryer - Cyclone	<u>Cyclone</u>: Pressure Drop: 5 – 6 inch w.c. Inlet temperature: 170 – 180 ^oF Dimensions: 42'-8 7/16" H x 11' D
Pellet burner / rotary dryer – Fabric filter [1]	<u>Fabric filter</u>: Performance: 0.005 gr/dscf Pressure Drop: 4 – 5" w.c. Inlet Temperature: 170 - 180 ^oF Dimensions: 494 bags, 7,118 ft^2 16 oz. Dacron fabric Air Flow Rate: 70,000 acfm Air-to-cloth Ratio: 9.1:1 Cleaning: plenum blowback
Pellet mills, dry hammermill, pellet cooler and pellet packaging system. One or more fabric filters.	<u>Fabric filter</u>: Performance: 0.005 gr/dscf Inlet Temperature: 125 ^oF Estimate total Air Flow Rate: 50,000 acfm Further details not available at this time.
Ash silo vent fabric filter	Performance guarantee: 0.02 gr/dscf Inlet temperature: 135 ^oF Air Flow Rate: 900 acfm

[1] The term fabric filter is synonymous with the term bag house for this document.

2.3 Description of Compliance Monitoring Devices

The Facility will be equipped with continuous emission monitoring devices (CEMS) which measure the emission of NO_x, CO, NH_3, and CO_2 from the Main Boiler to the ambient air. In addition, the Facility will operate and maintain a continuous opacity monitoring system (COMS) which measures the opacity of the exhaust gas from the Main Boiler.

2.4 Identification of Sources with Insignificant or Negligible Emissions

Although not required for determining applicability with Subchapter X, quantifiable emissions from "insignificant activities" must be included for the purposes of establishing whether or not a source is subject to other air pollution control requirements, including, but not limited to: reasonably available control technology, major source status, and Title V operating permit applicability.

Additionally, guidance provided by the U.S. EPA (entitled "White Paper for Streamlined Development of Part 70 Permit Applications") lists activities which are considered as "trivial" sources of air contaminants, and may be presumptively omitted from operating permit applications.

Table 2-3 lists activities at the Facility which were considered trivial, negligible or exempt sources of air contaminant emissions, and therefore were not considered as emission sources as part of the Permit review.

Table 2-3: Negligible Sources of Contaminant Emissions	
Fuel storage tanks:	Diesel fuel storage tanks.

It should be noted that a process or piece of equipment which is considered a "negligible activity" does not relieve the owner or operator from the responsibility of complying with any applicable requirements associated with said process or equipment.

2.5 Proposed Limitations

To avoid triggering the need to acquire NO_x emission reduction credits, the Permittee has proposed to limit the annual emission of NO_x to less than 100 tons at the Facility.

Short term emission limits are determined by MSER and/or HMSER determinations below.

The Permittee has proposed an annual capacity factor of 96% for the Main Boiler. The Permittee has also proposed to limit the production of wood pellets to 115,000 tons/year.

This permit limits the Facility to 115,000 oven-dry (0% moisture content) tons/year of output from the rotary dryer. The dried material leaving the rotary dryer will have a moisture content of approximately 10%. So the annual output from the rotary dryer could be 126,500 tons (at 10% moisture content). As the dried material is processed into pellets, some of it will become fines/dust and will not become part of the final pellet product. The fines are used on site as fuel. There is expected to be about 1 ton of fines for every 15 tons of output from the dryer; at full production this is about 8,400 tons each year. With the loss of the fines, there is approximately 118,100 tons of this 10% moisture content material made into pellets. As the wood material from the dryer is processed into pellets, there is some further loss of moisture and the moisture content in the finished pellets will be around 7%. So the total weight of the annual production of wood pellets is expected to be 114,880 tons at 7% moisture content. Unless noted otherwise in this permit, the weight of wood materials in the pellet manufacturing operation will be in terms of oven dry ton (ODT).

3.0 QUANTIFICATION OF POLLUTANTS

The quantification of emissions from a stationary source is necessary in order to establish the regulatory review process necessary for the operating permit application and to determine applicability with various air pollution control requirements. These determinations are normally based upon allowable emissions. Allowable emission is defined as the emission rate calculated using the maximum rated capacity of the source and, if applicable, either: (a) the applicable emission standard contained in the *Regulations*, if any, or (b) the emission rate or design, operational or equipment standard specified in any order or agreement issued under the *Regulations* that is state and federally enforceable. An applicant may impose in its application an emission rate or design, or an operational or equipment limitation which may be incorporated in the Permit to restrict operation to a lower level. Such limitations may include fuel restrictions or production limits.

3.1 Estimating Potential Emission of Criteria Pollutants from the Proposed Stationary Source

For the Main Boiler, the calculated allowable annual emissions of SO_2, NO_X, PM, CO and VOCs are based on the established emission limits expressed in lbs/MMBtu and a 96% capacity factor. Since ULSD oil firing is only for startup there are no separate emission limits established specifically for oil firing and the Facility is expected to comply with the emission limits at all times regardless of fuel.

The potential emissions for HAPs are based on a combination of emission factors from the U.S. EPA document, A Compilation of Air Pollutant Emission Factors (AP-42), emission data from the National Council for Air and Stream Improvement (NCASI) Technical Bulletin No. 858 and stack testing conducted at other biomass boilers in New England; additional details of this data is available in section 3.2 of this document.

Table 3-1: Main Boiler - Allowable Emissions

482 MMBtu/hr heat input x 96% Capacity Factor = 4,053,427 MMBtu/yr annual heat input

	Emission Factor			Allowable Emissions
	Factor	Units [1]	Source	tons per year
SO_2	0.02	lb/MMBtu	MSER	40.5
NO_x – Annual	0.03	lb/MMBtu	MSER	60.8
NO_x – hourly	0.065	lb/MMBtu	MSER	-
NO_x – 8-hr avg	0.33	lb/MMBtu	Startup limit when SCR is offline	-
$PM_{10}/PM_{2.5}$/PM [2]	0.019	lb/MMBtu	MSER / HMSER	38.5
CO	0.075	lb/MMBtu	MSER / HMSER	152
VOC	0.005	lb/MMBtu	MSER / HMSER	10.1
HAPs	0.0053	lb/MMBtu	AP-42, Wood Residue Combustion in Boilers, Tables 1.6-3 and 1.6-4 (9/03), NCASI Technical Bulletin No. 858, representative stack tests.	10.8

[1] lb/MMBtu: pounds of pollutant emitted per million British Thermal Units of energy input to the boiler.
[2] PM: total PM including filterable and condensable fractions.

Table 3-2: Burner / Rotary Dryer - Allowable Emissions				
Based on 115,000 ODT/yr 30 MMBtu/hr	Emission Factor			Allowable Emissions
	Factor	Units	Source	tons per year
SO_2	0.025	lb/MMBtu [1]	MSER & Permit application – burner manufacturer's guarantee [4]	2.7
NO_x	0.35	lbs/MMBtu		37.7
$PM_{10}/PM_{2.5}/PM$ [2]	0.20	lb/ODT [3]		11.6
CO	0.35	lb/MMBtu		37.7
VOC	0.69	lb/ODT		39.8
HAPs	0.18	lb/ODT	AP-42, Wood Residue Combustion in Boilers Table 1.6-3 and;	10.2
	0.014	lb/ODT	Formaldehyde emissions testing at New England Wood Pellet – Jaffrey, NH	

[1] lb/MMBtu: pounds of pollutant emitted per million British Thermal Units of energy input to the boiler.
[2] PM: total PM including filterable and condensable fractions.
[3] lb/ODT: pounds of pollutant emitted per oven-dry ton of wood output from the rotary dryer
[4] Manufacturer: Coen

Table 3-3: Allowable Emissions by Production Process – Particulate Emissions					
Equipment/Source	**Emission Factor (gr/dscf) [1]**	**Source of Emission Factor**	**Maximum Flow Rate (acfm)**	**Maximum Flow Rate (dscfm)**	**Emission Rate (ton/yr)**
Pellet mill processes other than burner/dryer Fabric filter	0.005	Application for AP-11-015	50,000	43,800 [2]	8.2
Ash silo vent - fabric filter	0.02		900	800	0.6

[1] gr/dscf: grains of particulate matter per dry standard cubic feet of exhaust gas.
[2] Assumes a 3% moisture content exhaust gas.

Table 3-4: Diesel Generators – Allowable Emissions				
Emission estimate based on 65 hours Total of 3000 kW of Tier 2 Engines	**Emission Factor**			**Allowable Emissions, tons/yr**
	Factor	**Units**	**Source**	
SO_2	0.0015	lb/MMBtu	15 ppm sulfur content in fuel	0.0015
PM	0.2	g/kW-hr	EPA Tier 2 Engine	0.04
NO_X	6.4			1.37
CO	3.5			0.75
VOC	-	-		-

Table 3-5: Fire Pump/Diesel Engine – Estimated Emissions				
Emission estimate based on 65 hours 250 kW Tier 3 Engine	Emission Factor			Allowable Emissions, tons/yr
	Factor	**Units**	**Source**	
SO_2	0.0015	lb/MMBtu	15 ppm sulfur content in fuel	0.0001
PM	0.2	g/kW-hr	EPA Tier 3 Engine	0.004
NO_X	4.0			0.07
CO	3.5			0.06
VOC	-	-		-

The operation of the cooling towers also results in the emission of PM. This is a result of the release of cooling water droplets to the atmosphere: "drift." The water droplets contain suspended solids and this becomes fine PM in the atmosphere when the water evaporates. The cooling towers will be equipped with a 'drift eliminator' to minimize this emission. The estimated emission of PM from the cooling towers is based on the flow rate of the cooling tower circulating water (12,696,055 lb/hr), the concentration of the total dissolved solids in the water (1,520 ppm), the drift rate (0.005%) and the operating hours (8760 hours/year * 96% capacity factor of the Main Boiler).

(12,696,055) * (1,520/1000000) * (0.005/100) * (8760) * (96%) / (2000lbs/ton) = 4.1 tons/yr PM

Table 3-6: Summary of Allowable Air Contaminant Emissions by Source (tons/year)						
Source	***PM/PM_{10}***	***SO_2***	***NO_X***	***CO***	***VOC***	***Total HAPs***
Main Boiler	38.5	40.5	60.8	152	10.1	10.8
Pellet Plant: Burner/Rotary Dryer	11.6	2.7	37.7	37.7	39.8	10.2
Pellet Manufacturing area	8.2	-	-	-	-	-
Diesel generators (2@500kW, 2@1000kW)	0.04	-	1.37	0.75	-	-
Diesel fire pump	-	-	0.07	0.06	-	-
Cooling Towers	4.1	-	-	-	-	-
Ash Silo vent	0.6	-	-	-	-	-
Facility Totals	**63.1**	**43.2**	**99.96**	**190.5**	**49.99**	**21**
Significance Levels	**25/15**	**40**	**40**	**50**	**40**	**-**

As summarized in Table 3-6 above:

- The Facility has allowable emissions of all air contaminants in the aggregate of ten (10) or more tons per year and has allowable emissions of carbon monoxide in excess of 100 tons per year: the Facility is therefore subject to Subchapter X of the Regulations and is designated as a Title V Subject Source. The Facility will be required to file an application for a Title V Permit to Operate within one year of commencing operation.

- The Facility has allowable emissions of PM, NO_X and CO greater than 50 ton/year which classifies the source as a “Major Source” and therefore is subject to the new source review requirements of §5-502 of the *Regulations*. In addition, for a Major Source, the allowable emissions of the other criteria pollutants are reviewed to determine if they exceed their respective ‘significant emission rate.’ SO_2 and VOC exceed their significant emission rates and will also be subject to §-502 of the *Regulations*. See section 5.0 for the review of the Most Stringent Emission Rate for the affected pollutants.
- The Facility is an electrical generating unit which uses fossil fuel (ULSD startup burners) and has a rating of > 25 MW; therefore the Facility is subject to the Acid Rain Program and the Permittee must file an Acid Rain permit application at least 24 months before commencing operation.

Table 3-7: Temporary Oil Fired Boiler - Allowable Emissions
These emissions are not added to the facility total since this boiler is only to be used during the construction phase of the project.

Unlimited operating - Total Fuel input : 634,783 gallons/yr ULSD

	Emission Factor			Allowable Emissions
	Factor	Units [2]	Source	tons per year
SO_2	142S [1] 0.0213		AP-42, Fuel Oil Combustion, Table 1.3-1 (9/98)	0.01
NO_x	20		AP-42, Fuel Oil Combustion, Table 1.3-1 (9/98)	6.4
PM	3.3	lb/1000 gal	AP-42, Fuel Oil Combustion, Tables 1.3-1 and 1.3-2 (9/98)	1.1
CO	5		AP-42, Fuel Oil Combustion, Table 1.3-1 (9/98)	1.6
VOC	0.34		AP-42, Fuel Oil Combustion, Table 1.3-3 (9/98)	0.1
HAPs	0.062		AP-42, Fuel Oil Combustion, Tables 1.3-8 to 1.3-10 (9/98)	0.02

[1] The sulfur content of ULSD is 0.0015% sulfur, so the emission factor is 0.0213 lb/1000 gal.

