

DRAFT 9/15/2011

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

TECHNICAL SUPPORT DOCUMENT

FOR

PERMIT TO CONSTRUCT

#AP-11-015

Draft Permit Date: September 15, 2011

**Beaver Wood Energy Fair Haven, LLC
Fair Haven, VT**

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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

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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 <i>The Rutland Herald</i>
Date & Location Public Meeting Noticed:	To be determined
Date & Location of Public Meeting:	To be determined
Deadline for Public Comments:	10/17/2011
Date Proposed Decision:	To be determined
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/PM₁₀/PM_{2.5}	SO₂	NO_x	CO	VOC	HAPs²	CO₂e³
63.2	43.2	99.9	190.5	49.9	<10/25	470,900

¹ PM/PM₁₀ - particulate matter, SO₂ - 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 CO₂e '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 PM₁₀. 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 (or fabric filter), 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 <i>CFR</i> Part 89	-
Two (2): Caterpillar C15 Diesel Engine Generator	500 kW ⁴ (each)			-
Diesel Engine Fire Pump	400 bhp ⁵		Tier 3	-
Temporary Five (5) Diesel Engine Generators – for construction	100 kW ⁴ (each)		per 40 <i>CFR</i> Part 89	-
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 °F Dimensions: 13'-10" D x 24'-8" W x 10'-4" H Air Flow Rate: 269,000 acfm
Main Boiler – ESP	Inlet Temperature: 450 °F 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 °F 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 °F 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 °F 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.	<u>Fabric filter:</u> Performance: 0.005 gr/dscf Inlet Temperature: 125 °F Estimate total Air Flow Rate: 50,000 acfm Further details not available at this time.
One or more fabric filters.	
Ash silo vent fabric filter	Performance guarantee: 0.02 gr/dscf Inlet temperature: 135 °F 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, NH₃, and CO₂ 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 amount to 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 SO₂, 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 tons per year
	Factor	Units ¹	Source	
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	-
PM ₁₀ /PM _{2.5} /PM ²	0.019	lb/MMBtu	MSER / HMSER	38.1
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; Formaldehyde emissions testing at New England Wood Pellet – Jaffrey, NH	10.2
	0.014	lb/ODT		

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 that are released 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).

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

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.’ SO₂ 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 tons per year
	Factor	Units ²	Source	
SO ₂	142S ¹ 0.0213	lb/1000 gal	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		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 (lb/mmbtu)	Boiler EF Source ¹	Burner/ Rotary Dryer Emission Factor (lb/ODT)	Facility Emission Rate ² (lb/8-hrs)	Action Level (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	766441 7	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	778250 5	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

Table 3-8 Quantification of HAC Emissions							
Hazardous Air Contaminant	CAS#	Toxic Category	Boiler Emission Factor (lb/mmbtu)	Boiler EF Source ¹	Burner/ Rotary Dryer Emission Factor (lb/ODT)	Facility Emission Rate ² (lb/8-hrs)	Action Level (lb/8-hrs)
cumene	98828	II	1.80E-05	NCASI		6.66E-02	3.32E+01
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	764701 0	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

Table 3-8 Quantification of HAC Emissions							
Hazardous Air Contaminant	CAS#	Toxic Category	Boiler Emission Factor (lb/mmbtu)	Boiler EF Source ¹	Burner/ Rotary Dryer Emission Factor (lb/ODT)	Facility Emission Rate ² (lb/8-hrs)	Action Level (lb/8-hrs)
Selenium	0	II	3.00E-06	NCASI		1.11E-02	1.50E-01
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	766493 9	II	4.59E-04	B&W		1.93E+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 SO₃ Mitigation, and Motobec USA technical paper: Reducing SO₂ 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 CO₂e 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	For wood - the calculations are based on tons of wood at 10% MC
Wood and Wood Waste	289,865	tons	

Table 3. Total Company-wide CO₂, CH₄ and N₂O Emissions from Stationary Source Fuel Combustion

Fuel Type	CO ₂ (kg)	CO ₂ (lb)	CH ₄ (kg)	CH ₄ (lb)	N ₂ O (kg)	N ₂ O (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 ₂ O	CO ₂ e		
	1.0	21.0	310.0	metric ton	short ton	
Total CO₂ 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.

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 - 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.

40 C.F.R. Parts 72-78 – 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.

40 C.F.R. Part 98 – Mandatory Greenhouse Gas Reporting

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/PM₁₀, SO₂, 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.

Wood Fired Boiler – MSER Determination:

5.1 Main Boiler - NO_x MSER Review

The NO_x 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 N₂ at temperatures between 500 to 800°F. There are several approaches to using a catalyst for NO_x 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 N₂. This can achieve NO_x reduction levels ranging from 30 – 50%. When combined with combustion controls, the overall NO_x 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 NO_x control. The catalyst system will be a multi pollutant catalytic reactor (MPCR) that will reduce NO_x, CO and VOC emissions. In addition the Permittee is proposing a NO_x limit of 0.06 lb/MMBtu based on a one hour block average and a long term NO_x 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 NO_x 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.