3.2 Estimating Emissions of Hazardous Air Contaminants.

The potential emissions of Vermont Hazardous Air Contaminants are estimated based on the maximum operating load for the Main Boiler and the burner/rotary dryer, and an appropriate emission factor. For this review the emission factors are based on a combination of sources that best represent the expected emissions from the respective sources: U.S. EPA AP-42, the National Council for Air and Stream Improvements (NCASI) and stack testing of similar wood fired boilers and wood pellet manufacturing operations located in Vermont and the rest of New England.

Table 3-8 Quantification of HAC Emissions							
Hazardous Air Contaminant	CAS#	Toxic Category	Boiler Emission Factor	Boiler EF Source [1]	Burner/ Rotary Dryer Emission Factor	Facility Emission Rate [2]	Action Level
			(lb/mmbtu)		(lb/ODT)	(lb/8-hrs)	(lb/8-hrs)
1,1,1-Trichloroethane	71556	II	3.10E-05	AP-42		1.15E-01	8.30E+01
1,2-Dichloroethane (ethylene dichloride)	107062	I	2.90E-05	NCASI		1.07E-01	3.20E-03
1,2-Dichloropropane (propylene dichloride)	78875	I	3.30E-05	NCASI		1.22E-01	4.20E-03
2,4,6-Trichlorophenol	88062	I	2.20E-07	NCASI		8.14E-04	2.70E-02
Acetaldehyde	75070	I	1.90E-04	NCASI	5.90E-02	6.90E+00	3.80E-02
Acetone	67641	II	2.20E-04	NCASI	4.70E-02	5.75E+00	2.61E+01
Acrolein	107028	II	1.59E-05	test	1.50E-02	1.63E+00	2.00E-03
Ammonia	7664417	II	10ppm	HMSER		2.18E+01	8.30E+00
Antimony	0	II	4.20E-07	NCASI		1.55E-03	3.00E-01
Arsenic	0	I	1.00E-06	NCASI		3.70E-03	1.90E-05
Barium	0	II	1.60E-04	NCASI		5.92E-01	4.00E-02
Benzene	71432	I	5.94E-04	test	4.70E-03	2.69E+00	1.10E-02
Benzo(a)pyrene	50328	I	2.67E-06	NCASI		9.88E-03	4.00E-05
Beryllium	0	I	1.90E-06	NCASI		7.03E-03	3.50E-05
bromodichloromethane	75274	I	3.00E-03	NCASI		1.11E+01	4.60E-03
Bromomethane (methyl bromide)	74839	II	1.50E-05	NCASI		5.55E-02	4.00E-01
Cadmium	0	I	1.90E-06	NCASI		7.03E-03	4.60E-05
Carbon disulfide	75150	II	1.30E-04	NCASI		4.44E-01	5.45E+01
Carbon tetrachloride	56235	I	8.90E-07	NCASI		3.29E-03	5.50E-03
Chlorine	7782505	III	7.90E-04	AP-42		3.05E+00	1.00E-02
Chlorobenzene	108907	II	1.70E-05	NCASI		6.29E-02	2.00E-01
Chloroform	67663	I	3.10E-05	NCASI		1.15E-01	3.60E-03
Chloromethane (methyl chloride)	74873	II	4.00E-05	NCASI		1.48E-01	7.50E+00
Chromium (total)	0	II	6.00E-07	NCASI		2.22E-03	1.00E-02
Chromium, hexavalent	0	I	4.90E-07	NCASI		1.81E-03	6.90E-06
Cobalt	0	I	1.90E-07	NCASI		7.03E-04	8.30E-04
Copper (dusts & mists)	0	II	5.50E-06	NCASI		2.04E-02	2.00E-02
cumene	98828	II	1.80E-05	NCASI		6.66E-02	3.32E+01

Table 3-8 Quantification of HAC Emissions							
Hazardous Air Contaminant	CAS#	Toxic Category	Boiler Emission Factor	Boiler EF Source [1]	Burner/ Rotary Dryer Emission Factor	Facility Emission Rate [2]	Action Level
			(lb/mmbtu)		(lb/ODT)	(lb/8-hrs)	(lb/8-hrs)
Di-butyl phthalate	84742	II	3.30E-05	NCASI		1.22E-01	2.50E-01
Dichloromethane (methylene chloride)	75092	I	5.40E-04	NCASI		2.15E+00	1.70E-01
dinitrotoluene-2,4	121142	I	9.40E-07	NCASI		3.48E-03	4.20E-04
Ethanol	64175	II	6.80E-05	NCASI		2.52E-01	3.72E+01
Ethylbenzene	100414	I	6.80E-06	NCASI		2.52E-02	8.30E+00
Fluoranthene	206440	II	1.64E-06	NCASI		6.07E-03	1.20E+00
Formaldehyde	50000	I	2.19E-04	test	1.40E-02	2.28E+00	6.50E-03
Hexachlorobenzene	118741	I	1.00E-06	NCASI		3.70E-03	1.80E-04
Hexane	110543	II	2.90E-04	NCASI		1.07E+00	5.81E+02
Hydrogen Chloride	7647010	II	3.40E-04	test		1.26E+00	1.70E+00
Iron oxides - dusts & fumes	0	II	9.90E-04	AP-42		3.66E+00	1.00E+00
Isopropanol	67630	II	3.90E-03	NCASI		1.44E+01	1.84E+02
Lead compounds	0	I	5.80E-06	NCASI		2.15E-02	8.30E-04
Manganese	0	II	3.43E-05	test		1.27E-01	4.00E-03
Mercury	0	II	9.90E-07	NCASI		3.66E-03	2.00E-02
Methanol	67561	II	8.30E-04	NCASI	5.90E-02	9.27E+00	9.70E+01
Methyl ethyl ketone	78933	II	9.10E-06	NCASI	3.40E-03	3.91E-01	4.15E+02
Methyl Isobutyl Ketone	108101	II	2.30E-05	NCASI		8.51E-02	2.49E+02
Molybdenum compounds (metal & insoluble)	0	II	1.10E-06	NCASI		4.07E-03	2.00E-01
Naphthalene	91203	I	1.60E-04	NCASI		5.92E-01	2.00E-02
Nickel compounds	0	I	2.90E-06	NCASI		1.07E-02	1.70E-04
PCDD/PCDF	-	0	1.38E-10	NCASI		5.11E-07	1.93E-09
Pentachlorophenol	87865	I	4.60E-08	NCASI		1.70E-04	2.40E-03
Phenanthrene	85018	II	7.21E-06	NCASI		2.67E-02	8.70E+00
Phenol	108952	II	1.40E-05	NCASI	7.90E-03	8.82E-01	5.30E+00
Pyrene	129000	II	3.79E-06	NCASI		1.40E-02	8.70E-01
Selenium	0	II	3.00E-06	NCASI		1.11E-02	1.50E-01

Table 3-8 Quantification of HAC Emissions							
Hazardous Air Contaminant	CAS#	Toxic Category	Boiler Emission Factor	Boiler EF Source [1]	Burner/ Rotary Dryer Emission Factor	Facility Emission Rate [2]	Action Level
			(lb/mmbtu)		(lb/ODT)	(lb/8-hrs)	(lb/8-hrs)
Silver compounds (metal)	0	II	1.40E-04	NCASI		5.18E-01	6.60E-01
Styrene	100425	I	6.40E-04	NCASI	5.70E-04	2.43E+00	8.30E+00
Sulfuric Acid Mist	7664939	II	9.19E-04	B&W		3.51E+00	2.70E-02
Tetrachloroethylene (perchloroethylene)	127184	I	2.80E-05	NCASI		1.04E-01	1.50E-02
Tin compounds (metal and inorganic)	0	II	3.90E-05	NCASI		1.44E-01	4.00E-01
Toluene	108883	II	2.90E-05	NCASI	5.90E-03	7.27E-01	2.49E+01
Trichloroethylene	79016	I	2.80E-05	NCASI		1.04E-01	4.00E-02
Trichlorofluoromethane	75694	II	4.10E-05	AP-42		1.52E-01	4.66E+01
Vanadium pentoxide	0	I	5.90E-07	NCASI		2.18E-03	8.30E-04
Vinyl Chloride	75014	I	1.80E-05	NCASI		6.66E-02	9.10E-03
Xylenes (o,m,p)	-	II	2.80E-05	NCASI	6.38E-03	7.74E-01	8.30E+00
Zinc oxide	0	II	4.50E-05	NCASI		1.67E-01	8.30E-02

[1] Sources of Emission Factors:

AP-42 = U.S. EPA document, A Compilation of Air Pollutant Emission Factors, 5th Edition.
NCASI = National Council for Air and Stream Improvement (NCASI) Technical Bulletin No. 858.
Test = stack testing conducted at other biomass boilers in New England.
B&W = Babcock & Wilcox technical paper: A System Approach to SO_3 Mitigation, and Motobec USA technical paper: Reducing SO_2 Emissions at Coal Fired Power Plants.
HMSER = Hazardous Most Stringent Emission Rate – see section 7.4 of this document.

[2] For category 3 contaminants, the calculated emission rate is based on maximum short term capacity of the facility. . For category 1 & 2 contaminants, the emission rate is based on the annual capacity of the facility taking into account operating restrictions.

3.3 – Estimating Potential Green House Gas Emissions

Section 3.3 Estimation of CO_2e Emissions

Facility:	BWE - Fair Haven	Permit #:	AP-11-015			
Source ID	**Source Description**	**Fuel Combusted**	**Potential or Allowable Quantity Combusted**	**Units**	**Estimated wood usage (raw tons)**	**Estimated %MC for raw wood fuel**
	Main Boiler	Wood and Wood Waste	275,233	tons	450381	45.0%
	Auxiliary burners	Distillate Fuel Oil #2	6,500	gallons	0	0.0%
	Emergency generator	Distillate Fuel Oil #2	15,301	gallons	0	0.0%
	Wood burner - dryer	Wood and Wood Waste	14,632	tons	23944	45.0%

Table 2. Total Company-Wide Stationary Source Fuel Combustion

Fuel Type	Quantity Combusted	Units
Distillate Fuel Oil #2	21,801	gallons
Wood and Wood Waste	289,865	tons

For w ood - the calculations are based on tons of w ood at 10% MC

Table 3. Total Company-wide CO_2, CH_4 and N_2O Emissions from Stationary Source Fuel Combustion

Fuel Type	CO_2 (kg)	CO_2 (lb)	CH_4 (kg)	CH_4 (lb)	N_2O (kg)	N_2O (lb)
Distillate Fuel Oil #2	222,511	490,553	9.0	19.9	1.8	4.0
Total Fossil Fuel Emissions	222,511	490,553	9.0	19.9	1.8	4.0
Wood and Wood Waste	418,172,227	921,910,856	142,660	314,511	18,724	41,280
Total Non-Fossil Fuel Emissions	418,172,227	921,910,856	142,660	314,511	18,724	41,280
Total Emissions for all Fuels	418,394,739	922,401,409	142,669	314,531	18,726	41,284

Global Warming Potential	CO_2	CH_4	N_2O		CO_2e	
	1.0	21.0	310.0		**metric ton**	**short ton**
Total CO_2 Emissions - Equivalent (Fossil CO2e + Biogenic CH4 & N2O)					**9,024**	**9,947**
All CO2e emissions at stack (Fossil CO2e + Biogenic CO2e) - for APCD Permit info					**427,196**	**470,902**

4.0 DISCUSSION OF SELECT APPLICABLE AND NON-APPLICABLE REQUIREMENTS

The Agency will assess compliance with these regulations during any inspections of the Facility. The inspections will include confirmation of the proper operation and maintenance of equipment and air pollution control devices, visual observations of emission points, and review of any records required by the Permit.

4.1 Vermont Air Pollution Control Regulations and Statutes

§5-201 and §5-202 - Open Burning Prohibited and Permissible Opening Burning

Open burning of materials is prohibited except in conformance with the requirements of this section.

§5-211(2) - Prohibition of Visible Air Contaminants - Installations constructed subsequent to April 30, 1970

This emission standard applies to all point sources of air emissions at the Facility.

§5-211(3) - Prohibition of Visible Air Contaminants – Exceptions – Wood Fuel Burning Equipment

This emission standard applies to the Main Boiler and the burner for the rotary dryer.

§5-221(1) - Prohibition of Potentially Polluting Materials in Fuel; Sulfur Limitation in Fuel

This prohibition applies to all stationary fuel burning equipment used on-site. Based on the application submittal the Permittee is expected to comply with this regulation based on the use of Ultra Low Sulfur Diesel fuel oil certified by the supplier to contain no more 0.0015% (15 ppm) sulfur by weight and natural wood fuel.

§5-231(1)(b) - Prohibition of Particulate Matter; Industrial Process Emissions

This emission standard applies to the wood pellet manufacturing operations. Based on the application submitted the Permittee is expected to comply with the particulate matter emission limit of this section through the use of fabric filters to control the particulate matter.

§5-231(3) - Prohibition of Particulate Matter; Combustion Contaminants

Based on the application submitted and information available to the Agency, this Facility has applicable fuel burning equipment subject to this regulation. The allowable particulate emissions are shown in Table 4-1.

Table 4-1: Equipment Subject to §5-231(3)			
Equipment ID	***Size/Capacity***	***Emission Standard, lbs/MMBtu***	***Allowable Emissions, lbs/hr***
Main Boiler	482 MMBtu/hr	0.1 [1]	48.2
Temporary boiler	<10 MMBtu/hr	0.5	< 0.5

[1] The Main Boiler is held to a more stringent emission standard under the MSER requirements of §5-502(3).

§5-231(4) - Prohibition of Particulate Matter; Fugitive Particulate Matter
This section requires the use of fugitive PM control equipment on all process operations and the application of reasonable precautions to prevent PM from becoming airborne during the handling, transportation, and storage of materials, or use of roads. This requirement applies to the entire Facility.

§5-241(1) & (2) - Prohibition of Nuisance and Odor
This requirement applies to the entire Facility and prohibits the discharge of air contaminants that would be a nuisance to the public or the discharge of objectionable odors beyond the property-line of the Facility.

§5-251 - Control of Nitrogen Oxide Emissions
Based on the application submittal and information available to the Agency, the main boiler is greater than 250 MMBtu/hr and is subject to this regulation 5-251(1) while burning fossil fuel. However the main boiler is being held to a more stringent emission standard under the MSER requirements of 5-502(3). The Facility does not have allowable emissions of NO_X in excess of 100 tons per year and is therefore not subject to subsection 5-251(3).

§5-252 - Control of Sulfur Dioxide Emissions
Based on the application submittal and information available to the Agency, the main boiler is greater than 250 MMBtu/hr and is subject to this regulation while burning fossil fuel. However the main boiler is being held to a more stringent emission standard under the MSER requirements of 5-502(3).

§5-253.1 – 5-253.20 - Control of Volatile Organic Compounds
Based on the application submittal and information available to the Agency, this Facility currently has no applicable operations subject to this regulation.

§5-261 - Control of Hazardous Air Contaminants
See Section 7.0 below.

§5-271 – Control of Air Contaminants from Stationary Reciprocating Internal Combustion Engines
This emission standard applies to all stationary reciprocating internal combustion engines with a brake horsepower output rating of 450 hp or greater. This section applies to the emergency generators at the Facility.

4.2 Federal Air Pollution Control Regulations and the Clean Air Act

40 *C.F.R.* Part 60 Subpart Db – ***Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units***
"The affected facility to which this Subpart applies is each steam generating unit for which construction, modification, or reconstruction is commenced after June 19, 1984 and that has a maximum design heat input capacity of greater than 29 megawatts (MW) (100 million BTU per hour).

The Main Boiler is subject to this regulation. However the main boiler is held to more stringent emission standards through MSER.

40 *C.F.R.* Part 60 Subpart IIII – ***Standards of Performance for Stationary Compression Ignition Internal Combustion Engines***

Applies to CI RICE model year 2007 and newer. This regulation establishes emission rates for affected engines, requires routine engine maintenance and sets maximum sulfur content for the diesel fuel. Beginning October 1, 2010 applicable engines shall only use diesel fuel with a maximum sulfur content of 15 ppm (ULSD).

This regulation applies to the diesel engines that power the emergency generators and the fire pump at the Facility.

40 *C.F.R.* Part 63 Subpart JJJJJJ – ***National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial and Institutional Boilers – area sources.***

This regulation has requirements for emission limits (PM <0.03 lb/MMBtu heat input), work practice standards, operating limits for the PM control device, performance stack testing, and demonstrating continuous compliance (similar to Compliance Assurance Monitoring discussed below).

This regulation applies to the Main Boiler.

This regulation also applies to the temporary boiler: biennial tune-up, notification and reporting requirements.

40 *C.F.R.* Part 63 Subpart ZZZZ – National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines. Applies to new engines installed after June 12, 2006 at area sources of HAPs. Requires such engines to meet the emission standards of NSPS Subpart IIII and JJJJ, imposes ULSD fuel limitations, and imposes maintenance requirements. Separate provisions of ZZZZ also apply to existing engines installed prior to June 12, 2006.

Subpart ZZZZ applies to the diesel engines that power the emergency generators and the fire pump at the Facility.

<u>Clean Air Act §§114(a)(3), 502(b), and 504(a)-(c); 40 CFR Part 70 §§70.6(a)(3)(i)(B) and 70.6(c)(1); and 40 CFR Part *64*</u> - *Compliance Assurance Monitoring.*

This Facility will be subject to CAM. The emissions of CO, PM and NOx from the Main Boiler are subject to CAM because:

- the Facility is a Title V Subject Source;
- the uncontrolled emission rates of CO, PM and NOx exceed their respective Title V major source thresholds (100 ton/yr);
- the emissions of CO (MSER and HMSER) PM (NSPS, MSER and HMSER) and NOx (MSER) are subject to an applicable rule;
- the Main Boiler is equipped with emissions control devices for each of these pollutants.

The CAM Plan for this Facility will be included in the Title V Operating permit. The Facility is required to file an application for a Title V Operating permit within one year of commencing operation. The Facility is expected to establish the parameters of the CAM plan during the initial operating period of the Facility so they can be included in the CAM plan portion of the Title V operating permit application.

<u>40 *C.F.R.* Parts 72-78</u> – Acid Rain Program

The Permittee is required to operate the Facility under a permit that includes the Acid Rain Program requirements. This section also requires that the Facility be equipped with a CEMS and meet additional recordkeeping and reporting requirements. Pursuant to §72 the Facility is required to file an application for an Acid Rain permit at least 24 months prior to commencing operation.

<u>40 *C.F.R.* Part 98 – Mandatory Greenhouse Gas Reporting</u>

Pursuant to §98.2(a)(1)(i) the Permittee is required to report the Facility's greenhouse gas emissions from the Main Boiler.

4.3 Non-Applicable Requirements for Which a Permit Shield Provision Has Been Requested

Pursuant to §5-1015(a)(14) of the Regulations, an owner/operator may request to be shielded from potentially applicable state or federal requirements. The Facility has not requested a permit shield from any specific, potentially applicable requirement. Accordingly, the Agency has not granted any permit shields for the Facility.

5.0 CONTROL TECHNOLOGY REVIEW FOR MAJOR SOURCES AND MAJOR MODIFICATIONS

Pursuant to §5-502 of the Regulations each new major source and major modification must apply control technology adequate to achieve the Most Stringent Emission Rate ("MSER") with respect to those air contaminants for which there would be a major or significant emission increase, respectively. For those unfamiliar with Vermont's term MSER, it can be thought of as a functional equivalent to the federal Best Available Control Technology.

As shown in Tables 3-6 above, the Facility must achieve MSER for PM/PM_{10}, SO_2, CO, VOC and NO_x. Note that the emission rate of beryllium using available wood burning emission factor data also is estimated to exceed its significant emission rate of 0.0004 ton/yr. Since beryllium is also a HAC, it will be reviewed under §5-261 of the *Regulations* which establishes the Hazardous Most Stringent Emission Rate for HACs that are expected to be emitted at a rate that exceeds their Action Level.

MSER is established following the procedures identified in the Agency's "Air Pollution Control Permitting Handbook", NESCAUM's "BACT Guideline", and the U.S. EPA's "New Source Review Workshop Manual". The process of determining MSER is to first list all available options for reducing emissions and then rank the alternatives in order of effectiveness from top to bottom (top being the most effective). One of the sources for information on emission limits and control technologies for permitted facilities is the U.S. EPA's "RACT, BACT, LAER Clearinghouse (RLBC)." MSER requires the application of the top option unless it can be demonstrated based upon costs (economic, energy, and environmental) or technical constraints that such an option is not achievable for the proposed project. If the Agency concurs with the applicant that an option is not achievable, then the next most effective option is evaluated. This process may take several iterations before MSER is established.

MSER will be established for the following sources: Main Boiler, pellet plant burner/rotary dryer, and the emergency engines.

<u>Wood Fired Boiler – MSER Determination:</u>

5.1 Main Boiler - NO_X MSER Review

The NOx control alternatives identified in the permit application for the proposed Main Boiler, listed in order of effectiveness:

1. Selective catalytic reduction (SCR): use of a catalyst to reduce NO_x to N_2 at temperatures between 500 to 800°F. There are several approaches to using a catalyst for NOx reduction. One is a hot side SCR where the exhaust gases pass straight through the catalyst and out the stack. In cases where the exhaust gases are too cool for the catalyst to function properly, additional heat is necessary to bring the exhaust gases up in temperature. In these systems, the added heat energy is often recovered by cycling back and forth over heat recovery media beds. This is referred to as a regenerative SCR. Straight SCR systems can achieve very high levels of emission reductions depending on the volume of catalyst and amount of ammonia used. RSCR systems perform slightly lower.

2. Selective non-catalytic reduction (SNCR): injection of ammonia or urea into the boiler exhaust gases under high temperatures (between 1600 to 2100°F) to reduce NO_x to N_2. This can achieve NOx reduction levels ranging from 30 – 50%. When combined with combustion controls, the overall NOx reduction can be in the range of 65 – 75%.
3. Flue gas recirculation and/or water injection into the combustion zone to lower combustion temperature and thermal NO_x formation.
4. Combustion controls: Controlling the fuel/air mixing, excess air levels, and other combustion parameters to achieve efficient combustion and to lower the formation of fuel and thermal NO_x.

All of the above technologies are technically feasible. The Permittee is proposing to use a combination of 1 & 4 as MSER for NOx control. The catalyst system will be a multi pollutant catalytic reactor (MPCR) that will reduce NOx, CO and VOC emissions. In addition the Permittee is proposing a NOx limit of 0.06 lb/MMBtu based on a one hour block average and a long term NOx emission limit of 0.03 lb/MMBtu for an annual block average.

There are a number of wood fired electrical generating stations both proposed and operating in the northeast that utilize a selective catalytic reduction system for controlling NOx emissions. Some of these SCR systems are located as a “cold side” SCR and they incorporate a regenerative heat exchanger to maintain the proper temperatures with the minimal amount of additional fuel to heat up the exhaust gases.

Table 5-1: NO_X Emission Limits and Performance

Facility	Nominal Rating	Permit Date	NO_X Controls	NO_X Limit (lb/MMBtu)	NO_X Emission Performance
Clean Power Berlin, Berlin, NH	29 MW	9/25/09	SCR	0.065 (30 day rolling avg)	Plant has not been built.
Concord Steam Concord, NH	19.5 MW	8/12/2011	SCR	0.065 (30 day rolling avg)	Plant has not been built.
Montville Power, Uncasville, CT	42 MW	4/6/10	RSCR	0.06 (24 hr block)	Plant has not been built.
Russell Biomass, Russell, MA	50 MW	12/30/08	RSCR	0.060 (12 month rolling avg)	Plant has not been built.
Palmer Renewable Energy, Springfield, MA	38 MW	3/7/11 (draft permit)	HRSCR [1]	0.055 (1 hr block) 0.017 (12 month block)	Plant has not been built.
Pioneer Renewable Energy, Greenfield, MA	47 MW	7/2/09 application w/ amend.	MPCR	0.055 (1 hr block) 0.022 (12 month block)	Plant has not been built.
Lufkin Generating Plant, Lufkin, TX	45 MW	10/26/09	SCR	0.075 (30 day rolling avg)	Started August 2011
Laidlaw Berlin BioPower, Berlin, NH	70 MW	7/26/10	SCR	0.060 (30 day rolling avg)	Plant has not been built.
PSNH - Schiller Station (Unit SR5) Portsmouth, NH	50 MW	3/7/06	SNCR	0.075 (24 hr avg)	Based on CEMS, 1st qtr 2011 estimated at 0.064 lb/MMBtu
Yellow Pine Energy Company Fort Gaines, GA	115 MW	5/15/09	SNCR	0.10 (30 day rolling avg).	Plant has not been built.

Table 5-1: NO_X Emission Limits and Performance					
Facility	**Nominal Rating**	**Permit Date**	**NO_X Controls**	**NO_X Limit (lb/MMBtu)**	**NO_X Emission Performance**
McNeil Generating Station, Burlington, VT	50 MW	2/2/09	RSCR	0.075 (Quarterly block)	2010 Quarterly averages: 0.067, 0.072, 0.072, 0.069.

[1] HRSCR – high efficiency regenerative selective catalytic reduction system. The proposed system at this facility includes an oxidative catalyst as well for reducing CO and VOC emissions.

Many of the operating facilities are controlling NOx emissions, on a long term basis (typically a 3 month average) to qualify for the Massachusetts or Connecticut renewable energy credit markets. Since the REC markets with the highest value credits allow for a maximum quarterly NOx emission rate of 0.065 and 0.075 lb/MMBtu, this is the typical range of demonstrated emission rate performance for this technology.

Two of the most recently proposed projects in Massachusetts: Palmer Renewable Energy and Pioneer Renewable Energy have proposed to achieve a NOx emission rate of 0.055 lb/MMBtu based on a one hour block average. The Palmer Renewable Energy project has also proposed an annual average NOx emission rate of 0.017 lb/MMBtu. Since neither of these projects has been constructed and these emission rates have not been demonstrated, they are not being considered as a basis to lower the proposed NOx emission rates for the project under review.

Based on review of the proposed alternatives, the Agency concurs that MSER for NOx is the use of combustion controls with a MPCR and the following NOx emission rates: hourly average of 0.060 lb/MMBtu of heat input and a 12 month rolling average of 0.030 lb/MMBtu of heat input.