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	2/27/09, 6/04/10	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)	Anticipated startup May 2011.
Laidlaw Berlin BioPower, Berlin, NH	70 MW	7/26/10	SCR	0.06 (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, 1 st 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 NO_x 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 NO_x 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 NO_x 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 NO_x 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 NO_x emission rates for the project under review.

Based on review of the proposed alternatives, the Agency concurs that MSER for NO_x is the use of combustion controls with a MPCR and the following NO_x 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/PM₁₀”) 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 or fabric filter as MSER for PM/PM₁₀ 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/PM₁₀ Emission Limits and Performance					
Facility	Nominal Rating	Permit Date	PM Controls	PM/PM₁₀ 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	3/7/11 (draft permit)	Multi-clone, fabric filter	Filterable PM: 0.012 Total PM: 0.019	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	Anticipated startup May 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: 0.01 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/PM₁₀ 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	Anticipated startup May 2011.
Laidlaw Berlin BioPower, Berlin, NH	70 MW	7/26/10		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	Anticipated startup May 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 (SO₂) 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 SO₂ concentrations. The Palmer Renewable Energy project is proposing to use this technology to control SO₂ 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 SO₂ emissions.
4. Dry Sorbent Injection. Depending upon the SO₂ 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: SO₂ Emission Limits and Performance					
Facility	Nominal Rating	Permit Date	SO₂ Controls	SO₂ Limit (lb/MMBtu)	SO₂ 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 1 st 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	Anticipated startup May 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.
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 SO₂ control. In addition, the Permittee is proposing a SO₂ limit of 0.02 lb/MMBtu.

Based on review of the proposed alternatives, the Agency concurs that the MSER for SO₂ 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 SO₂ CEMS, then the limit is based on an annual average.

Pellet Plant Burner/Rotary Dryer MSER Determination:

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

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
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	SO₂ 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) <i>lb/hr limits are for each of the 2 lines</i>	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	SO₂ 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 °F	Multi-clone	Good combustion	NA
Deposit Wood Pellet	Good combustion	Good combustion	Multi-clone	Good combustion	Low sulfur fuel

Table 5-8: Burner/Dryer Control Technology					
Facility	NO_x limit	CO limit	PM limit ¹	VOC limit	SO₂ Limit ³
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 SO₂ 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	SO₂
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 NO_x 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°F) 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°F. 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 NO_x at all of the referenced permitted wood pellet manufacturing facilities.

The Permittee is proposing the use of a Coen low NO_x 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 NO_x 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 NO_x 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 NO_x.

The Agency agrees that MSER for CO for the wood burner/dryer system is the use of a Coen low NO_x burner and good combustion controls with an hourly average emission rate of 0.35 lb/MMBtu. As with the NO_x 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 estimated cost for an RTO to treat the VOCs from this smaller system is not economically feasible.
2. Oxidative catalyst. The oxidative catalyst has the same issues as the SCR for NO_x 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 NO_x 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 NO_x.

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/PM₁₀”) 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/PM₁₀ 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/PM₁₀ 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 (SO₂) 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 SO₂ emissions from wood pellet manufacturing plants. These types of facilities limit their emissions of SO₂ 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 SO₂ 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 SO₂ emission limit of 0.025 lb/MMBtu.

The Agency has determined MSER for SO₂ 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, SO₂ 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 MSER requirement for greenhouse gases became effective February 8, 2011 when Vermont adopted the federal requirements into its permitting program. This requirement

stems from recent federal requirements referred as the Green House Gas Tailoring rule adopted by the US EPA June 3, 2010.

Under both state and federal requirements, the greenhouse gas review requirement is phased in. For permits being issued between January 1, 2011 and July 1, 2011 the requirements for greenhouse gases only apply to projects that are also independently subject to federal major PSD review for some other pollutant. After July 1, 2011 the requirement will apply to any major source or modification that is major for greenhouse gases regardless of the applicability of other pollutants.

On July 20, 2011 the US EPA issued a final rule deferring for three years the greenhouse gas permitting requirements for bioenergy facilities such as this Facility. However, Vermont's regulations do not include a three year deferral for Bioenergy facilities, so the MSER requirement still applies to this project.