5.2 Main Boiler – Particulate Matter (“PM/PM_{10}”) MSER Review

The alternatives identified in the permit application for the proposed wood fired Main Boiler- listed in order of effectiveness:

1. Multi-clone followed by an Electrostatic Precipitator (ESP) or fabric filter.
2. Multi-clone followed by a wet scrubber.
3. Electrified filter bed.
4. Multi-clone.

All of the above technologies are technically feasible. The Permittee is proposing the use of a multi-clone followed by an ESP as MSER for PM/PM_{10} control. In addition, the Permittee is proposing a filterable PM emission limit of 0.012 lb/MMBtu and a total PM (filterable + condensable PM) limit of 0.019 lb/MMBtu.

In the table shown below is a summary of the PM emission limits of several recently permitted wood fired boiler EGUs, as well as the two wood fired EGUs currently operating in Vermont.

Table 5-2: PM/PM_{10} Emission Limits and Performance					
Facility	**Nominal Rating**	**Permit Date**	**PM Controls**	**PM/PM_{10} Limit (lb/MMBtu)**	**PM Emission Performance**
Seneca Sustainable Energy, Eugene, OR	18.8 MW	10/9/09	Multi-clone, ESP	Total PM: 0.008	Stack test completed; results did not demonstrate compliance at this time.
Montville Power, Uncasville, CT	42 MW	4/6/10	Multi-clone, ESP	Filterable PM: 0.012 Total PM: 0.026	Plant has not been built.
Russell Biomass, Russell, MA	50 MW	12/30/08	Multi-clone, ESP or fabric filter	Filterable PM: 0.012 Total PM: 0.026	Plant has not been built.
Palmer Renewable Energy, Springfield, MA	38 MW	6/30/2011	Multi-clone, fabric filter	Filterable PM: 0.008 Total PM: 0.015	Plant has not been built.
Pioneer Renewable Energy, Greenfield, MA	47 MW	7/2/09 application w/ amend.	Multi-clone, ESP	Filterable PM: 0.012 Total PM: 0.019	Plant has not been built.
Lufkin Generating Plant, Lufkin, TX	45 MW	10/26/09	ESP	Filterable PM: 0.012 Total PM: 0.025 Both 30 day rolling avg	Started August, 2011
Laidlaw Berlin BioPower, Berlin, NH	70 MW	7/26/10	Fabric filter	Filterable PM: 0.01	Plant has not been built.
PSNH - Schiller Station (Unit SR5) Portsmouth, NH	50 MW	3/7/06	Fabric filter	Filterable PM: 0.025 (at all times) 0.01 (24-hour avg)	Stack test 5/6/10 0.001 lb/MMBtu Stack test 5/10/09 0.001 lb/MMBtu
Yellow Pine Energy Company Fort Gaines, GA	115 MW	5/15/09	Fabric filter	Filterable PM: 0.010 Total PM: 0.018	Plant has not been built.
McNeil Generating Station, Burlington, VT	50 MW	2/2/09	ESP	Filterable PM: 0.007 gr/dscf (0.016 lb/MMBtu)	Stack test 7/14/04 0.00060 lb/MMBtu Stack test 10/26/10 0.00015 lb/MMBtu
Ryegate Power Station East Ryegate, VT	20 MW		ESP	Filterable PM: 0.007 gr/dscf (0.016 lb/MMBtu)	Average of 9 stack tests since 1993: 0.0013 lb/MMBtu

Based on review of the proposed alternatives, the Agency concurs that the best available control technology for PM/PM_{10} emissions from the Main Boiler is the use of a multi-clone in conjunction with either an ESP or a fabric filter and a total PM emission rate of 0.019 lb/MMBtu. The Agency has not found enough PM emission data on large boilers to adequately characterize the contribution of the condensable portion of the PM, so we are not requiring a lower emission rate for total PM. The condensable PM data that has been gathered suggests that the emission rate of 0.008 lb/MMBtu for Seneca Sustainable Energy for total PM is not expected to be consistently achievable.

However, for the filterable PM emission rate unit SR5 at the Schiller Station in Portsmouth, NH has a filterable PM emission rate of 0.01 lb/MMBtu. In addition numerous stack test results for filterable PM from Schiller Station, McNeil, and Ryegate have all demonstrated that 0.010 lb/MMBtu is attainable and therefore the Agency is establishing MSER for filterable PM at 0.010 lb/MMBtu as an hourly average.

5.3 Main Boiler – Carbon Monoxide (CO) MSER Review

The alternatives identified in the permit application for the proposed wood fired Main Boiler-listed in order of effectiveness:

1. Oxidative catalyst.
2. Good combustion design and combustion practices.

Table 5-3: CO Emission Limits and Performance

Facility	Nominal Rating	Permit Date	CO Controls	CO Limit (lb/MMBtu)	CO Emission Performance
Montville Power, Uncasville, CT	42 MW	4/6/10	Combustion Control and CO catalyst	0.10 (8 hr block)	Plant has not been built.
Russell Biomass, Russell, MA	50 MW	12/30/08		0.075	Plant has not been built.
Palmer Renewable Energy, Springfield, MA	38 MW	3/7/11 (draft permit)		0.114 (1 hr block) 0.07 (4 hr block) 0.0365 (12 month rolling avg)	Plant has not been built.
Pioneer Renewable Energy, Greenfield, MA	47 MW	7/2/09 application w/ amend.		0.07	Plant has not been built.
Lufkin Generating Plant, Lufkin, TX	45 MW	10/26/09		0.075	Started August, 2011
Laidlaw Berlin BioPower, Berlin, NH	70 MW	7/26/10	Bubbling fluidized bed boiler and FGR	0.075 (24 hr avg)	Plant has not been built.
PSNH - Schiller Station (Unit SR5) Portsmouth, NH	50 MW	3/7/06	Good combustion w/ fluidized bed	0.10 (24 hr avg)	Plant operating and using CEMS to monitor CO emissions.

All of the above technologies are technically feasible. The Permittee is proposing to use a combination of 1 & 2 as MSER for CO control. In addition, the Permittee is proposing a CO limit of 0.075 lb/MMBtu based on a 24-hour block average.

Based on review of the proposed alternatives, the Agency concurs that MSER for CO is the use of combustion controls with a MPCR and a limit of 0.075 lb/MMBtu of heat input as a 24 hour rolling average.

5.4 Main Boiler – Volatile Organic Compounds (VOC) MSER Review

Similar to CO, volatile organic compounds are formed because of incomplete combustion of fuel. Thus, the above discussion regarding the generation and control of CO emissions for the proposed project applies to volatile organic compounds.

The alternatives identified in the permit application for the proposed wood fired Main Boiler- listed in order of effectiveness:

1. Oxidative catalyst.
2. Good combustion design and combustion practices.

Table 5-4: VOC Emission Limits and Performance

Facility	Nominal Rating	Permit Date	VOC Controls	VOC Limit (lb/MMBtu)	VOC Emission Performance
Montville Power, Uncasville, CT	42 MW	4/6/10	Combustion Control and CO catalyst	0.01	Plant has not been built.
Russell Biomass, Russell, MA	50 MW	12/30/08		0.01	Plant has not been built.
Palmer Renewable Energy, Springfield, MA	38 MW	3/7/11 (draft permit)		0.01	Plant has not been built.
Pioneer Renewable Energy, Greenfield, MA	47 MW	7/2/09 application w/ amend.		0.01	Plant has not been built.
Lufkin Generating Plant, Lufkin, TX	45 MW	10/26/09		0.01	Started August, 2011.
Ryegate Power Station East Ryegate, VT	20 MW	5/15/2011	Good combustion control	0.03	Average of 7 stack tests since 1993: 0.0013 lb/MMBtu
PSNH - Schiller Station (Unit SR5) Portsmouth, NH	50 MW	3/7/06	Good combustion w/ fluidized bed	0.005	

All of the above technologies are technically feasible. The Permittee is proposing to use a combination of 1 & 2 as MSER for VOC control. In addition, the Permittee is proposing a VOC limit of 0.005 lb/MMBtu.

Based on review of the proposed alternatives, the Agency concurs that MSER for VOC is the use of combustion controls with an oxidation catalyst within the MPCR and a VOC limit of 0.005 lb/MMBtu of heat input based on an hourly average.

5.5 Main Boiler - Sulfur Dioxide (SO_2) MSER Review:

The alternatives identified in the permit application for the proposed wood fired Main Boiler- listed in order of effectiveness:

1. Use of low sulfur content fuel:
2. Installation and Operation of a Wet Scrubber (70-90% Control Efficiency): Exhaust gas temperature from the boiler would decrease to below 212°F, reducing buoyancy induced dispersion of boiler exhaust which would likely increase ground level SO_2 concentrations. The Palmer Renewable Energy project is proposing to use this technology to control SO_2 and HCl.
3. Installation and Operation of a Spray Dryer. The South Point Biomass project proposes this technology as one of their options for controlling SO_2 emissions.
4. Dry Sorbent Injection. Depending upon the SO_2 loading and the system design, the control efficiency can be as high as 80%. Table 5-5 lists a couple facilities that use or are proposing to use this technology.

Table 5-5: SO_2 Emission Limits and Performance

Facility	Nominal Rating	Permit Date	SO_2 Controls	SO_2 Limit (lb/MMBtu)	SO_2 Emission Performance
Seneca Sustainable Energy, Eugene, OR	18.8 MW	10/9/09	None	0.025	Stack test completed, results not available at this time.
Montville Power, Uncasville, CT	42 MW	4/6/10	None	0.025	Plant has not been built.
PSNH - Schiller Station (Unit SR5) Portsmouth, NH	50 MW	3/7/06	Dry sorbent injection [1]	0.02	Based on CEMS from 1st Qtr 2011, estimated average emission rate < 0.001 lb/MMBtu.
Lindale Renewable Energy, Lindale, TX	50	1/08/2010	None	0.025	Plant has not been built.
Lufkin Generating Plant, Lufkin, TX	45 MW	10/26/09	None	0.025	Started August , 2011
South Point Biomass, South Point, OH	7 boilers, 318 MMBtu/hr (each)	4/04/2006	Spray dryer or sodium bicarbonate injection	22.13 lb/hr (0.07 lb/MMBtu)	Plant has not been built.
Laidlaw Berlin BioPower, Berlin, NH	70 MW	7/26/10	Dry sorbent injection	0.012	Plant has not been built.
Palmer Renewable Energy, Springfield, MA	38 MW	3/7/11 (draft permit)	Sorbent injection, Turbosorp scrubber	0.02	Plant has not been built.
Pioneer Renewable Energy, Greenfield, MA	47 MW	7/2/09 application w/ amend.	None	0.025	Plant has not been built.

Table 5-5: SO_2 Emission Limits and Performance					
Facility	**Nominal Rating**	**Permit Date**	**SO_2 Controls**	**SO_2 Limit (lb/MMBtu)**	**SO_2 Emission Performance**
Ryegate Power Station East Ryegate, VT	20 MW	5/16/2011	None	None	Stack test 6/16/2004 0.0022 lb/MMBtu

[1] Schiller Station is also permitted to burn coal in Unit SR5.

All of the above technologies are technically feasible. However, due to the relatively low emission rate of SO2 due in part to a lack of dual fuel use except for start-up, the costs of control for the wet and dry scrubbing technologies are prohibitive. The Permittee is proposing that wood as a low sulfur fuel represents MSER for SO_2 control. In addition, the Permittee is proposing a SO_2 limit of 0.02 lb/MMBtu.

Based on review of the proposed alternatives, the Agency concurs that the MSER for SO_2 is the use of wood as a low sulfur content fuel a limit of 0.02 lb/MMBtu of heat input based on an hourly average. If the facility is required by the Acid Rain Program to operate an SO_2 CEMS, then the limit is based on an annual average.

<u>Pellet Plant Burner/Rotary Dryer MSER Determination:</u>

A review of the US EPA RACT/BACT/LAER Clearinghouse yielded only one wood pellet manufacturing facility: International Biofuels Inc. in Greenville, VA. This facility received a construction permit in 2005 but was subsequently never built. It was permitted for over 500,000 dry tons per year of output from the dryers compared to Beaver Wood Energy's proposed 115,000 oven dry tons. This higher capacity results in much higher estimated emissions of VOCs; resulting in the facility being required to use a thermal oxidizer for controlling VOC emissions.

As noted in the permit application, the rotary dryers used in particle and/or wafer board manufacturing plants are similar to the rotary dryer proposed by the Permittee. However, the information available in the RBLC for board manufacturer dryers is for much larger facilities with much higher potential air emissions. As a result, many of these larger board manufacturing facilities employ regenerative thermal oxidizers to control the VOC emissions from their rotary dryers.

Since there are several permitted wood pellet manufacturing plants that are more representative of the Permittee's proposed operation, the emission rates from these facilities will be reviewed for the MSER determinations from the pellet plant burner and rotary dryer.