5.11 Main Boiler Greenhouse Gas MSER Review:

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 CO₂ control technology for a source that has exhaust gases with high-purity CO₂ streams. At this time, CSS technologies have not been developed for capturing CO₂ in the dilute exhaust gases being emitted from biomass combustion.
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 CO₂ per unit of energy when they are combusted. Fuel switching is not part of the MSER review – for instance the review cannot conclude that the use of natural gas would result in lower CO₂ emissions than wood, therefore the use of natural gas is BACT. In the EPA's March 2011 "Guidance for Determining Best Available Control Technology for Reducing Carbon Dioxide Emissions from Bioenergy Production" they have suggested that BACT for CO₂ emissions at a bioenergy facility is the combustion of biogenic fuel by itself.
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.

The Permittee has proposed that MSER for GHGs will be the use of biomass fuel, implementing energy efficiency and good operating and maintenance practices for CO₂ control.

In accordance with the US EPA's March 2011 "Guidance for Determining Best Available Control Technology for Reducing Carbon Dioxide Emissions from Bioenergy Production" the Agency agrees that MSER for GHGs is the use of biomass fuel and implementing energy efficiency and good operating and maintenance practices for GHG control. In addition, a CO₂e emission limit has been established based on the rated heat input to the boiler and the design electrical output: 2993 lb CO₂e / 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. The use of biomass as a fuel for the Coen burner that provides heat for the rotary dryer.
2. 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 40% of the heat energy required for the rotary dryer.
3. 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.

All of the above alternatives are technically and economically feasible.

The Agency has determined MSER for GHGs to be the use of wood fuel, good operating and maintenance practices, when available, heat energy from the Main Boiler exhaust and a CO₂e emission limit of 427 lb CO₂e / ton of finished pellets produced based on a monthly average.

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 manufacturers 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				
<i>ID</i>	<i>Description</i>	<i>Device</i>	<i>Heat input (MMBtu/hr)</i>	<i>Production Rate (ODT/hr)</i>
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	PM¹	SO₂	NH₃
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 PM₁₀.

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 SO₂ 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 (µg/m³)	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 PM₁₀ annual NAAQS standard. However, up until May 2011, in certain cases, the EPA allowed a PM₁₀ surrogate policy that allowed a project to demonstrate compliance with the PM₁₀ 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 PM₁₀ surrogate policy. Since the application for this permit included information on the PM₁₀ 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 SO₂ for the following five sources: Telescope Casual Furniture in Granville, NY (NO_x); NYS Great Meadow Correctional Facility in Comstock, NY (SO₂); Finch Paper LLC in Glens Falls, NY (SO₂ & NO_x); International Paper in Ticonderoga, NY (NO_x & SO₂) and Lehigh Northeast Cement Company in Glens Falls, NY (NO_x). 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 (µg/m³)	Background (µg/m³)	Total Impact (µg/m³)	NAAQS (µg/m³)
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 NO₂ and SO₂ 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 NO₂ or SO₂ 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 SO₂ impacts greater than the NAAQS. The Facility’s maximum contribution to the impacts at any of these 100 receptors was 0.53 µg/m³ which is below the SIL of 7.8 µg/m³. This demonstrates that the Facility does not cause or contribute to any violation of the 1-hour SO₂ NAAQS.

There were 28 receptors with combined source 1-hour NO₂ impacts greater than the NAAQS. The Facility’s maximum contribution to the impacts at any of these 28 receptors was 0.033 µg/m³ which is below the SIL of 7.5 µg/m³. This demonstrates that the Facility does not cause or contribute to any violation of the 1-hour NO₂ 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 NO₂, PM_{2.5}, or PM₁₀. Finch Paper and International Paper Ticonderoga both consume SO₂ 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 (µg/m³)		PSD Increment Standard (µg/m³)		Available Increment (µg/m³)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

Table 6-5: PSD Increment Impacts							
Pollutant	Averaging Time	Max Impact ($\mu\text{g}/\text{m}^3$)		PSD Increment Standard ($\mu\text{g}/\text{m}^3$)		Available Increment ($\mu\text{g}/\text{m}^3$) ¹	
		Class I	Class II	Class I	Class II	Class I	Class II
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) 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 (SO₂, NO_x, SO₄, and total PM) divided by the distance, in kilometers, between the source and the Class I area. 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, 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 Statutes 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 (“HMSE”) 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 HMSE 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. HMSE 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 HMSE 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 HMSE 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. HMSE 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.

HMSEER 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 SO₂ and to a lesser degree SO₃. The SO₃ rapidly reacts with the water vapor in the exhaust gases to form H₂SO₄ (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 SO₂ and were determined to not be cost effective for SO₂, 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 NO_x control show that the lowest limit is 10 ppm NH₃ @ 7% O₂ (this is essentially the same as 13 ppm NH₃ @ 3% O₂).

The Permittee has proposed an HMSER of 10 ppm NH₃ @ 7% O₂. The Agency agrees with this proposed limit and is establishing HMSER as an ammonia slip limit of 10 ppm NH₃ @ 7% O₂ 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°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°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.