Table 5-6: Wood Dryers at Wood Pellet Plants					
Facility	**Burner Size (MMBtu /hr)**	**Permitted Capacity (ODT/yr)**	**Max hourly dryer throughput (ODT/hr)**	**Permit Date**	**Operating Status**
Vermont Renewable Energy Company, Brighton, VT	40	100,000	11.4	2/10/2010	Plant has not been built.
New England Wood Pellet, Jaffery, NH	40	89,300	10.2	9/10/2007	Operating Stack test 8/2006
Schuyler Wood Pellet Schuyler, NY	50	131,400	15	5/7/2010	Operating Stack test 2/2009
Deposit Wood Pellet Deposit, NY	50	113,800	15	4/27/2010	Operating Testing required (CO, NOx, PM)
Geneva Wood Fuels Strong, ME	40	136,065 [1]	16.38	3/18/2010	Operating Stack test 10/2010
Maine Woods Pellet Company Athens, ME	50	114,480 [2]	14.4	3/16/2010	Operating Stack test 11/2008
Corinth Wood Pellet Corinth, ME	20 each (2 lines)	Varies based on wood species	11.1 each	6/25/2009	Operating Stack test 9/2009

[1] Based on the permit limit of 8,322 hours/year and the maximum production rate of 16.38 ODT/hr

[2] Based on the permit limit of 7,950 hours/yr and the maximum production rate of 14.4 ODT/hr

Table 5-7: Burner/Dryer Emission Limitations					
Facility (ODT/hr)	**NO_X limit**	**CO limit**	**PM limit**	**VOC limit**	**SO_2 Limit**
Vermont Renewable Energy Company (11.4)	0.66 lb/ODT 7.5 lb/hr	0.66 lb/ODT 7.5 lb/hr	0.97 lb/ODT 11.0 lb/hr	11.4 lb/hr (~ 1.0 lb/ODT)	NA
New England Wood Pellet (10.2)	0.69 lb/ODT 7.04 lb/hr	1.43 lb/ODT 14.59 lb/hr	0.30 lb/MMBtu 0.84 lb/ODT 8.57 lb/hr	0.57 lb/ODT 5.81 lb/hr	0.025 lb/MMBtu
Schuyler Wood Pellet (15)	21.5 lb/hr (~1.4 lb/ODT)	21.5 lb/hr (~1.4 lb/ODT)	0.42 lb/MMBtu	10.5 lb/hr (~0.7 lb/ODT)	NA
Deposit Wood Pellet (15)	19.15 lb/hr (~1.3 lb/ODT)	17.5 lb/hr (~1.2 lb/ODT)	0.050 gr/dscf	8.55 lb/hr (~0.57 lb/ODT)	Fuel limit: lb S/ MMBtu 2.5 max 1.9 3-mo avg 1.7 12-mo avg
Geneva Wood Fuels (16.38)	0.66 lb/ODT 10.8 lb/hr	0.66 lb/ODT 10.8 lb/hr	8.5 lb/hr (~0.5 lb/ODT)	0.59 lb/ODT 9.7 lb/hr	1.9 lb/hr (~0.048 lb/MMBtu)
Maine Woods Pellet Company (14.4)	5.0 lb/hr (~0.35 lb/ODT)	15.1 lb/hr (~1.1 lb/ODT)	8.5 lb/hr (~0.59 lb/ODT)	12.5 lb/hr (~0.9 lb/ODT)	5.1 lb/hr (~0.010 lb/MMBtu)
Corinth Wood Pellet (11.1 each) *lb/hr limits are for each of the 2 lines*	5.7 lb/hr 0.51 lb/ODT	Pine & other SW: 65.5 lb/hr 5.9 lb/ODT HW: 50 lb/hr 4.5 lb/ODT	Pine: 20 lb/hr 1.8 lb/ODT SW: 25.5 lb/hr 2.3 lb/ODT HW: 30.0 lb/hr 2.7 lb/ODT	Pine 48.8 lb/hr 4.4 lb/ODT SW: 23.3 lb/hr 2.1 lb/ODT HW: 11.1 lb/hr 1.0 lb/ODT	0.5 lb/hr 0.025 lb/MMBtu

Table 5-8: Burner/Dryer Control Technology					
Facility	**NO_X limit**	**CO limit**	**PM limit [1]**	**VOC limit**	**SO_2 Limit [3]**
Vermont Renewable Energy Company	Good combustion	Good combustion	Multi-clone	Good combustion	No limit
New England Wood Pellet	Good combustion	Good combustion	Multi-clone	Good combustion	Low sulfur fuel
Schuyler Wood Pellet	Good combustion	Good combustion & combustion temperature > 1700 ^oF	Multi-clone	Good combustion	NA
Deposit Wood Pellet	Good combustion	Good combustion	Multi-clone	Good combustion	Low sulfur fuel
Geneva Wood Fuels	Good combustion	Good combustion	Multi-clone	Good combustion	Low sulfur fuel
Maine Woods Pellet Company	Good combustion	Good combustion	Wet scrubber	Good combustion	No controls
Corinth Wood Pellet	Good combustion	Good combustion	Cyclone [2]	Good combustion	No controls

[1] If a cyclone or multi-clone is listed, it also serves as process equipment that is used to separate the dried wood product from the rotary dryer's exhaust gas.
[2] The Maine DEP has also required this facility to investigate the use of exhaust gas recycle as a control option.
[3] For all facilities, if there is an SO_2 emission limit, the facility's plan is to use wood as the fuel since it is considered to be inherently low in sulfur content.

Table 5-9: Burner/Dryer Test Results					
Facility	**NO_X**	**CO**	**PM**	**VOC**	**SO_2**
Vermont Renewable Energy Company	Facility not constructed – no testing.				
New England Wood Pellet	8/2006 3.3 lb/hr (~0.33 lb/ODT)	8/2006 11.5 lb/hr (~1.15 lb/ODT)	8/2006 7.4 lb/hr (~0.74 lb/ODT)	8/2006 2.6 lb/hr (~0.26 lb/ODT)	-
Schuyler Wood Pellet	2/2009 5.96 lb/hr ~ 0.4 lb/ODT	2/2009 0.85 lb/hr ~ 0.06 lb/ODT	2/2009 0.41 lb/ MMBtu	2/2009 3.6 lb/hr ~ 0.24 lb/ODT	-
Deposit Wood Pellet	Facility operating, no test results available at this time.				
Geneva Wood Fuels	-	10/2010 3.21 lb/hr ~ 0.43 lb/ODT	10/2010 4.28 lb/hr ~ 0.58 lb/ODT	10/2010 1.49 lb/hr ~ 0.20 lb/ODT	-
Maine Woods Pellet Company	-	-	11/2008 4.88 lb/hr 0.26 lb/MMBtu 6/2010 3.4 lb/hr	11/2008 11.97 lb/hr 6/2010 6.4 lb/hr	-
Corinth Wood Pellet	9/2009 Line 1 HW: 2.1 lb/hr 0.35 lb/ODT Line 2 HW: 2.3 lb/hr 0.36 lb/ODT	9/2009 Line 1 HW: 18.8 lb/hr 3.1 lb/ODT Line 2 HW: 9.8 lb/hr 1.5 lb/ODT	9/2009 Line 1 HW: 4.1 lb/hr 0.67 lb/ODT Line 2 HW: 4.2 lb/hr 0.64 lb/ODT	9/2009 (THC) Line 1 HW: 0.2 lb/hr 0.03 lb/ODT Line 2 HW: 0.21 lb/hr 0.03 lb/ODT	-

5.6 Wood Pellet Burner/Dryer - NO_X MSER Review:

The NOx control alternatives identified in the permit application for the proposed wood dryer/burner, listed in order of effectiveness:

1. Selective catalytic reduction (SCR). Due to the high particulate loading in the burner's exhaust gas between the burner and the rotary dryer (where the combustion gases are at the correct temperature for the reaction), the catalyst would become fouled. If the catalyst is located after the proposed fabric filter, the temperature of the exhaust gas is too low for the reaction to take place without prohibitive levels of reheating. The exhaust temperatures exiting the dryers are much lower than for a conventional boiler. The temperature profile in the dryer itself cannot be significantly increased without partially combusting the wood material and increasing incomplete combustion emissions. SCR is not technically feasible.
2. Selective non-catalytic reduction (SNCR). As noted in Table 5-8 none of the permitted wood pellet manufacturing operations utilize SNCR to reduce the emissions of NO_X. As noted in Section 5.1 above, an SNCR system requires a section in combustion gas pathway that has both a specific temperature range (1600 – 2100^oF) and sufficient residence time for the ammonia to mix and react with the NO_X. The burner in wood pellet drying systems do not typically operate at the high temperatures present in a boiler, and almost immediately after exiting the burner, the exhaust gases are cooled to temperatures well below 1600^oF. The exhaust gases must be cooled to prevent charring of the wood in the rotary dryer. SNCR is not technically feasible.
3. Combustion controls: Controlling the fuel/air mixing, excess air levels, and other combustion parameters to achieve efficient combustion and to lower the formation of fuel and thermal NO_x. This is the technique used to control NOx at all of the referenced permitted wood pellet manufacturing facilities.

The Permittee is proposing the use of a Coen low NOx burner and good combustion controls with an emission rate of 0.35 lb/MMBtu as MSER. The optimal temperature range for achieving the proposed emission rate, as measured at the exit of the burner, will be established during stack testing.

The Agency agrees that MSER for the wood burner/dryer system is the use of a Coen low NOx burner and good combustion controls with an hourly average emission rate of 0.35 lb/MMBtu heat input at the burner.

5.7 Wood Pellet Burner/Dryer - CO MSER Review:

The alternatives identified in the permit application for the proposed wood burner/dryer system - listed in order of effectiveness:

1. Oxidative catalyst. The oxidative catalyst has the same issues as the SCR, and it is not considered a feasible technology for controlling CO from this process.
2. Good combustion design and combustion practices.

The Permittee is proposing the use of a Coen low NOx burner and good combustion controls with an emission rate of 0.35 lb/MMBtu as MSER for CO. The Coen burner design incorporates a dual air zone scroll feed that is intended to optimize the combustion by ensuring good mixing for low CO emissions, and limiting the availability of oxygen in the hottest part of the flame to minimize the formation of thermal NOx.

The Agency agrees that MSER for CO for the wood burner/dryer system is the use of a Coen low NOx burner and good combustion controls with an hourly average emission rate of 0.35 lb/MMBtu. As with the NOx limit, the optimal combustion temperature range for achieving the proposed emission rate, as measured at the exit of the burner, will be established during stack testing.

5.8 Wood Pellet Burner/Dryer - VOC MSER Review:

VOCs are emitted from the burner/dryer process due to incomplete combustion in the burner as well as the VOCs that are released from the wood as it is being dried in the rotary dryer. It is expected that the bulk of the VOC emissions will be from the drying of the wood, especially if pine is being dried. While good control of the combustion process in the burner will help minimize the VOCs from that stage of the process, it will not influence the VOCs released in the dryer. The temperature at which the drying takes place is a key parameter in the release of the VOCs in the drying phase of this system.

The alternatives identified in the permit application for the proposed wood burner/dryer system - listed in order of effectiveness:

1. Regenerative Thermal Oxidizer (RTO). This is a common control technology used on the larger dryer systems used in the board manufacturing industry. The cost for an RTO to treat the VOCs from this smaller system is estimated to be $32,336/ton and this is not considered to be economically feasible.
2. Oxidative catalyst. The oxidative catalyst has the same issues as the SCR for NOx control, and it is not considered a feasible technology for controlling VOC from this process.
3. Carbon Adsorption: This technology is best suited for cool, dry exhaust gases from lower volume systems. Since the burner/dryer system is a high volume, hot, very moist gas, the carbon adsorption is not a feasible technology.
4. Good combustion design and combustion practices. This technique is feasible for the VOCs from the combustion process, but will not affect the VOCs released from drying wood in the rotary dryer.
5. Process controls for the dryer such as controlling the temperature profile in the dryer to prevent overheating of the wood material that would release VOC emissions.

The Permittee is proposing to use the same approach for VOC control from the burner as they have proposed for CO control: a Coen low NOx burner and good combustion controls with an overall emission rate of 0.69 lbs/ODT as MSER for VOCs. The Coen burner design incorporates a dual air zone scroll feed that is intended to optimize the combustion by ensuring good mixing for low CO and VOC emissions, and by limiting the availability of oxygen in the hottest part of the flame to minimize the formation of thermal NOx.

The Agency has determined that VOC MSER is a combination of 4 and 5 that will use dryer process controls as well as the proposed Coen burner and an overall hourly average emission rate of 0.69 lb/ODT. The Permittee will also need to establish the operating temperature range at the inlet to the rotary dryer that is necessary to achieve this emission limit.

5.9 Wood Pellet Burner/Dryer – Particulate Matter (“PM/PM_{10}”) MSER Review

The base level of PM control from the rotary dryer output is the use of a cyclone or multi-clone to separate the dried wood material from the exhaust gases. All of the control devices shown below are preceded by a cyclone.

The alternatives identified in the permit application for the proposed wood fired Main Boiler- listed in order of effectiveness:

1. Fabric filter
2. Electrostatic Precipitator (ESP).
3. Wet scrubber.
4. Electrified gravel filter bed.

The Permittee is proposing the use of a fabric filter as MSER for PM/PM_{10} control. In addition, the Permittee is proposing a filterable PM emission limit of 0.005 gr/dscf and a total PM (filterable + condensable PM) limit of 0.2 lb/ODT.

The Agency agrees that MSER for PM/PM_{10} is the use of a fabric filter and an hourly average filterable PM emission limit of 0.005 gr/dscf and an hourly average total PM limit of 0.2 lb/ODT.

5.10 Wood Pellet Burner/Dryer - Sulfur Dioxide (SO_2) MSER Review:

The alternatives identified in the permit application for the proposed burner/dryer - listed in order of effectiveness:

1. Use of low sulfur content fuel:
2. Wet Scrubber.
3. Dry Sorbent Injection.

Based on the review of the facilities listed in Table 5-6 and the RBLC, no examples were found where a wet scrubber or dry sorbent injection is in use for controlling SO_2 emissions from wood pellet manufacturing plants. These types of facilities limit their emissions of SO_2 through the use of wood fuel which is considered to be a low sulfur content fuel.

Based on the emission limit for Geneva Wood Fuels, the Permittee has proposed MSER to be an SO_2 emission limit of 0.05 lb/MMBtu.

Upon review of the facilities listed in Table 5-7, both New England Wood Pellet and Corinth Wood Pellet have a lower SO_2 emission limit of 0.025 lb/MMBtu.

The Agency has determined MSER for SO_2 to be an hourly average limit of 0.025 lb/MMBtu heat input at the burner.

Diesel Engines MSER Determination:

The Facility will use diesel engines to provide power through emergency generators and a fire water pump. These engines are sources of NO_X, CO, PM, SO_2 and VOCs.

MSER for the engines will be met through the use of new engines that are Tier certified in accordance with 40 *CFR* Part 60 Subpart IIII, and upon start up of the Main Boiler, a limit of 65 hours/year for maintenance and exercising of the engines.

Facility Greenhouse Gas Emissions MSER Review:

The science and technical issues regarding the effect of a bioenergy facility on carbon stocks and overall carbon emissions is complex and evolving. On June 3, 2010, EPA finalized new thresholds for greenhouse gas emissions that define when Clean Air Act permits are required (also known as the "Tailoring Rule"). In January 2011, Vermont adopted the Tailoring Rule thresholds for greenhouse gas emissions in the Vermont Air Pollution Control Regulations. In July 2011, EPA deferred for a period of three years the application of permitting requirements to biogenic carbon dioxide (CO_2) emissions and committed to conducting a detailed examination of the science and technical issues associated with accounting for emission of biogenic CO_2 emissions.

Vermont has not amended its regulations to defer the applicability of permitting requirements for biogenic CO_2 emission sources such as BWE. However, because a carbon accounting method has not yet been developed to accurately adjust a bioenergy facility's actual stack emissions up or down based on the induced changes in carbon stocks on land (in soils, plants and forests), such sources are currently subject to air permitting requirements in Vermont based solely on direct CO_2 emissions from the stationary sources. In other words, at this time, air permitting for biogenic stationary sources is not taking into account possible supplemental emissions such as from depleted soils after harvesting or any future carbon sequestration that could result from the use of biogenic feedstocks. Likewise, the Agency is not establishing wood procurement requirements in its air permits for biogenic sources at this time. This may change in the future, for example when an accounting method for biogenic CO_2 emissions from the stationary sources is finalized and/or standards for sustainable harvesting and production are established.

The Agency reserves its right to raise any issues related to the management of forest resources, and the potential impact of this or any other facility, in the context of other proceedings such as Act 250, Section 248, or other permitting regimes.

5.11 Main Boiler Greenhouse Gas MSER Review:

In response to public comments on the draft permit, the Agency has added additional documentation of our review process. The Agency has also taken a closer look at whether alternative fuels as a control option would fundamentally redefine the proposed facility or whether alternative fuels should be included as a control option in determining BACT/MSER. In doing so, the Agency "must be mindful that BACT, in most cases, should not be applied to regulate the applicant's objective or purpose for the proposed facility, and therefore, the permit issuer must discern which design elements are inherent to that purpose, articulated for reasons independent of air quality permitting, and which design elements may be changed to achieve pollutant emission reductions without disrupting the applicant's basic business purpose for the proposed facility." In re Prairie State Generating Co., 13 E.A.D. 1, 23 (EPA 2006). The crucial question to consider in determining whether a control option, such as alternate or cleaner fuels, would redefine the project is "when does the imposition of a control technology require enough of a redesign of the proposed facility that it strays over the dividing line to become an impermissible redefinition of the source?" In re Desert Rock Energy Company, PSD Appeal No. 08-03 et al. at 63-64 (EAB Sept. 24, 2009).

BWE is proposing to construct a 34 MW (gross) biomass fuel electric generating facility co-located with a 115,000 ton per year wood pellet production facility. According to BWE, "The BWE Fair Haven project concept, design, and development are based on the availability of sufficient biomass fuel in the project area. . . . The project was designed and sited on the basis of the availability of biomass wood waste in the project area." As part of the development for this project, BWE hired Innovative Natural Resource Solutions, LLC to conduct a biomass fuel supply study for the Fair Haven area. This study concluded that there is enough wood available to sustainably supply the proposed BWE project. The Agency has not undertaken, as part of the air permitting process, an independent analysis of the conclusions reached in the wood supply study, and has looked at the study for the limited purpose of considering whether alternative fuels should be included as a control option in determining BACT/MSER. BWE also maintains that the use of fossil fuels, such as coal, natural gas, or oil, would fundamentally redefine the proposed facility. In addition, BWE states that the use of fossil fuels would also be infeasible due to availability and/or economic considerations. Further, BWE is "unaware of any sources of alternative biogenic fuel stocks available in the required amounts within a reasonable radius of the facility."

The Agency finds that BWE's objective is to build a biomass fuel electric generating facility co-located with a wood pellet production facility. Based on the application and statements made by BWE, the Agency also finds that BWE has "defined its 'goal, objectives, purpose, or basic design' for the proposed facility," In re Desert Rock Energy Company, PSD Appeal No. 08-03 et al. at 65 (EAB Sept. 24, 2009), based on BWE's conclusions regarding the availability of biomass wood fuel. The Agency further notes that the co-location of the electric plant and the wood pellet facility will allow bark and other residue generated by the adjacent wood pellet manufacturing plant to be used as a small portion of the overall fuel source at the wood-fired electric generating plant. In addition, the proposed facility is designed to allow waste heat from the Main Boiler at the electric generating plant to replace an equivalent amount of fuel input to the wood fired burner at the pellet plant. Thus, for the limited purpose of considering whether alternative fuels should be included as a control option in determining BACT/MSER, the Agency finds that these design elements are inherent to BWE's basic purpose.

The Agency concludes that BWE's choice of fuel is integral to the proposed facility's fundamental purpose and basic design. Thus, imposing alternate fuels such as coal, natural gas, or oil as a control option would fundamentally redefine the proposed facility. For these reasons, the Agency finds that such alternate fuels should not be included as a control option in determining MSER. With respect to alternative biogenic fuels, the Agency finds there is currently not sufficient availability of other biogenic fuels (such as grasses, agricultural byproducts, bio oils from seed crops or bio gases from digesters) to contribute significant fuel energy to a project such as BWE Fair Haven.

Step 1: Identify all Control Technologies: The alternatives identified in the permit application for the proposed wood fired Main Boiler- listed in order of effectiveness:

1. Carbon capture and storage (CSS). CSS technologies are still in the development stage. CSS is promising as a CO_2 control technology for a source that has exhaust gases with high-purity CO_2 streams.
2. Energy efficiency. The Permittee reviewed the advantages and disadvantages of two major biomass combustion technologies: stoker fired and bubbling fluidized bed systems and found that their overall efficiencies are very similar, with a slight advantage to the stoker design. Due to the proposed design of the air pollution control equipment (the tail end MPCR), there needs to be a minimum temperature in the exhaust gases for efficient operation of the catalytic reduction system, so too much heat recovery from the exhaust gases before treatment in the MPCR would adversely affect the performance of the MPCR.
3. Combined heat and power (CHP). CHP offers the advantage of extracting additional heat energy from the low grade waste heat emitted from the biomass boiler – in this case the exhaust gas.
4. Type of fuel. Due to their chemical makeup, some fuels generate less CO_2 per unit of energy when they are combusted. As noted above, fuel switching would redefine this source and is therefore not considered further in the MSER review.
5. Good operating and maintenance practices. This is an extension of energy efficiency; make sure that the equipment is operating at peak performance to help ensure that the overall system efficiency remains as designed. This would include minimizing air leaks into the boiler system through procedures and methods to detect air leakage, in addition to maintaining proper insulation on the steam and condensate lines and identifying and repairing condensate leaks.

Step 2: Eliminate Technically Infeasible Options:

1. CSS: At this time, CSS technologies have not been developed for capturing CO_2 in the dilute exhaust gases being emitted from biomass combustion, it is therefore not technically feasible for this project..
2. Energy efficiency is technically feasible.
3. CHP is technically feasible through the use of boiler exhaust gas as a source of heat for the pellet plant's rotary dryer. The Permittee is also exploring the possibility of heating green houses as a means to expand the combined heat idea.
4. Good operating and maintenance practices to maintain system performance is technically feasible.

Step 3: Rank Remaining Control Technologies by Control Effectiveness:

1. Energy efficiency
2. CHP – through the recovery of waste heat in the boiler exhaust gas in the pellet plant rotary dryer.
3. Good operating and maintenance practices do not reduce GHG emissions, but it does help ensure that the facility continues to operate as designed.
   Steps 4 & 5 are combined since the Facility will be using all three of the control technologies identified in Step 3. Note that CHP is deferred to the GHG MSER for the burner/dryer in the pellet plant since this is where the heat is recovered.

The Agency has determined that MSER for GHGs is implementing energy efficiency and good operating and maintenance practices for GHG control. In addition, a CO_2e emission limit has been established based on the rated heat input to the boiler and the design electrical output: 2993 lb CO_2e / MW-hr electrical output based on a 30 day rolling average.

5.12 Wood Pellet Burner/Dryer Greenhouse Gas MSER Review:

The Agency is not aware of any prior GHG BACT determinations for wood pellet manufacturing operations. The main alternatives that may be used for minimizing GHG emissions from the wood pellet production process include:

1. Combined heat and power (CHP). CHP offers the advantage of extracting additional heat energy from the low grade waste heat emitted from the biomass boiler – in this case the exhaust gas. The Permittee has proposed to use a portion of the Main Boiler's exhaust gas to supply up to 12 MMBtu/hr of the heat energy required for the rotary dryer.
2. Good operating and maintenance practices. This is an extension of energy efficiency; make sure that the equipment is operating at peak performance to help ensure that the overall system efficiency remains as designed.

Both of the above alternatives are technically and economically feasible.

The Agency has determined MSER for GHGs to be good operating and maintenance practices, when available, heat energy from the Main Boiler exhaust and a CO_2e emission limit of 427 lb CO_2e / ton of finished pellets produced based on a monthly average.

The CO_2e emission limit for the burner/dryer will be phased in over three years.

- During the first year of operation, the limit will be 591 lb CO_2e / ton of finished pellets. This limit is based on no heat recovery. This is being done to provide the Permittee with time to work through any issues associated with the start-up of a new facility.
- During the second year of operation, the limit will be 509 lb CO_2e / ton of finished pellet – this limit is based on using '50%' of the available waste heat.
- For the third year and after, the limit will be 427 lb CO_2e / ton of finished pellets.

Regardless of the operating year, for periods of time when the Main Boiler is not operating, the limit is 591lb CO2e/ton finished pellets. For months that include periods of pellet plant operation while the Main Boiler is down, the limit will be prorated: [(hours without Main Boiler)*591 + (hours with Main Boiler)*(591 or 509 or 427)] / [hours without Main Boiler + hours with Main Boiler]

5.13 Diesel Engine Greenhouse Gas MSER Review:

The Agency is not aware of any technologies that have been designed to reduce the GHG emissions from diesel powered emergency engines generators and/or fire pumps. Energy efficiency of the engine design is the best way to minimize the emissions of GHGs from these sources. Since the EPA's engine emission standards for other criteria pollutants are based on the emission rate of the pollutant per unit of energy output, engine manufactures have employed a combination of reducing the mass emission rate of the pollutant(s) and increasing the overall efficiency of the engines. Thus the use of a Tier certified engine will help ensure the use of highest energy efficient diesel engine(s) available.

The Agency has determined MSER for GHGs from the emergency diesel engines will be met through the use of new engines that are Tier certified in accordance with 40 *CFR* Part 60 Subpart IIII.

6.0 AMBIENT AIR QUALITY IMPACT EVALUATION

An ambient air quality impact evaluation is performed to demonstrate whether or not a proposed project will cause or contribute to violations of the ambient air quality standards and/or significantly deteriorate existing air quality. The Agency's implementation procedures concerning the need for an ambient air quality impact evaluation under §5-406(1) of the Regulations, specifies that such analyses may be required when a project results in an allowable emissions increase of ten (10) tons per year or more of any air contaminant, excluding VOCs.

6.1 MODEL DATA INPUTS

For this review, EPA’s AERMOD model was used for both screening and interactive modeling. The meteorological data sets were for the years 1998 – 2002. The surface met data was from the Rutland Airport, and the upper air data was from Albany, NY.

The Permittee conducted modeling for several operating load scenarios for the main boiler and the dryer as well as a startup scenario for the main boiler. This is necessary since full load operation does not necessarily correspond to the highest emission rate or worst dispersion. In some cases, lower operating loads can result in higher ambient impacts due to either higher emission rate concentrations (even though lower mass) or lower temperature or velocity of the exhaust. Tables 6-1 and 6-2 summarize the operating loads and emission rates for the operating scenarios that were modeled.

Table 6-1: Operating Load Scenarios

ID	***Description***	***Device***	***Heat input (MMBtu/hr)***	***Production Rate (ODT/hr)***
MAX	55% moisture fuel; maximum boiler heat input; full dryer load	Boiler	482	-
		Dryer	17.9	14.6
Case 1	45% moisture fuel; full dryer load	Boiler	403	-
		Dryer	17.9	14.6
Case 2	55% moisture fuel; 100% boiler load; no dryer	Boiler	435.8	-
		Dryer	0	0
Case 3	45% moisture fuel; 75% boiler load; 65% dryer load;	Boiler	301.3	-
		Dryer	7.99	9.5

Case 4	35% moisture fuel; 50% boiler load; full dryer load, maximum (dryer) burner heat input	Boiler	191.5	-
		Dryer	30	14.0
Case 5	35% moisture fuel; 100% boiler load; lowest dryer flow (dryer burner not operating).	Boiler	382.5	-
		Dryer	0	4.5

Table 6-2: Short Term Exhaust Parameters

ID	***Device***	***Emission Rate [lb/hr (top); gram/sec (bottom)]***				
		NO_X	***CO***	***PM [1]***	***SO_2***	***NH_3***
MAX	Boiler	28.92 3.64	36.15 4.55	10.6 1.34	9.64 1.21	2.31 0.29
	Dryer	6.27 0.79	6.27 0.79	2.08 0.26	0.36 0.05	-- --
Case 1	Boiler	24.18 3.05	30.23 3.81	8.87 1.12	8.06 1.02	1.93 0.24
	Dryer	6.27 0.79	6.27 0.79	2.08 0.26	0.36 0.05	-- --
Case 2	Boiler	26.15 3.29	32.69 4.12	9.59 1.21	8.72 1.10	2.09 0.26
	Dryer	-- --	-- --	-- --	-- --	-- --
Case 3	Boiler	18.08 2.28	22.60 2.85	6.63 0.84	6.03 0.76	1.45 0.18
	Dryer	2.80 0.35	2.80 0.35	2.08 0.26	0.16 0.02	-- --
Case 4	Boiler	11.49 1.45	14.36 1.81	4.21 0.53	3.83 0.48	0.92 0.12
	Dryer	10.50 1.32	10.50 1.32	2.10 0.27	0.60 0.08	-- --
Case 5	Boiler	22.95 2.89	28.69 3.62	8.42 1.06	7.65 0.96	1.84 0.23
	Dryer	0 0	0 0	2.07 0.26	0 0	-- --

[1] The PM emission is assumed to all be fine enough to be characterized as $PM_{2.5}$. This PM emission therefore also represents PM_{10}.

6.2 NAAQS Analysis

Based on the above scenarios, the emissions from the facility were modeled to establish the significant impact area (SIA). The SIA is based on the distance from the facility to the maximum point at which predicted impacts fall below the Significant Impact Level (SIL). The SIA is a circle around the facility with a radius equal to this distance. If there are no predicted impacts greater than the SIL for a pollutant then there is no SIA and interactive modeling is not necessary.

The Agency used the following criteria to determine if the emissions from a nearby source would need to be included in the interactive modeling for this Facility:

1. Each pollutant for which a SIA has been identified, shall include the following class of nearby sources in the interactive modeling:
   a. Nearby sources located within the SIA with actual emissions greater than the following significant emission rates:
      i. CO: 50 tons/yr
      ii. NOx: 40 tons/yr
      iii. SO2: 40 tons/yr
      iv. PM10: 15 tons/yr
      v. PM2.5: 10 tons/yr
   b. Nearby sources located within 20 km of the wood boiler stack that have actual emissions greater than 50 tons/yr.
   c. Nearby sources located within 50 km of the wood boiler stack that have actual emissions greater than 500 tons/yr.

Table 6-3 shows that the emissions for $PM_{2.5}$, NO_X, and SO_2 are predicted to exceed one or more their respective SILs, so it was necessary to include any sources that met the above noted criteria as interactive sources in the modeling analysis.

Table 6-3: Distance to Significant Impact Level (km)

Pollutant	Averaging Time	Significant Impact Levels ($\mu g/m^3$)	Distance (km) from project	Load Case
PM_{10}	24-hour	5	No impacts > SIL	N/A
	Annual [1]	1	No impacts > SIL	N/A
$PM_{2.5}$	24-hour	1.2	9.0	MAX
	Annual	0.3	0.6	MAX, 1,3,4,5
SO_2	1-hour	7.8	10.5	MAX
	3-hour	25	No impacts > SIL	N/A
	24-hour	5	No impacts > SIL	N/A
	Annual	1	No impacts > SIL	N/A
NO_2	1-hour	7.55	30.6	MAX
	Annual	1	1.0	Case 4
CO	1-hour	2,000	No impacts > SIL	N/A
	8-hour	500	No impacts > SIL	N/A

[1] Note that effective 12/28/2006, the EPA revoked the PM_{10} annual NAAQS standard. However, up until May 2011, in certain cases, the EPA allowed a PM_{10} surrogate policy that allowed a project to demonstrate compliance with the PM_{10} annual NAAQS as a means to also demonstrate compliance with the $PM_{2.5}$ annual NAAQS. This permit demonstrated compliance with the $PM_{2.5}$ annual NAAQS and did not propose to use the PM_{10} surrogate policy. Since the application for this permit included information on the PM_{10} annual NAAQS, we are including this information in this document.

Based on the above noted criteria the interactive source modeling included emissions of NO_X and/or SO_2 for the following five sources: Telescope Casual Furniture in Granville, NY (NO_X); NYS Great Meadow Correctional Facility in Comstock, NY (SO_2); Finch Paper LLC in Glens Falls, NY (SO_2 & NOx); International Paper in Ticonderoga, NY (NOx & SO_2) and Lehigh Northeast Cement Company in Glens Falls, NY (NOx). There were no nearby sources of $PM_{2.5}$ that met the criteria noted above.

The maximum emissions from the proposed Facility (MAX in Table 6-2) along with the emissions from the five facilities noted above were modeled to predict the maximum impacts to determine if there were any predicted NAAQS violations.

Table 6-4: Summary of Maximum Impacts – NAAQS Review

Pollutant	Averaging Time	Max Impact ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	24-hour	3.5	35	38.5	150
	Annual	0.6	13.6	14.2	50
$PM_{2.5}$	24-hour	3.5	28.7	32.2	35
	Annual	0.6	10.4	11.0	15
SO_2	1-hour	2,907.3	94.2	2,001.5	196
	3-hour	819.6	96.9	916.5	1,300
	24-hour	258.7	60.2	318.9	365
	Annual	28.2	9.7	37.9	80
NO_2	1-hour	568.2	80.9	649.1	188
	Annual	10.1	18.1	28.2	100
CO	1-hour	63.6	3,664	3,727.6	40,000
	8-hour	14.6	2,406	2,419.6	10,000

With the exception of the 1-hr NO_2 and SO_2 standards, comparison of the total impacts to the NAAQS indicates that the Facility's emissions will not cause or contribute to a violation of the NAAQS.

To determine if the Facility's emissions cause or contribute to a violation of the 1-hour NO_2 or SO_2 NAAQS, it is necessary to identify the Facility's contribution to impacts at the receptors that have a total impact that is greater than the NAAQS. This was done with a post-processing software program provided by BEE-Line Software.

There were 100 receptors with combined source 1-hour SO_2 impacts greater than the NAAQS. The Facility's maximum contribution to the impacts at any of these 100 receptors was 0.53 $\mu g/m^3$ which is below the SIL of 7.8 $\mu g/m^3$. This demonstrates that the Facility does not cause or contribute to any violation of the 1-hour SO_2 NAAQS.

There were 28 receptors with combined source 1-hour NO_2 impacts greater than the NAAQS. The Facility's maximum contribution to the impacts at any of these 28 receptors was 0.033 µg/m^3 which is below the SIL of 7.5 µg/m^3. This demonstrates that the Facility does not cause or contribute to any violation of the 1-hour NO_2 NAAQS.

The results of this refined modeling demonstrate that the Facility, in conjunction with emissions from other nearby sources, will not cause or contribute to a violation of the NAAQS.

6.3 Prevention of Significant Deterioration (PSD) Increment Analysis

Major new sources of air pollution must demonstrate that the proposed project will not significantly deteriorate the existing air quality in regions that have been established as being in attainment of federal air quality standards. All of Vermont has been determined to be in attainment, or unclassified, for all of the federal air quality standards. Significant deterioration is considered to have occurred if the air quality impact concentration of the facility alone exceeds the remaining PSD increment value. In Vermont, major new sources are allowed to consume no more than 75% of the available short term increment and no more than 25% of the available annual increment.

Vermont and the U.S. EPA have adopted PSD increments for three classifications of geographical areas. Except for the Lye Brook Wilderness Area near Manchester, VT, all of Vermont is considered Class II. The Lye Brook Wilderness Area is classified as Class I. Class I areas are afforded greater protection under air pollution control laws in order to preserve their more pristine characteristics.

Nearby sources that consume increment are to be included in the PSD increment analysis for the proposed project in order to determine what the remaining available increment is to the proposed source. Certain facilities that have increased their emissions of respective pollutants since the respective baseline date are considered to have consumed increment. A review of the sources near the proposed Facility has determined that there are no nearby sources that consume increment for NO_2, $PM_{2.5}$, or PM_{10}. Finch Paper and International Paper Ticonderoga both consume SO_2 increment, so these sources were included in this PSD increment analysis.

Table 6-5 summarizes the results of the predicted PSD increment impacts. The maximum predicted impacts for both Class I and Class II areas are less than the available increment.

Table 6-5: PSD Increment Impacts							
Pollutant	Averaging Time	Max Impact ($\mu g/m^3$)		PSD Increment Standard ($\mu g/m^3$)		Available Increment ($\mu g/m^3$)[1]	
		Class I	Class II	Class I	Class II	Class I	Class II
PM_{10}	24-hour	0.028	3.5	8	30	6	22.5
	Annual	0.002	0.6	4	17	1	4.25
$PM_{2.5}$	24-hour	0.028	3.5	2	9	1.5	6.75
	Annual	0.002	0.6	1	4	0.25	1
SO_2	3-hour	0.87	84.1	25	512	18.76	384
	24-hour	0.16	14.4	5	91	3.75	68.25
	Annual	0	2.4	2	20	0.5	5
NO_2	Annual	0.004	1.4	2.5	25	0.625	6.25

[1] Vermont regulations allow major new sources to consume only 25% of the annual increment and 75% off the short term increment.

6.4 Class I Visibility Impairment

The visibility regulations for new source review (40 *CFR* §51.307 and §52.27) require visibility impact analysis in PSD areas for major new sources or major modifications that have the potential to impair visibility in any Class I area. An “adverse impact on visibility” means visibility impairment which interferes with the management, protection, preservation, or enjoyment of a visitor’s visual experience of the Class I area.

The Federal Land Managers Air Quality Related Values (AQRV) Workgroup (FLAG) Phase 1 report revised (2010)[1] has established a method to screen out from AQRV review those sources with relatively small amounts of emissions and/or located a large distance from a Class I area. The method calculates a ratio (Q/d) of the total tons of pollutants (SO_2, NO_X, SO_4, and total PM) divided by the distance, in kilometers, between the source and the Class I area. The guidance document FLAG 2010 states that the pollutant tonnage rate should be based on the maximum daily emission rates * 365 days to determine the ton/year value for Q. The Facility uses a 96% capacity factor for the main boiler and an 82% capacity factor for the burner/dryer: the annual emissions from these two production areas will need to be increased proportionately to determine the inputs for calculating Q.

[1] U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service. 2010. Federal land managers’ air quality related values work group (FLAG): phase I report—revised (2010). Natural Resource Report NPS/NRPC/NRR—2010/232. National Park Service, Denver, Colorado.

Main boiler:
SO_2: 40.5 tpy / 96% = 42.2
NO_X: 60.8 tpy / 96% = 63.3
SO_4: 1.9 tpy / 96% = 2.0
PM (boiler and cooling towers): (38.5 + 4.1 tpy)/96% = 44.4

Burner/dryer:
SO_2: 2.7 tpy / 82% = 3.3
NO_X: 37.7 tpy / 82% = 46
SO_4: 0.06 tpy / 82% = 0.07
PM (dryer and pellet plant bag houses): (11.6 + 8.8 tpy)/82% = 24.9

Q = SO_2 + NO_X + SO_4 + PM = (42.2+3.3) + (63.3+46) + (2.0 + 0.07) + (44.4+24.9) = 226.2 ton/yr

The distance from the source to Lye Brook Class I area is 52 km.

Q/d = 226.2 / 52 = 4.35

The combination of potential emissions from the proposed project and the distance to the Lye Brook Class I area results in a Q/d value that is well below the threshold of 10, and additional assessments of impacts on AQRVs by the FLM are not anticipated to be necessary.

The Permittee also conducted a Level 1 Screening Procedure as outlined in EPA's Workbook for Plume Visual Impact Screening and Analysis using EPA's VISCREEN model. VISCREEN is used to calculate the potential visual impact of a plume of emissions for specific transport and meteorological conditions. Based on the results of this Level 1 Screening Procedure using VISCREEN, the proposed Facility's plume visual impact will not cause an adverse impact in the Lye Brook Class I area.

6.5 Effects on Soils, Vegetation, and Secondary Impact Analysis

New major sources and major modifications are required to evaluate their effects on soils and vegetation in the impact area. Any permit application for such a project is expected to provide a characterization of the soils and vegetation in the impact area and an evaluation of any adverse economic and ecological effects from the ambient concentration projected by the air quality modeling.

As required by federal PSD regulations, 40 *CFR* 52.21(o), the Permittee included in the permit application additional impact analysis of: (a) the impairment to visibility, soils and vegetation that would occur as a result of the new major source and general, commercial, residential, industrial, and other growth associated with the new major source, except that an analysis of the impact on vegetation having no significant commercial or recreational value is not required; (b) the air quality impact projected for the area as a result of the general commercial, residential, industrial, and other growth associated with the facility.

In accordance with Vermont's *State Implementation Plan*, impacts on vegetation, soils and an assessment of secondary growth will be conducted through procedures established in Title 10 Chapter 151, *Vermont Statures Annotated.* Section 6081 of this law requires the review and issuance of an Act 250 Land Use Permit for all significant changes in land use throughout the state. This section includes all secondary growth and all development of a nature likely to impact soils and vegetation through emissions to the ambient air.

Section 6086 requires each district commission or the Environmental Board to review all environmental impacts of a proposed development prior to issuing a permit. Section 6086(a)(1) specifically requires a finding that the proposed project "will not result in undue water or air pollution." Section 6086(a)(8) further requires a finding that such projects "will not have an undue adverse effect of the scenic or natural beauty of the area, aesthetics, historic sites or rare and irreplaceable natural areas".

The air quality impact of general commercial, residential, industrial and other growth occurring as a result of construction of the proposed source under review is included in these analyses. Since the Air Pollution Control Division and the Environmental Board have maintained a close working relationship in the past, it is expected that these provisions will be adequate to prevent the impairment of visibility, soils and vegetation and the effects of such secondary growth due to the construction of new sources of air pollution.

7.0 HAZARDOUS AIR CONTAMINANTS

Emissions of hazardous compounds into the air are regulated under both state and federal regulations. Federal regulations are promulgated under 40 CFR Part 63 and use the terms "Hazardous Air Pollutants (HAPs)", "Major Source of HAPs", and "Area Source of HAPs". These regulations are specific to source emission categories, such as boilers, reciprocating engines, or chrome plating operations. Typically separate emission standards are established for Major Sources and Area Sources. The proposed Facility is not considered a Major Source of HAPs and is instead classified as an Area Source. The applicable federal regulations for HAPs were discussed above in Section 4.2. Vermont regulates emissions of hazardous air contaminants ("HACs") under to §5-261 of the Regulations. This regulation is pollutant specific rather than emission category specific. The Owner/Operator of a source must quantify its facility wide emissions of each HAC regulated by this rule. Any Facility whose emission rate of a HAC exceeds its respective Action Level ("AL") is subject to the rule for that respective HAC. The Owner/Operator must then demonstrate that the emissions of the HAC are minimized to the greatest extent practicable by achieving the Hazardous Most Stringent Emission Rate ("HMSER") for that HAC.

As shown in Section 3.2, the facility is expected to exceed the action level of 32 different HACs and is therefore subject to §5-261.

For the HMSER review, the HACs are divided up into several categories based on their emission control characteristics: (1) non-mercury metallic HACs; (2) organic HACs; (3) acid gases; (4) ammonia; and (5) CDD/CDF.

7.1. HMSER Selection – non-mercury metallic HACs

The non-mercury metallic HACs that are estimated to exceed their respective action level include: arsenic, barium, beryllium, cadmium, chromium-hexavalent, copper (dusts & mists), iron oxides (dusts & fumes), lead compounds, manganese, nickel compounds, vanadium pentoxide and zinc oxide.

Non-mercury metallic HACs are a component of the PM contained in the fly ash from the boiler and/or the wood pellet burner/dryer. The choice of control devices for non-mercury metallic HACs is the same as those for fine PM.

7.1.1. Main Boiler – non-mercury metallic HACs

The Agency is establishing HMSER for non-mercury metallic HACs from the Main Boiler as the use of an ESP, or equivalent PM air pollution control device and a filterable PM emission limit of 0.010 lb/MMBtu (1 hour block average). The single filterable PM emission limit is serving as a surrogate for separate emission limits for each of these numerous non-mercury metallic HACs from the main boiler.

7.1.2. Wood Pellet Burner/Dryer – non-mercury metallic HACs

The Agency is establishing HMSER for non-mercury metallic HACs from the wood pellet burner/dryer as the use of a fabric filter and a filterable PM emission limit of 0.005 gr/dscf (1 hour block average). This single filterable PM emission limit also is serving as a surrogate for separate emission limits for each of these non-mercury metallic HACs from the wood pellet burner/dryer.

7.2. HMSER Selection – organic HACs

The Facility's organic HAC emissions that are estimated to exceed their respective action level include: 1,2-Dichloroethane (ethylene dichloride), 1,2-dichloropropane (propylene dichloride), acetaldehyde, acrolein, benzene, benzo(a)pyrene, bromodichloromethane, Chloroform, Dichloromethane (methylene chloride), 2,4-dinitrotoluene, formaldehyde, hexachlorobenzene, naphthalene, tetrachloroethylene (perchloroethylene), trichloroethylene, and vinyl chloride.

These organic emissions are formed by incomplete combustion of fuel. In the case of the pellet plant dryer, they are also formed by the high temperature drying of the wood material that volatilizes and partially combusts organic components in the wood.

7.2.1. Main Boiler – organic HACs

The methods for control of organic HACs from the Main Boiler would be the same as for the control of VOCs. Thus total VOC emissions or CO can reasonable serve as a surrogate to demonstrate adequate control of the individual organic HACs.

HMSER for organic HACs is good combustion control and the use of an oxidative catalyst in the MPCR, and a CO emission limit of 0.075 lb/MMBtu (24 hour rolling average), and a VOC emission limit of 0.005 lb/MMBtu (hourly average).

7.2.2. Wood Pellet Burner/Dryer – organic HACs

These HACs are organic compounds for which emission control techniques would be similar to the techniques to control volatile organic compounds. The potential control technologies for VOCs (and organic HACs) include carbon adsorption, condensation, biofiltration, and thermal oxidation. The exhaust from the rotary dryer is a high moisture content, low VOC content, high volume exhaust stream which is challenging for existing control technologies to reduce the emissions.

Carbon adsorption: A carbon adsorption system removes VOCs from the exhaust stream when the VOC is adsorbed to the surface of activated carbon. Over time, the carbon media becomes saturated with VOCs requiring the unit to be desorbed by introducing heat (usually steam). The desorption process results in the production of a VOC laden wastewater stream that must be treated prior to discharge. Generally carbon adsorption systems are used on dry, lower volume streams. To use this technology, the hot exhaust stream from the rotary dryer would need to be cooled before being processed by a carbon adsorber, and this would result in additional condensate/waste water that would also need to be treated prior to discharge. Additionally the particulate matter in the dryer's exhaust would tend to foul the carbon media. Carbon adsorption is not a suitable technology for the exhaust from a wood dryer.

Condensation: Condensers in use today may fall in either of two categories: refrigerated or non-refrigerated. Non-refrigerated condensers are widely used as raw material and/or product recovery devices in chemical process industries. They are frequently used prior to control devices (e.g., incinerators or absorbers). Refrigerated condensers are used as air pollution control devices for treating emission streams with high VOC, concentrations (usually > 5,000 ppmv). The low concentration (anticipated to be less than 100 ppm) of VOCs in the dryer's exhaust gas is too low for condensers to be effective. This technology is not technically feasible for wood dryers.

Biofilters: Biofilters operate by passing the VOC laden stream through organic or inorganic structural media containing microbes. The VOCs are degraded by the microbial populations living in the media. Biofilters depend upon constant pollutant streams with high humidity. This technology is technically feasible to treat the exhaust gases from the dryer. The air permit A-736-71-C-A issued by the Maine Bureau of Air Quality to Maine Woods Company, LLC in 2004 has capital cost information for a biofilter designed for 80,000 acfm of exhaust gases from lumber drying operating. The design exhaust volume is similar to the exhaust flow rate from the rotary dryer, so the cost of the system would be similar. In the permit it was noted that organic biofilter packing must be replaced every one to three years due to packing deterioration. Inorganic packing is expected to be replaced once every ten years. That system was designed to achieve 90% control of VOCs and was estimated to cost $2,400,000. This type of control device is not economically feasible for controlling the estimated 10 tons/yr of organic HACs from the rotary dryer. In addition, since the dryer exhaust also contains combustion products the low temperature and low release height from a biofilter would be of concern from a pollution dispersion stand point.

Catalytic Oxidation: Catalytic oxidation units are very sensitive to particulate contamination, and are usually only used on clean exhaust streams. For this technology to work on the dryer exhaust, a high efficiency particulate matter control device such as an ESP or a fabric filter would be needed to pretreat the exhaust gases. The system will be equipped with such a fabric filter however if the catalyst is located after the proposed fabric filter, the temperature of the exhaust gas is too low for the reaction to take place without prohibitive levels of reheating. The exhaust temperatures exiting the dryers are much lower than for a conventional boiler. The temperature profile in the dryer itself cannot be significantly increased without partially combusting the wood material and increasing incomplete combustion emissions.

Regenerative Thermal Oxidation: The application included cost estimates for an RTO which is anticipated to have a 95% destruction efficiency for organic VOCs and HACs. The RTO was estimated to have a total annual cost of $1,230,000. There are an estimated 10 tons/year of organic HACs; the cost per ton for this type of control would be approximately $130,000/ton. This is not a feasible control solution for HACs from this source.

The Permittee has proposed HMSER for organic HACs from the dryer system to be the burner design and good combustion practices as well as a VOC emission limit of 0.69 lb/ODT.

The Agency agrees that HMSER for organic HACs is proper burner design and good combustion practices as well as an hourly average VOC emission rate of 0.69 lb/ODT. The Permittee will also need to establish the operating temperature ranges at the inlet and outlet to the rotary dryer that are necessary to achieve this emission limit.

7.3. Acid Gases

Sulfuric acid mist and chlorine are estimated to exceed their respective action level. Based on the emission testing at wood fired boilers in New England HCl is not expected to exceed its Action Level.

Sulfur that is present in fuels is converted during combustion to SO_2 and to a lesser degree SO_3. The SO_3 rapidly reacts with the water vapor in the exhaust gases to form H_2SO_4 (sulfuric acid mist). Some of the chlorine that is present in the wood fuel may also be released from the chemical composition of the wood and a portion of this may form hydrochloric acid.

Add-on control technologies that are available to reduce acid gas emissions include dry sorbent injection, wet scrubbing systems and spray dryer adsorbers. These control technologies were reviewed in Section 5.5 and 5.11 above for the control of SO_2 and were determined to not be cost effective for SO_2, with the lower emission rate of sulfuric acid mist, the cost of control would be even higher. The Agency is not aware of any conventional wood fired plants that are equipped with acid gas controls.

HMSER for both the Main Boiler and the wood pellet burner/dryer is the use of natural wood which has an inherently low level of sulfur and chlorine.

7.4. Ammonia

Ammonia is used as a reagent in the MPCR unit of the boiler to react with NO_X to form nitrogen and water. Some of the ammonia will pass through the MPCR unreacted and be emitted with the exhaust gas. This is referred to as ammonia slip. Ammonia slip is minimized through good controls of the ammonia feed system and the use of an ammonia CEMS. A review of ammonia emission limits for other wood fired boilers equipped with SCR systems for NOx control show that the lowest limit is 10 ppm NH_3 @ 7% O_2 (this is essentially the same as 13 ppm NH_3 @ 3% O_2).

The Permittee has proposed an HMSER of 10 ppm NH_3 @ 7% O_2. The Agency agrees with this proposed limit and is establishing HMSER as an ammonia slip limit of 10 ppm NH_3 @ 7% O_2 based on a 24-hour rolling average for the wood fired boiler.

No ammonia is expected to be emitted from the dryer process.

7.5. CDD/CDF

In combustion processes, CDDs and CDFs can be formed from the thermal breakdown of precursor ring compounds and chlorine. These precursor compounds are produced as a result of incomplete combustion. According to the EPA, dioxin formation occurs between 392 and 842^{o}F. Typical control is using fuels with low chlorine content and through the use of good combustion design and combustion practices to minimize the formation of the precursors. In municipal incinerators, which have higher levels of chlorine in the fuels and therefore greater CDD/CDF emission rates, controls have also included the injection of powdered activated carbon (PAC) into the exhaust gas. The gaseous CDD/CDFs are absorbed onto the activated carbon, and carbon can be removed from the exhaust gases with a traditional PM control device (ESP or fabric filter). For this approach to be the most effective it must be located at a point in the exhaust system where the exhaust temperatures are lower than the dioxin formation range (less than ~ 400^{o}F). This would require a PAC system on this Facility's boiler to be located downstream of the MPCR, which would necessitate a second PM control device to remove the carbon.

The Permittee is proposing HMSER for CDD/CDFs to be good combustion practices and properly operated air pollution control equipment. The Agency agrees that HMSER for CDD/CDFs is good combustion practices and properly operated air pollution control equipment.